Technical Report B

Dredged sediment disposal options assessment

Part 2

Viva Energy Gas Terminal Project

Appendix A

Dredging & Offshore Contamination Assessment (AECOM, 2021b)

Prepared for
Viva Energy Gas Australia Pty Ltd
ABN: N/A

Appendix A: Dredging and offshore contamination assessment

Viva Energy Gas Terminal Project Environment Effects Statement

25-Feb-2022
Viva Energy Gas Terminal Project

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Appendix A: Dredging and offshore contamination assessment

Viva Energy Gas Terminal Project Environment Effects Statement

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Executive summary

This technical report provides a *Phase III Sediment Quality Assessment* undertaken to support the Environment Effects Statement (EES) for the Viva Energy Gas Terminal Project (the project).

In December 2020, the Victorian Minister for Planning determined that the project requires assessment through an EES under the *Environment Effects Act 1978* (Vic). The reasons for the decision were primarily related to the potential for significant adverse effects on the marine environment of Corio Bay and the potential for contributing to greenhouse gas emissions. Secondarily, the EES was required to assess the effects of the project on air quality, noise, land use, Aboriginal and historic heritage, native vegetation, groundwater, traffic and transport as well as visual amenity.

In January 2021, the project was also determined to require assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to the potential for the project to have a significant impact on wetlands of international importance, listed threatened species and communities, and listed migratory species. The EES process is the accredited environmental assessment process for the controlled action decision under the EPBC Act in accordance with the bilateral agreement between the Commonwealth and Victorian governments.

Overview

Viva Energy Gas Australia Pty Ltd (Viva Energy) is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate supply of a new source of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU), and regasify the LNG as required to meet industrial, commercial and residential customer demand. A 7-kilometre gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The gas terminal would be located adjacent to, and on, Viva Energy's Geelong Refinery in a heavily industrialised setting and would benefit from Viva Energy's experience and capability as an existing Major Hazard Facility (MHF) operator and potential synergies between the two facilities such as reuse of the FSRU seawater discharge within the refinery operations.

The project would involve localised dredging of approximately 490,000 m^3 of sediment in Corio Bay to provide a berth pocket and swing basin at the proposed extension to Refinery Pier for Berth No. 5 (referred to as the 'Loading Site' in this report). Several sediment disposal options are being considered with disposal at the existing Ports Victoria Point Wilson dredge material ground (DMG) (referred to as the 'Disposal Ground' in this report) the current preferred option, based on a preliminary assessment and discussions with the Victorian Regional Channels Authority (now Ports Victoria).

Methodology

For any proposed sediment dredging in Australia, sediment quality must be evaluated in accordance with national regulations and guidelines; primarily the *National Assessment Guidelines for Dredging* (NAGD, 2009). This *Phase III Sediment Quality Assessment* report evaluated whether sediment from the Loading Site is suitable for relocation to the existing Point Wilson Disposal Ground in accordance with NAGD (2009) assessment and reporting guidelines.

Fieldwork was conducted by AECOM between 19 August and 8 September 2021 to collect sediment, pore water and seawater samples to inform the assessment in accordance with a *Sampling, Analysis and Quality Plan* (SAQP) (AECOM, 2021). Data generated from these fieldworks were combined with data reported by Coffey (2020) and AMA (2020) (within the Loading Site) because all three data sets were required to satisfy the NAGD (2009) assessment and reporting requirements.

Existing conditions

The following conclusions were made regarding the existing sediment conditions at the Loading Site, Disposal Ground and ambient baseline locations in Corio Bay:

- The physical characteristics of the Loading Site and Disposal Ground are generally very similar. Sediment physical characteristics at the ambient baseline locations in the vicinity of the Disposal Ground are also broadly similar but with a higher percentage of fine sands.
- Sediments at the Loading Site reported 95% upper confidence limit (UCL) and/or mean concentrations greater than the default guideline value (DGV) for antimony, arsenic, lead, mercury and nickel. Sediment elutriate analysis was subsequently performed for these metals/metalloids and the mean elutriate concentrations within the AECOM dataset were below the DGV indicating a low potential for bioavailability (and hence ecotoxicity) to marine biota. Silver and zinc elutriate concentrations were reported above the DGV in the Coffey (2020) data set however given that these elutriate tests were not initially required as per the NADG (2009) assessment process, are discrete, isolated occurrences, and are likely to be significantly diluted by the dredging process, the results are not considered to be significant exceedances that would contribute to adverse impacts to aquatic biota.
- Low levels of perfluorooctane sulfonate (PFOS) were detected in sediments at the ambient baseline locations, Loading Site and Disposal Ground; and in seawater collected within the outer harbour of Corio Bay (all below the adopted DGV). In addition, per- and polyfluoroalkyl substances (PFAS) were reported in sea water above the laboratory limit of reporting (LOR) at concentrations ranging between 0.0004 and 0.0009 µ/L. With the exception of PFOS, the PFAS detected in seawater were not recorded in the sediment samples collected from any location (including the Loading Site) indicating ubiquitous concentrations of PFAS in seawater across Corio Bay.

Sediment Quality Assessment

The NAGD (2009) sets out a phased methodology for the assessment of potential contaminant impacts during dredging activities that may pose risks to ecological receptors. While initial results from the sediment sampling identified some chemical concentrations that exceeded the assessment criteria, the NAGD (2009) phased approach sets out a process to further examine the potential toxicity to ecological receptors. These further test results identified no potential adverse impacts to ecological receptors at both the Loading Site and Disposal Ground during dredging activities.

On the basis of the Sediment Quality Assessment undertaken in accordance with the NAGD (2009), it is concluded that the sediments proposed to be dredged at the Loading Site are suitable for offshore disposal at the Point Wilson Disposal Ground.

Information from this *Phase III Sediment Quality Assessment* will be used to inform a Dredged Spoil Disposal Options Assessment (DSDOA) to be prepared by AECOM in a separate report.

Abbreviations and Definitions

Abbreviation/Term	Definition
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ANC	Acid Neutralising Capacity
ASS	Acid Sulfate Soil
CEE	Consulting Environmental Engineers
COC	Chain of Custody
COPC	Chemicals of Potential Concern
DELWP	Victorian Department of Environment, Land, Water and Planning
DG	Disposal Ground
DGV	Default Guideline Value
DMG	Dredge Material Ground
DSDOA	Dredged Spoil Disposal Options Assessment
EES	Environment Effects Statement
EMF	Environmental Management Framework
EPA Vic	Environment Protection Authority Victoria
EP Act	*Environment Protection Act 2017*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERS	Environmental Reference Standard
FSRU	Floating Storage and Regasification Unit
GPS	Global Positioning System
HEPA	Heads of EPA
HDD	Horizontal Direction Drilling
HDPE	High Density Polyethylene
LNG	Liquified Natural Gas
LOR	Limit of Reporting
LS	Loading Site
MACA	*Marine and Coastal Act 2018*
mbs	metres below seabed
MHF	Major Hazard Facility
MLA	Marine Loading Arms

Abbreviation/Term	Definition
NAGD	*National Assessment Guidelines for Dredging*, 2009
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NM	Nautical Miles
OC	Organic Carbon
OCP	Organochlorine Pesticides
OM	Organic Matter
OPP	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Per- and Poly-fluoroalkyl Substances
PFOS	Perfluorooctane Sulfonate
PSD	Particle Size Distribution
QAQC	Quality Assurance/Quality Control
ROW	Right of Way
RPD	Relative Percentage Difference
SAQP	Sampling, Analysis and Quality Plan
SWI	Seawater Intake
SWP	South West Pipeline
SWTP	Seawater Transfer Piping
TOC	Total Organic Carbon
TBT	Tributyltin Tin
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
USCS	United States Classification System
VRCA	Victorian Regional Channel Authority (now Ports Victoria)
VTS	Victorian Transmission System

1.0 Introduction

This technical report provides the results of a *Phase III Sediment Quality Assessment* performed to inform a Dredged Spoil Disposal Options Assessment (DSDOA) which will be prepared to support the Environment Effects Statement (EES) for the Viva Energy Gas Terminal Project (the project).

Viva Energy Gas Australia Pty Ltd (Viva Energy) is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate supply of a new source of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU) and would convert LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification) as required to meet industrial, commercial, and residential customer demand. A 7 kilometre (km) gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The project would be situated adjacent to, and on, Viva Energy's Geelong Refinery, within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. Co-locating the project with the existing Geelong Refinery and within the Port of Geelong offers significant opportunity to minimise potential environmental effects and utilise a number of attributes that come with the port and industrial setting.

In December 2020, the Victorian Minister for Planning determined that the project requires assessment through an EES under the *Environment Effects Act 1978* (Vic). The reasons for the decision were primarily related to the potential for significant adverse effects on the marine environment of Corio Bay and the potential for contributing to greenhouse gas emissions. Secondarily, the EES was required to assess the effects of the project on air quality, noise, land use, Aboriginal and historic heritage, native vegetation, groundwater, traffic and transport as well as visual amenity.

In January 2021 the project was also determined to require assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to the potential for the project to have a significant impact on wetlands of international importance, listed threatened species and communities, and listed migratory species. The EES process is the accredited environmental assessment process for the controlled action decision under the EPBC Act in accordance with the bilateral agreement between the Commonwealth and Victorian governments.

1.1 Purpose

This *Phase III Sediment Quality Assessment* characterises sediment quality associated with the construction phase of the project to inform the preparation of the EES required for the project.

A separate report (*Viva Energy Gas Terminal Project Impact Assessment of Dredging*, Consulting Environmental Engineers, 2021a) identifies and recommends mitigation measures to avoid, minimise and manage potential impacts of the dredging which will inform the development of an Environmental Management Framework (EMF) for the project. The mitigation measures listed in the EMF would be implemented in the approvals and management plans for the project.

1.2 Why understanding sediment quality is important

The project would involve localised dredging of approximately 490,000 m^3 of sediment in Corio Bay to provide a berth pocket and swing basin at the proposed extension to Refinery Pier for Berth No. 5 (referred to as the 'Loading Site' in this report). Several sediment disposal options are being considered with disposal at the existing Ports Victoria Point Wilson dredge material ground (DMG) (referred to as the 'Disposal Ground' in this report) the current preferred option, based on a preliminary assessment and discussions with the Victorian Regional Channels Authority (now Ports Victoria).

For any proposed sediment dredging in Australia, sediment quality must be evaluated in accordance with national regulations as detailed in **Section 3.0**. This *Phase III Sediment Quality Assessment* report

evaluates whether sediment from the proposed Loading Site is suitable for disposal at the Point Wilson Disposal Ground.

Information from this *Phase III Sediment Quality Assessment* will be used to inform a DSDOA to be prepared by AECOM in a separate report.

1.3 Project area

The project would be located at, and adjacent to, the Geelong Refinery and Refinery Pier in the City of Greater Geelong, 75 km south-west of Melbourne. The project area is within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. The Geelong central business district is located approximately 7 km south of the project.

Corio Bay is the largest bay in the south-west corner of Port Phillip Bay and is a sheltered, shallow basin at the western end of the Geelong Arm, with an area of 44 square kilometres (km^2). The Point Wilson/Limeburners Bay section of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site is located along the northern shoreline of Corio Bay, approximately 1 km to the north-east of the project.

The Port of Geelong has been in operation for over 150 years and is the largest industrial bulk cargo port in Victoria, attracting over 600 ship visits and handling more than 14 million tonnes of product annually. Geelong's shipping channels extend 18 nautical miles through Corio Bay from Point Richards through to Refinery Pier. Ports Victoria manages commercial navigation in the port waters in and around Geelong and is responsible for the safe and efficient movement of shipping, and for maintaining shipping channels and navigation aids. The channels are man-made having been deepened and widened through periodic dredging to support port trade development.

Refinery Pier is the primary location within the Port of Geelong for movement of bulk liquids. Vessels up to 265 metres (m) in length currently utilise the four berths at Refinery Pier which service Viva Energy refinery operations. The majority of ship visits to the port are to Refinery Pier, with Viva Energy accounting for over half of the trade through the Port of Geelong.

The Geelong Refinery has been operating since 1954 with both the refinery and the co-located Lyondell Bassel plant being licensed Major Hazard Facilities (MHFs). A range of industrial activities are situated in the Port environs including wood fibre processing and chemical, fertiliser and cement manufacturing.

To the north of the Geelong Refinery, along the proposed underground pipeline corridor, the area is predominantly rural. There are several other existing Viva Energy-owned underground pipelines running between the refinery and the connection point to the South West Pipeline (SWP) at Lara. The proposed pipeline route follows already disturbed pipeline corridors, where possible, through a mix of land uses.

The project area is shown in **Figure 1**.

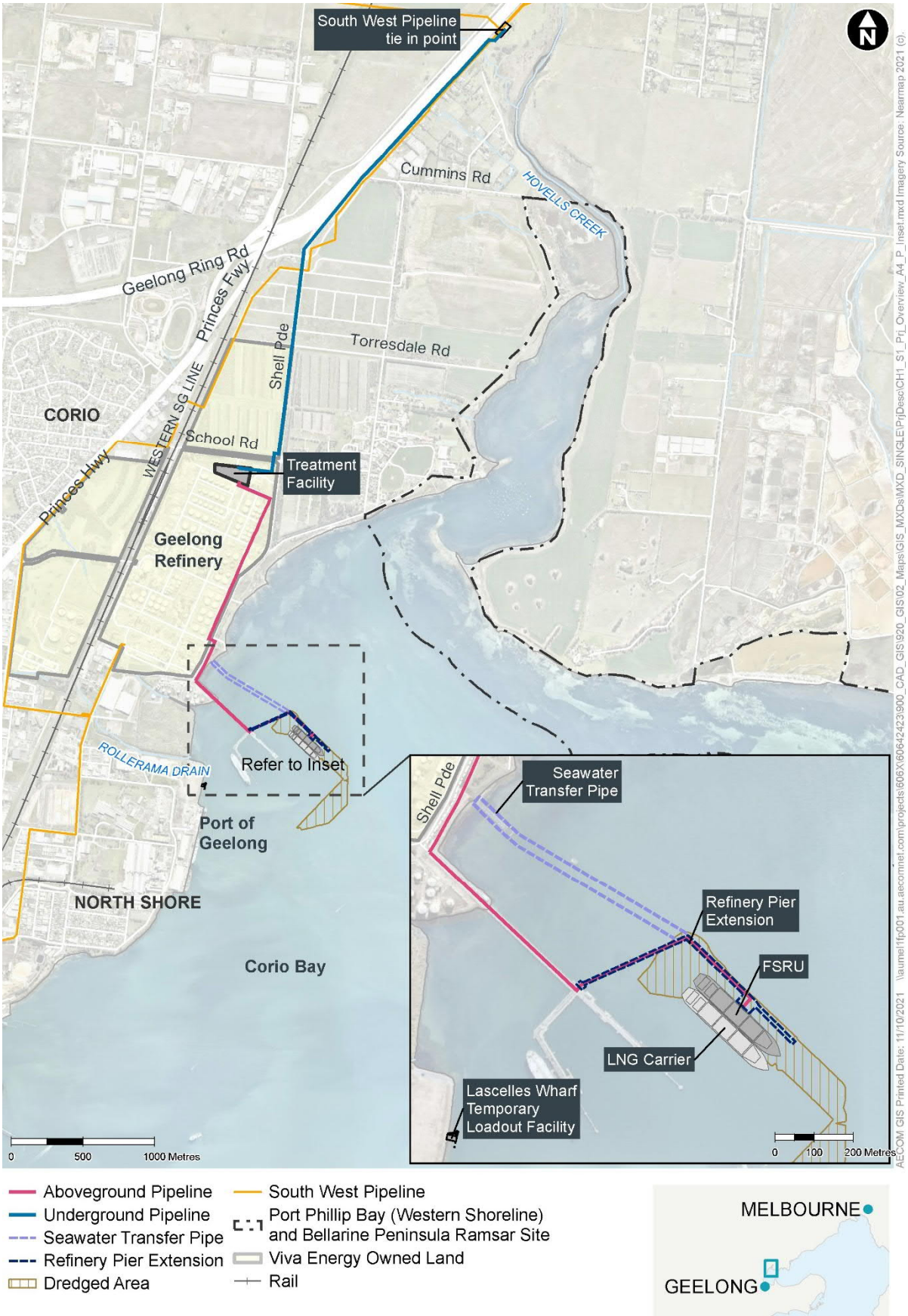

Figure 1 Project area

1.4 Project description

This section summarises the project as described in Chapter 4: *Project description*. Key components of the project include:

- extension of the existing Refinery Pier with an approximately 570 m long angled pier arm, new berth and ancillary pier infrastructure including high pressure gas marine loading arms (MLAs) and transfer lines connecting the seawater discharge points on the FSRU to the refinery seawater intake
- continuous mooring of an FSRU at the new Refinery Pier berth to store and convert LNG into natural gas. LNG carriers would moor alongside the FSRU and unload the LNG
- construction and operation of approximately 3 km of aboveground gas pipeline on the pier and within the refinery site connecting the FSRU to the new treatment facility
- construction and operation of a treatment facility on refinery premises including injection of nitrogen and odorant (if required)
- construction and operation of an underground gas transmission pipeline, approximately 4 km in length, connecting to the SWP at Lara.

The Refinery Pier extension would be located to the north-east of Refinery Pier No. 1. The new pier arm would be positioned to allow for sufficient clearance between an LNG carrier berthed alongside the FSRU and a vessel berthed at the existing Refinery Pier berth No. 1. Dredging of approximately 490,000 cubic metres (m^3) of seabed sediment would be required to allow for the new berth pocket and swing basin.

The FSRU vessel would be up to 300 m in length and 50 m in breadth, with the capacity to store approximately 170,000 m^3 of LNG. The FSRU would receive LNG from visiting LNG carriers and store it onboard in cryogenic storage tanks at about -160°C.

The FSRU would receive up to 140 PJ per annum (approximately 45 LNG carriers) depending on demand. The number of LNG carriers would also depend on their storage capacity, which could vary from 140,000 to 170,000 m^3.

When gas is needed, the FSRU would convert the LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification). The natural gas would then be transferred through the aboveground pipeline from the FSRU to the treatment facility where odorant and nitrogen would be added, where required, to meet Victorian Transmission System (VTS) gas quality specifications. Nitrogen injection would occur when any given gas cargo needs to be adjusted (diluted) to meet local specifications. Odorant (mercaptan) is added as a safety requirement so that the normally odourless gas can be smelt when in use. From the treatment facility, the underground section of the pipeline would transfer the natural gas to the tie-in point to the SWP at Lara.

1.4.1 Key construction activities

Construction of the project would occur over a period of 18 to 24 months. The key construction activities relate to:

- localised dredging of seabed sediments to enable the FSRU and LNG carriers to berth at Refinery Pier and excavation of a shallow trench for the seawater transfer piping
- construction of the new pier arm and berthing infrastructure, and aboveground pipeline along Refinery Pier and through the refinery
- construction of the treatment facility on a laydown area at the northern boundary of the refinery site
- construction of the buried pipeline
- construction at the tie-in point to the SWP at Lara

There are no construction activities required for the FSRU component of the project. The vessel would be built, commissioned and all production and safety systems verified prior to being brought to site.

An estimated 490,000 m^3 of dredging would be required over an area of 12 hectares (ha) adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to turn. Dredging within the new berth would be undertaken to a depth of 13.1 m and the swing basin would be dredged to a depth of 12.7 m. The dredging footprint is shown in **Figure 2**. It is planned to deposit the dredged material within Ports Victoria's existing Disposal Ground in Port Phillip Bay to the east of Point Wilson, approximately 26 km from Refinery Pier.

Construction of the pier arm would be carried out once dredging was complete, primarily from the water using barge-mounted cranes. Steel piles would be driven into the seabed by cranes mounted on floating barges and pre-cast concrete and pre-fabricated steel components would be transported to site by barge and lifted into position. The installation of pier infrastructure such as the marine loading arms (MLAs), piping from the FSRU to the existing refinery seawater intake (SWI) and aboveground pipeline would also be undertaken from the water using barge-mounted cranes.

Installation of the 3 km above ground pipeline along the pier and through the refinery is anticipated to take 3.5 months to complete. The above ground pipeline would run along the pier to the existing pipe track east of Shell Parade within the pier foreshore compound. It would then pass through a road under-crossing to the existing refinery pipe track. The pipeline would then run north along the existing refinery pipe track to an existing laydown area where the treatment facility would be located.

The treatment facility would be located within an existing laydown area in the refinery site and cover an area of approximately 80 m x 120 m. Construction of the treatment facility would take approximately six months and would be undertaken by specialist crews across distinct phases of work.

The 4 km underground pipeline would be installed in stages over an approximate four month period within a 25 - 35m corridor which has been selected so as to avoid the need for trenchless construction beneath watercourses or other environmental sensitivities. Firstly, a construction right of way (ROW) would be established, clearly identified and fenced off where required. Typically, this would be between 10 and 20 m wide, and minimised where possible to reduce disturbance. Once the construction ROW is established, vegetation would be removed, and a trench excavated to a maximum depth of 2 m and a maximum width of 1 m for the pipeline to be placed. Following the placement of the pipeline, the construction ROW would be rehabilitated to its pre-existing condition as far as practicable.

Trenchless construction (including thrust boring or horizontal directional drilling (HDD)) would be used to install the underground pipeline in areas that are not suited to open trenching techniques, such as at intersections with major roads, which would be confirmed during detailed design. Trenchless construction would involve boring or drilling a hole beneath the ground surface at a shallow angle and then pushing or pulling a welded length of pipe through the hole without disturbing the surface. It is anticipated that the maximum depth of the trenchless section would be 25 m.

Construction at the tie-in point to the SWP at Lara would be undertaken by specialist crews across the distinct phases of works, as with the treatment facility.

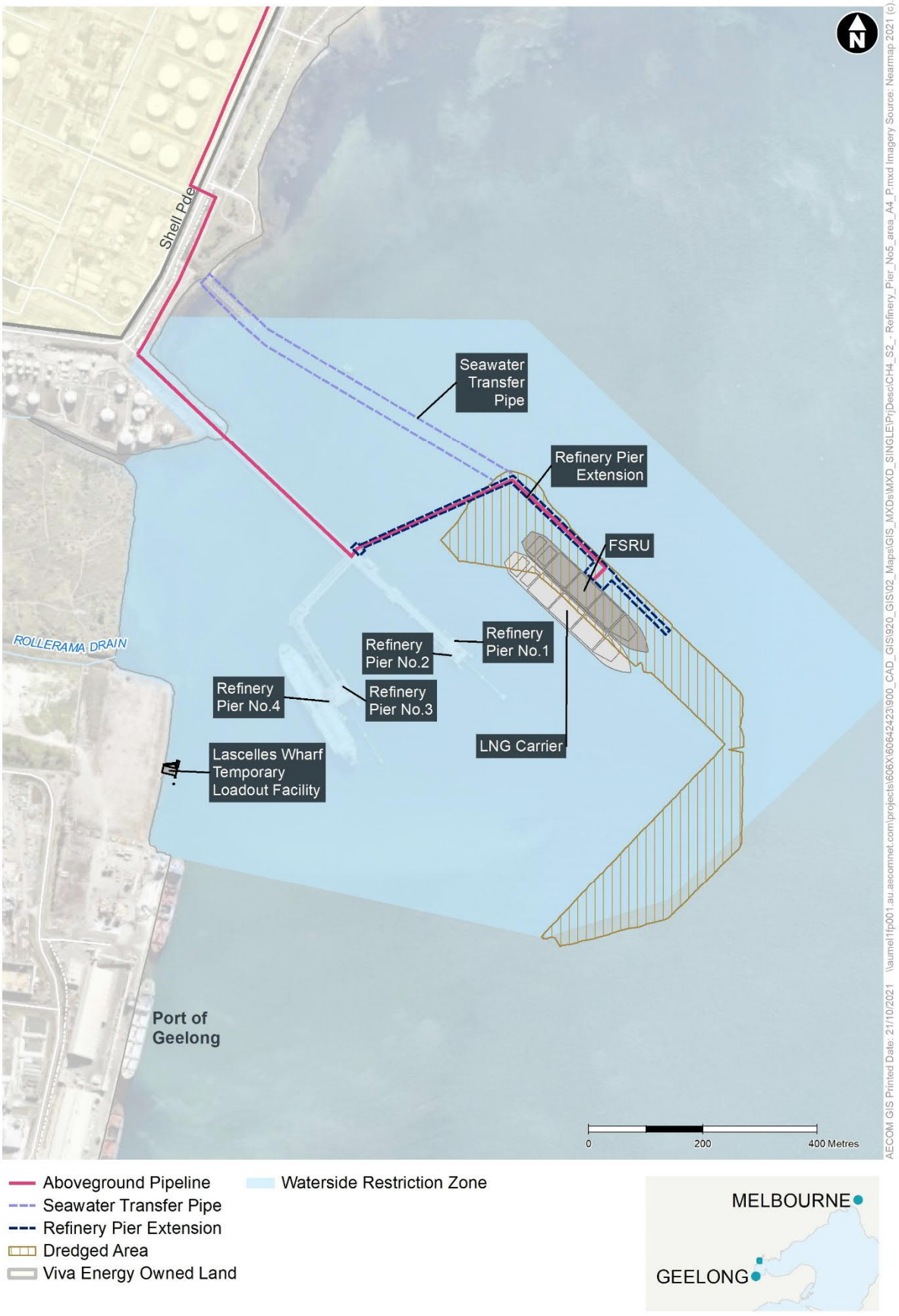

Figure 2 Proposed dredge footprint

1.4.2 Key operation activities

The project is expected to be in operation for 20 years. Key activities relating to project operation include:

- receipt of up to 45 LNG carriers each year at Refinery Pier – the number and frequency of LNG carriers arriving each year would depend on their storage capacity and gas demand
- regasification of LNG onboard the FSRU using seawater as a heat source, which would then be reused within the refinery as cooling water
- injection of nitrogen and odorant into the gas prior to distribution via the VTS
- monitoring and maintenance of the pipeline easement.

1.4.3 Key decommissioning activities

The FSRU, which continues to be an ocean-going vessel throughout the operation of the project, would leave Corio Bay on completion of the project life to be used elsewhere.

It is anticipated that the Refinery Pier berth and facilities would be retained for other port related uses. The underground pipeline would likely remain *in situ* subject to landholder agreements and either decommissioned completely or placed into care and maintenance arrangements.

Decommissioning activities may be subject to change, subject to legislative requirements at the time and potential repurposing of the infrastructure at the end of the project.

1.4.4 Project activities relevant to the assessment

The localised dredging of seabed sediments in the Loading Area to enable the FSRU and LNG carriers to berth at Refinery Pier and their subsequent deposition in the Disposal Ground is the main activity relevant to this assessment.

2.0 Scoping requirements

The scoping requirements for the EES set out the specific environmental matters to be investigated in the EES. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the project.

The following evaluation objective is relevant to the dredging and offshore contamination management assessment:

- **Waste management** – To minimise generation of wastes by or resulting from the project during construction and operation, including dredging and accounting for direct and indirect greenhouse gas emissions.

The scoping requirements of relevance to this dredging and offshore contamination assessment and where they are addressed in the report are shown in **Table 2-1**.

Table 2-1 Scoping requirements relevant to dredging and offshore contamination assessment

Aspect	Scoping requirement	Section addressed
Key issues	Potential for adverse environmental or health effects from waste materials/ streams generated from project works including dredging and disposal of material in dredge spoil management grounds.	Addressed in **Section 6.2** of this report with respect to the disposal of sediment in the Disposal Ground. Adverse effects to aquatic biota from the dredging process are addressed separately in the *Viva Energy Gas Import EES Impact Assessment of Dredging* report (Consulting Environmental Engineers, 2021).
	Potential for disturbance of contaminated soil or acid sulfate soil particularly during dredging.	Potential for acid sulfate soil is addressed in **Section 4.2.3** of this report.
Existing environment	Identify the potential occurrence of contaminated groundwater, contaminated soil/sediment, or potential acid sulfate soils within the area where project works may occur.	Addressed in **Sections 5.0** and **6.0** of this report
Likely effects	These requirements are addressed separately in the *Viva Energy Gas Terminal Project mpact Assessment of Dredging* report (Consulting Environmental Engineers, 2021)	
Mitigation measures		
Performance objectives	These requirements are addressed separately in the *Viva Geelong Gas Terminal Dredge Study Report* (Worley, 20 April 2021)	

3.0 Legislation, policy and guidelines

Table 3-1 summarises the key environmental legislation that apply to the project in the context of this *Phase III Sediment Quality Assessment*, as well as the implications for the project and the required approvals.

Additional guidelines and technical criteria relevant to the *Phase III Sediment Quality Assessment* are described in **Section 3.1**.

Table 3-1 Primary environmental legislation and associated information

Legislation	Description	Implications for the project	Approval required
Commonwealth Legislation			
Environment Protection (Sea Dumping) Act, 1981	Under the Sea Dumping Act, the Australian Government regulates the dumping, and loading for the purposes of dumping, of wastes and other matter at sea. If dumping will occur in the sea, a Sea Dumping Permit is required. The Sea Dumping Act applies to Australian Waters, from the low water mark to the limits of the Exclusive Economic Zone, apart from internal waters, within the limits of a state or territory (such as Port Phillip Bay).	The project will not require a Sea Dumping Permit to dispose of dredged sediment in the existing Ports Victoria Point Wilson Disposal Ground as this is located entirely within internal waters (i.e. Port Phillip Bay) under the jurisdiction of the state of Victoria.	No approval required
Environment Protection and Biodiversity (EPBC) Act, 1999	The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage Matters of National Environment Significance (MNES) including, but not limited to, World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The EPBC Act states that 'controlled' actions i.e. actions that are determined as likely to have a significant impact on a MNES are subject to assessment and approval under the EPBC Act.	The project is a 'controlled actions' requiring assessment and approval under the EPBC Act, due to the following relevant controlling provisions: • wetlands of international importance (Sections 16 and 17B) • listed threatened species and communities (Sections 18 and 18A) • listed migratory species (Sections 20 and 20A)	EPBC Act approval

Legislation	Description	Implications for the project	Approval required
State Legislation			
Marine and Coastal Act 2018	Provides an integrated and coordinated approach to planning and managing the marine and coastal environment by: • Enabling protection of the coastline and the ability to address the long-term challenges of climate change, population growth and ageing coastal structures. • Ensuring that partners work together to achieve the best outcomes for Victoria's marine and coastal environment.	Application for consent to use or develop marine and coastal Crown Land is required to be made to the Minister. Provision of a bond and/or payment of a periodic management charge may be a condition of the consent as security for carrying out the use, development or works.	Consent from the Minister under s. 68 (via DEWLP and EPA acting as technical advisors).
Environment Protection Act 2017 (EP Act) and *Environment Protection Amendment Act, 2018*	Sets out a framework for the protection of human health and the environment by reducing the harmful effects of pollution and waste and provides and framework for the management of waste. Central to the EP Act 2017 is the General Environmental Duty (GED). The GED is an ongoing duty to prevent the risk of harm to human health and the environment. According to Section 25(1) of the EP Act 2017, the GED requires that a person or entity who is engaging in an activity that may give rise to risks of harm to human health or the environment, to minimise those risks, so far as reasonably practicable.	The *Environment Reference Standard* [ERS] (2021) is a tool made under the EP Act that identifies environmental values on both land and water that need to be protected and provides a way to assess the relevant environmental values. For the assessment of environmental values for the offshore disposal option, the ERS identifies species protection levels for the location where the Point Wilson Disposal Ground is situated within Port Phillip Bay.	DEWLP/ EPA technical review of the Sediment Quality Assessment, and DSDOA.

3.1 Guidelines

Commonwealth guidelines relevant to contamination assessment include:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT.

- HEPA, 2020. *PFAS National Environmental Management Plan 2.0*, February 2020. Heads of EPA Australian and New Zealand (HEPA).
- NAGD (2009) *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, ACT.
- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended in 2013. National Environment Protection Council.

An additional state and technical specific guidelines referred to includes:

- *EPA Publication 1828.2 Waste Disposal Categories – characteristics and thresholds* (EPA 1828.2) (formerly IWRG 621 Soil Hazard Categorisation and Management)
- Simpson SL and Batley GE (2016) *Sediment Quality Assessment: A Practical Guide, Second Edition*. CSIRO.
- Simpson SL, Mosley L, Batley GE, Shand P (2018) *National Acid Sulfate Soils guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management*. Department of Agriculture and Water Resources, Canberra, ACT.
- Victorian Government (2021), *Environment Reference Standard, No. S245,* 26 May 2021.

4.0 Methodology

4.1 Project risk screening approach

A risk-based screening approach has been used for the EES assessment in accordance with the requirements outlined in the 'Ministerial guidelines for assessment of Environmental Effects under the *Environment Effects Act 1978*' (page 14). The risk screening is undertaken to ensure that the level of investigation conducted in each technical study is adequate to inform an assessment of the significance and acceptability of the project's potential environmental impacts.

An environmental, social and economic issues risk screening tool has been used to prioritise and focus the proposed investigations, assessments and approaches to avoiding, minimising or managing potential impacts. The issue screening process involved an evaluation of the potential environmental, social and economic issues associated with the project based on the information collected through a series of initial assessments undertaken into the potential effects of the project.

A risk workshop convened by a qualified risk practitioner and comprising technical specialists from the proponent, project design team and EES team conducted the initial risk screening. The risk screening process utilised knowledge of the project infrastructure and design, existing environment and land use setting to assess potential risks based on the specialised knowledge of the technical experts.

The purpose of the issues screening approach was to assist in identifying:

- significant issues, uncertainties and/or potential impacts that require more detailed characterisation and/or assessment within the EES
- matters or potential impacts considered to be already well understood or less significant.

A high, medium, or low screening value was assigned to potential issues to determine the level of assessment required to identify and investigate impacts.

Each potential issue was given a score (1, 2 or 3) against the categories of:

- community and stakeholder interest
- significance of assets, values and uses
- potential impact (spatial, temporal and severity).

The scores were added together, or the highest score across the three contributing categories was used, to give a 'screening value' of high, medium or low, which gives an indication of the level of impact assessment that is required. Issues that were assigned a screening value of high or medium required detailed assessment in the EES at a level commensurate with them being considered primary level issues.

Issues that were assigned a screening value of low were proposed to be documented and managed with some investigation and assessment in the EES at a level commensurate with them being considered secondary level issues.

4.1.1 Criteria and consequence ratings

Risks, issues, and potential impact pathways were identified for both construction and operation of the project. **Table 4-1** defines the criteria and consequence ratings for each of the three categories that have been used to inform the issues screening. The sum of the scores against each of the three categories or the highest rating across any of the three contributing categories gives the 'screening value'.

Table 4-1 Issues screening criteria and consequence ratings

Rating	Community and stakeholder interest	Significance of assets, values and uses	Potential impact (spatial, temporal and severity)
1	Low interest and perceived impact	Locally significant asset, value or use	Potential for localised, temporary impact
2	Some interest and targeted perceived impacts	Regionally significant asset, value or use	Potential for significant temporary, or localised permanent impact
3	Broad community and stakeholder interest or impacts	State or nationally significant asset, value or use	Potential for significant permanent impact

The screening values are then used to determine the level of assessment required as shown in **Table 4-2**.

Table 4-2 Issue investigation categories

Screening score	Screening value	Potential consequences	Complexity of mitigation	Level of assessment
7, 8 or 9 or the highest rating across any one of the three contributing categories is 3	High	Potential for elevated, longer term impacts, significant assets or values may be affected with enduring changes. Considers both impacts and benefits, or Issue may not be well defined and insufficient information is available for the impact assessment, or High level of community interest.	Stringent management measures may be required	Detailed assessment required
4, 5 or 6 or the highest rating across any one of the three contributing categories is 2	Medium	Potential for moderate level impacts, significant assets or values may be affected over an extended time frame with some resultant changes. Considers both impacts and benefits, or Issue may be moderately understood, and some information is available, however more is required for the impact assessment, or Medium level of community interest.	Standard management measures are available that can be adopted with some modification	Moderate assessment required
3 or the highest rating across any one of the three contributing categories is 1	Low	Potential for short term and localised impact. Asset or values may be temporarily affected but recovery expected, or Issue is well understood and there is enough information available for the impact assessment, or Low level of community interest.	Standard management measures are available.	Some assessment required

Further information about the risk screening process is detailed in Chapter 7: *Assessment framework.*

Outcomes from the risk screening process relating to contaminated dredge sediments are outlined in **Section 4.1.2** below.

4.1.2 Risk screening results

Table 4-3provides the key potential issues related to dredging and offshore contamination identified as part of the risk screening process for the project and presents the screening value for each issue.

Table 4-3 Dredging and offshore contamination issues screening results

Aspect	Issue	Community & stakeholder perceived impacts	Significance of assets, values & uses	Potential impact (spatial, temporal & severity)	Screening Score	Screening Value
Construction						
Offshore contamination	Potential impact on the environment from dredge spoil, piling cuttings	3	3	3	9	High

The screening value of “High” for the potential impact on the environment from dredge spoil and piling cuttings required that a detailed assessment of the potential impact be undertaken.

4.2 Existing conditions assessment method

4.2.1 Study area

Sediment dredging is proposed to be undertaken in Corio Bay to the east of the Geelong Refinery, adjacent to the existing Refinery Pier and shipping channel. The proposed localised dredging is required to remove sediments to:

- create a berth pocket for the proposed extension to Refinery Pier for Berth No. 5
- to increase the existing swing basin.

The proposed dredging extent is illustrated on **Figure 2** (**Section 1.4.1**), as indicated by the red shading.

In accordance with the NAGD (2009), a Dredged Spoil Disposal Options Assessment (DSDOA) is required to comparatively assess alternatives to ocean disposal (e.g., onshore reuse, disposal and/or treatment) as well as disposal at identified ocean disposal sites.

An estimated 490,000 m^3 (*in-situ* volume) of dredged material would need to be removed adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to manoeuvre (Worley, 2021a). The new berth pocket would be dredged to a depth of -13.1 metres Inner Harbour Chart Datum and the swing basin would be dredged to a depth of -12.7 metres Inner Harbour Chart Datum (Worley, 2021b).

It is understood that the current preference, subject to the findings of the DSDOA, is to dispose of all dredged material at the existing Ports Victoria Point Wilson Disposal Ground where spoil from past dredging programs in Corio Bay has been taken.

The Disposal Ground is approximately 26 km from the Loading Site (refer to **Figure 3** below). It is estimated that a bulked volume of 460,300 m^3 of dredged material would need to be placed at the Disposal Ground (noting that further bulking may occur during placement at the Disposal Ground) (Worley, 2021a). Placement of dredged material is assumed to be by bottom dumping from barges (as

has previously occurred at the Disposal Ground), with no requirements for bunding, layering or capping of material (Worley, 2021a).

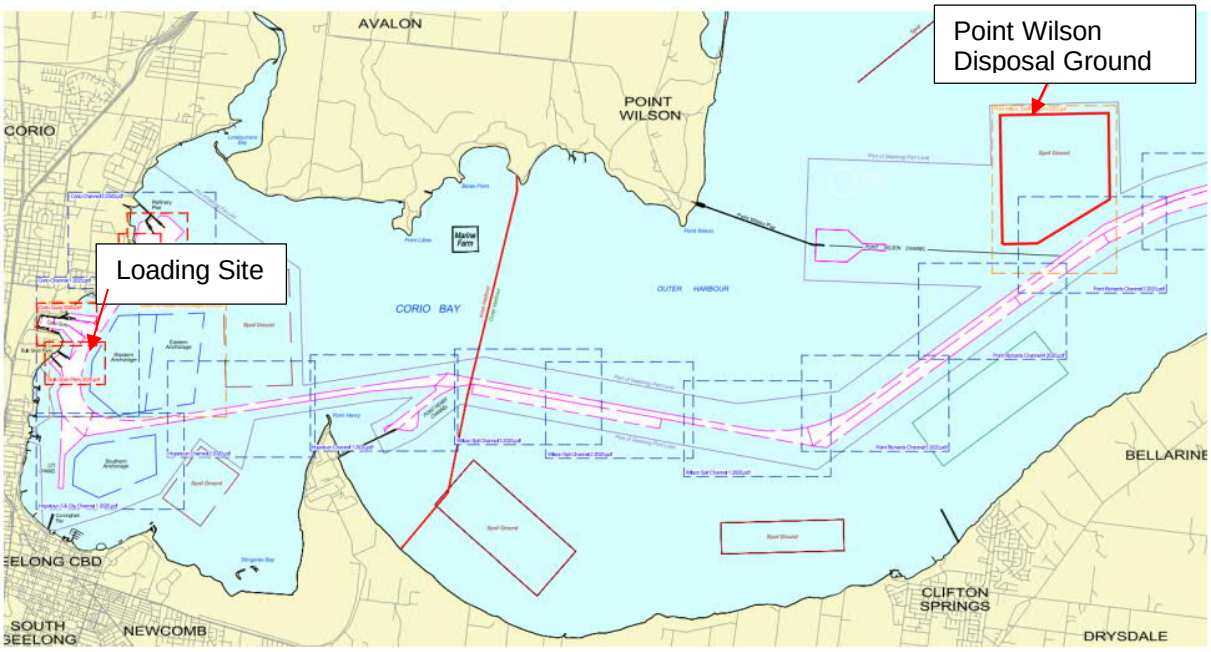

Figure 3 Location of Point Wilson Disposal Ground (from *Viva Geelong Gas Terminal, Dredge Study Report,* Worley, 2021a).

In addition to the dredging of sediment associated with the berth pocket and swing basin, the design of the FSRU includes seawater transfer piping from the FSRU to the shoreline (refer to **Figure 1**). The current design indicates that approximately 8,800 m^3 of sediment will need to be excavated in order to install the piping below the seabed. At this stage, it is proposed that the excavated material be reused to backfill the excavation, creating a mound over the piping.

Sediment investigations based on the original dredge footprint have been performed at the Loading Site by AMA (2020) and Coffey (2020) which identified low levels of per-and poly-fluoroalkyl substances (PFAS) and elevated concentrations of some heavy metals/metalloids when compared with the adopted regulatory assessment criteria (where available).

Data gaps remaining after the AMA (2020) and Coffey (2020) sediment investigations and actions proposed to address these data gaps were presented in the Sampling, Analysis and Quality Plan (SAQP) (AECOM, 2021). This is included as **Appendix A**.

Following further development of the design, the option to install the seawater transfer piping below the seabed via trenching was considered, and consequently, seven additional sample locations were added to the scope along the alignment of the proposed seawater transfer piping. These locations are included on **Figure 4** (**Section 4.4.2**). The SAQP was implemented by AECOM between 19 August 2021 and 8 September 2021, and the results are presented in **Section 5.0**.

4.2.2 Sediment Quality Assessment Approach

This section describes the staged assessment approach performed to identify whether the dredged material from the Loading Site is suitable for disposal at the Point Wilson Disposal Ground. The staged assessment approach is performed in accordance with the *National Assessment Guidelines for Dredging* (NAGD, 2009), and follows the phased approach illustrated in **Plate 1**.

This report presents the results of Phase I (**Section 4.3**), Phase II (**Section 4.4** and **Section 6.1**) and Phase III (**Section 6.2**) of the NAGD (2009) assessment process, as illustrated in **Plate 1**.

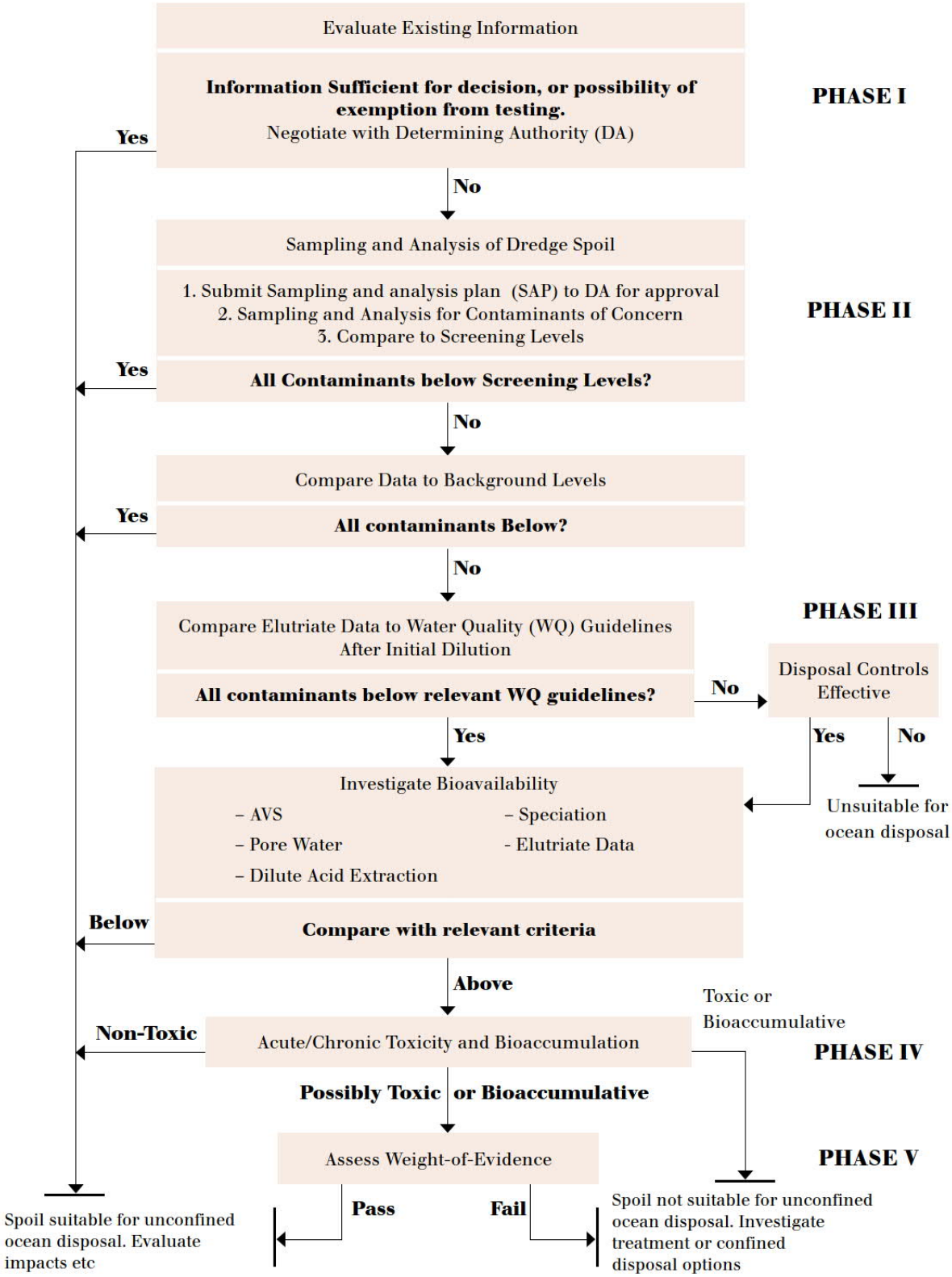

Plate 1 NAGD (2009) Phased Assessment Approach

4.2.3 Acid sulfate soil potential

Coffey (2020) performed a preliminary acid sulfate soil (ASS) assessment to identify the ASS status of the sediments to be dredged, primarily to assess suitability for onshore disposal (i.e. drying or significant oxidation would occur). The results identified the presence of sulfides and acid generating potential in sediments within the proposed dredging depth profile. However, considerable acid neutralising capacity (ANC) was also reported, and when the ANC was considered, the net acidity values were below the ASS action criteria. Coffey (2020) noted that the neutralising capacity exceeded the acid generating capacity by more than 15 times in most samples. Coffey (2020) concluded that:

- all sediments could be classed as non-ASS for onshore management
- further sampling and analysis would be required if the sediments are to be dried or significant oxidation is likely. This statement is consistent with Simpson et al (2018) which states that "*When ASS are below the water table they are generally considered harmless*…".

In accordance with Simpson et al (2018) guidance for dredging of ASS sediments, the preliminary assessment conducted by Coffey (2020) is considered to comprise Step 2 (Initial Assessment) of the ASS assessment process. Since the initial assessment of ASS potential did not identify that ASS is likely to be an issue, and because the sediment is proposed to be disposed within Corio Bay (i.e. sediments will not be dried prior to disposal), no further assessment of ASS potential was considered to be required.

Furthermore, it is understood that at the Loading Site, sediment will be loaded into split hopper barges and transported to the Disposal Ground within approximately two hours of dredging (CEE, 2021a). Given the relatively short time where the external layer of sediments in the barge would be exposed to the atmosphere, minimal 'drying' and oxidation of sediment would occur and consequently potential ASS generation would be limited.

4.3 Phase I - Evaluate Existing Information

Phase I was completed during preparation of the AECOM (2021) SAQP (**Appendix A**) to evaluate the existing relevant information relating to the project to identify the chemicals of potential concern (COPC) and data gaps relevant to the assessment of the Loading Site, Disposal Ground and ambient baseline conditions, to comply with the NAGD (2009) assessment and reporting guidelines.

4.3.1 Information reviewed

Data provided in the following reports were reviewed during development of the AECOM (2021) SAQP (**Appendix A)**:

- AMA (2020) *Targeted Sediment Investigation, Project VEGA*. 12 October 2020
- Coffey (2020) *Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project*. 4 December 2020
- Worley (2021a) *Viva Geelong Gas Terminal, Dredging Study*. 8 April 2021
- Cardno (2011) *Corio Bay Safety Adjustment Program – Turbidity from Dredging*. 23 November 2011
- The University of Melbourne (2011) *Environmental Risk Assessment for VRCA Corio Bay Channel Safety Adjustment Program*. 11 March 2011.
- URS (2014) *Sediment Investigation Sampling and Analysis*. 18 July 2014
- Worley Parsons Services Pty Ltd (2011a) *Corio Bay Safety Adjustment Program – SAP Implementation Report*. 19 October 2011
- Worley Parsons Services Pty Ltd (2011b) *Corio Bay Safety Adjustment Program – Factual Report on Geotechnical Investigation*. 22 February 2011
- Worley, 2021a *Viva Geelong Gas Terminal,* Dredge Study Report.

Data from some of these reports were not relevant due to their location outside of the Loading Site and/or Disposal Ground. Relevant findings from previous investigations undertaken at the Loading Site and/or Disposal Ground are summarised in Table 1 of the AECOM (2021) SAQP (**Appendix A**).

4.3.2 Chemicals of potential concern (COPC) identification

An evaluation of the reports listed in **Section 4.3.1** identified the following COPC in vicinity of the Loading Site:

- metals and metalloids: antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc
- tributyltin (TBT)
- total recoverable hydrocarbons (TRH)
- polycyclic aromatic hydrocarbons (PAHs): 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(e)pyrene, benzo(k)fluroanthene, chrysene, coronene, dibenz(a.h)anthracene, fluoranthene, fluorene, indeno(1.2.3.cd)pyrene, naphthalene, perylene, phenanthrene, pyrene, benzo(g,h,i)perylene and benz(a)anthracene)
- organophosphorus pesticides (OPPs)
- organochlorine pesticides (OCPs): total dichlorodiphenyltrichloroethane (DDT), dieldrin, chlordane, lindane, endrin
- polychlorinated biphenyls (PCBs)
- PFAS: perfluorobutane sulfonic acid (PFBS), perfluorohexane sulfonic acid (PFHxS), perfluorooctane sulfonic acid (PFOS), perfluorobutanoic acid (PFBA), perfluoropentanoic acid (PFPeA), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorooctanoic acid (PFOA), 4:2 fluorotelomer sulfonic acid (4:2 FTS), 6:2 fluorotelomer sulfonic acid (6:2 FTS), 8:2 fluorotelomer sulfonic acid (8:2 FTS), and 10:2 fluorotelomer sulfonic acid (10:2 FTS).

TRH, OPPs, OCPs, and PCBs were not detected or detected very infrequently and at concentrations below nationally adopted default guideline values (DGVs) during previous investigations conducted by Coffey (2020). Therefore, it is unlikely these COPC would be encountered in future sampling and were consequently not considered further in the *Phase III Sediment Quality Assessment*.

In addition to the COPC identified above, the sediment samples at the Loading Site, Disposal Ground and ambient baseline locations required additional analysis to characterise the following attributes to satisfy NAGD (2009) assessment and reporting guidelines:

- particle size distribution (PSD)
- density
- total organic carbon (TOC)
- organic matter (OM).

4.3.3 Data gaps assessment

AECOM (2021) identified seven main data gaps in the existing information which required assessment to satisfy the NAGD (2009) assessment and reporting guidelines. These data gaps are described in detail in Table 2 of the SAQP (AECOM, 2021) and are summarised here as:

- Ambient baseline sediment data for conventional COPC were collected more than five years ago and are not considered representative of current conditions.
- The ambient sediment samples analysed for PFAS were not located in the vicinity of the Disposal Ground.
- Sediment sample density at the Loading Site and seawater sample density at the Disposal Ground were insufficient according to the requirements of NAGD (2009).
- Depth of sediment samples analysed for PFAS at the Loading Site was insufficient according to the requirements of the NAGD (2009).

- Information regarding the physical and chemical characteristics of the water column and sediments at the Disposal Ground were unknown.
- Limited analysis to understand COPC bioavailability was conducted by Coffey (2020) i.e., limited elutriate testing of sediments collected from the Loading Site.
- Insufficient collection and analysis of sediment samples at the Loading Site to further characterise the 'suspect'[1] layer (0 to 2.5 m below seabed (mbs)) and inform whether sediment from the 'suspect' layer may require special handling and disposal considerations.

4.4 Phase II – Sampling and analysis of dredge spoil

The AECOM (2021) SAQP outlined the proposed sampling and analysis program for the *Phase III Sediment Quality Assessment*. The SAQP was submitted to the environmental regulator (EPA Victoria) for review and comment. Comments were received from EPA Victoria on 25 June 2021 which were subsequently addressed in the revised SAQP.

4.4.1 Sampling and analysis for COPC

The following scope of work was completed for the *Phase III Sediment Quality Assessment* within the Loading Site, Disposal Ground and ambient baseline locations:

- collection of sediment samples at the Loading Site
- collection of sediment samples at ambient site locations
- collection of sediment and seawater samples at the proposed Disposal Ground.

4.4.2 Sample locations and rationale

Loading Site sample locations are illustrated on **Figure 4**, and **Figure 5** illustrates sampling locations at the Disposal Ground and ambient baseline locations.

Subsequent to review of and provision of comments on the SAQP by EPA Victoria, additional sampling locations were required. The design of the FSRU includes seawater transfer piping (SWTP) from the FSRU to the shoreline. The current design indicated that approximately 8,800 m^3 of sediment will need to be excavated in order to install the piping below the seabed. It is being proposed that the excavated material be reused to backfill the excavation, creating a mound over the piping. For completeness, additional sampling was undertaken in addition to the investigation locations outlined in the SAQP.

Table 4-4 provides a breakdown of the sample locations, environmental media sampled and the justification for the sample locations to inform the DSDOA.

[1] NAGD (2009) considers sediment to be 'suspect' if contamination is known or suspected to be present. NAGD (2009) stipulate that each site is to be classified as 'probably contaminated', 'suspect' or 'probably clean'.

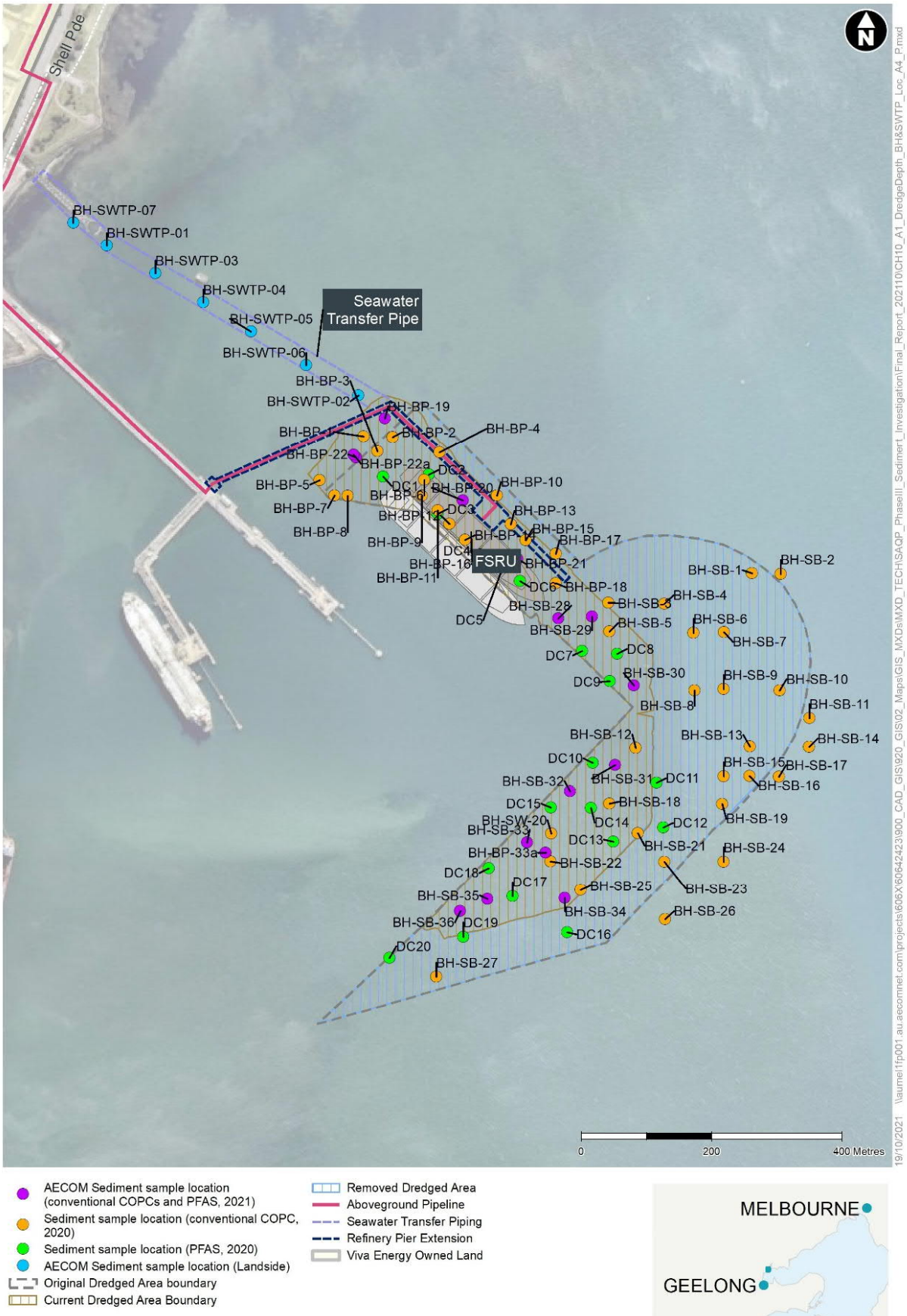

Figure 4 Loading site (including SWTP) sampling locations including original and revised dredge footprints

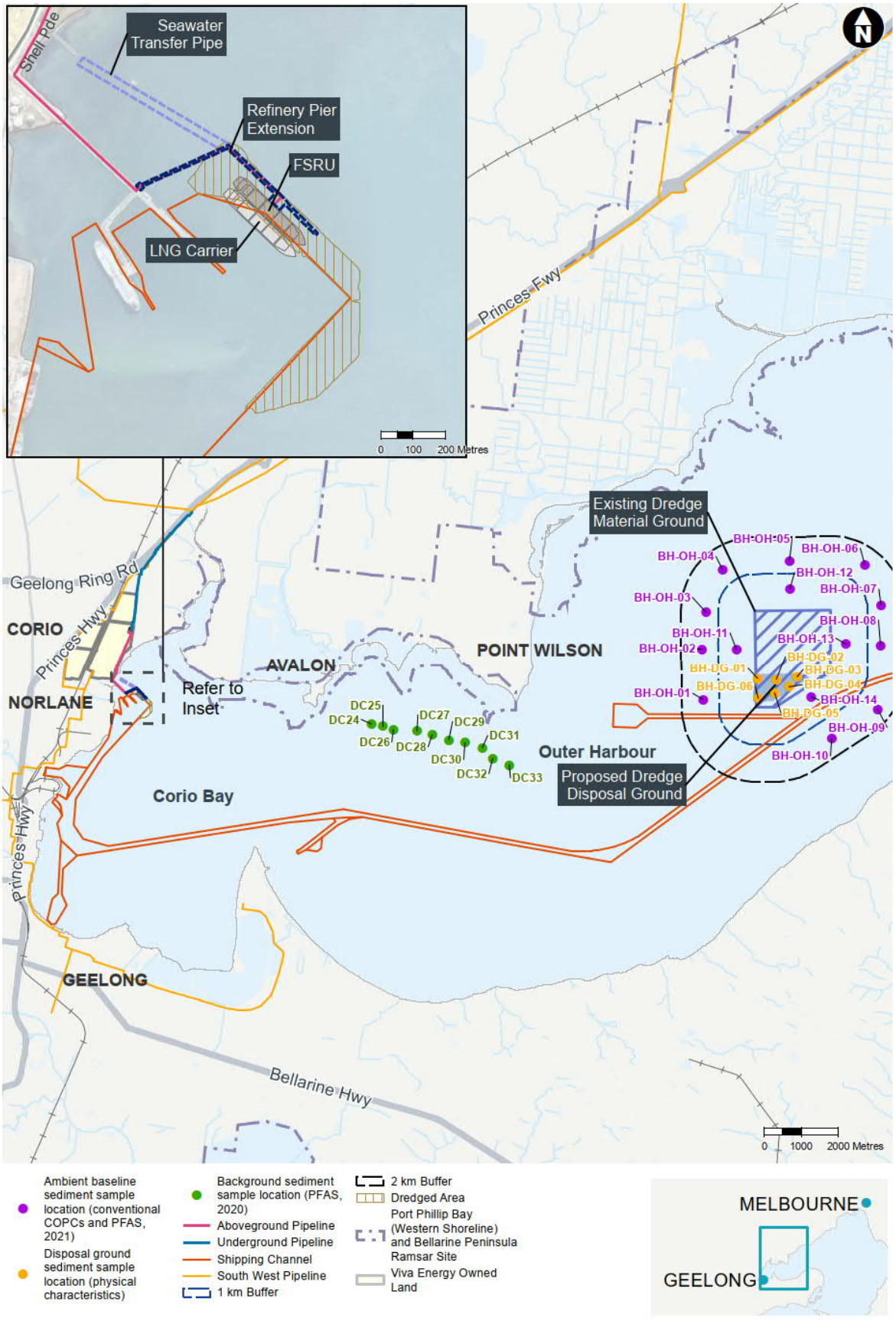

Figure 5 Ambient and Disposal Ground sampling locations

Table 4-4 Sample locations and rationale

Location / Justification	Number of Locations			Depth Interval (mbs); Collection Method	Analyte Suites					
	Sediment	Pore Water	Seawater		TOC and OM	PSD & Density	Metals Metalloids, and Organotins	PAHs	PFAS	Ammonia
Loading Site										
To supplement the AMA (2020) and Coffey (2020) data to satisfy the NAGD (2009) requirement of 28 sample locations for 490,000 m^3 of dredge material	13	-	-	0-7; Barge and drill rig	X	X	X	X	X	
	-	7	-	0-7; Extracted from sediment samples			X	X	X	X
Ambient Baseline Locations										
To satisfy the NAGD (2009) requirement of ambient baseline characterisation	14[2]	-	-	0-0.5; Hand-held core collected by divers	X	X	X	X	X	
Disposal Ground										
To satisfy the NAGD (2009) requirement of Disposal Ground physical characterisation, and seawater for elutriate testing	6[3]	-	-	0-0.5; Hand-held core collected by divers	X	X				
	-	-	3	Mid water column; container collected from boat			X	X	X	

[2] Based on a power analysis conducted (as per the NAGD (2009)) and to enable transects through the Disposal Ground.
[3] Minimum number of locations required.

Location / Justification	Number of Locations			Depth Interval (mbs); Collection Method	Analyte Suites					
	Sediment	Pore Water	Seawater		TOC and OM	PSD & Density	Metals Metalloids, and Organotins	PAHs	PFAS	Ammonia
Seawater Transfer Piping										
To satisfy the NAGD (2009) requirement of seven sample locations for 8,880 m^3 of dredge material (area not previously assessed)	7	-	-	0-1.5 Hand-held cores collected via vibracoring by divers	X	X	X	X	X	

4.4.3 Sampling methodology

Fieldwork was conducted between 19 August 2021 and 8 September 2021using sampling techniques consistent with the SAQP (AECOM, 2021).

At the Loading Site, sediment samples were collected using a drill rig mounted on a barge. Push tube and vibracoring drilling techniques were used to obtain the sediment cores to a maximum drilling depth of 7 mbs. Sediment samples were collected at 0.5 m intervals from the sediment core (where recovery allowed).

At the Disposal Ground, SWTP and ambient baseline locations, divers collect samples using handheld polycarbonate corers to a maximum depth of 0.5 mbs (Disposal Ground and ambient baseline) and 1.5 m bgs (SWTP).

Bore logs for each location were recorded using the Unified Soil Classification System (USCS) and are provided in **Appendix D**. The GPS coordinates for each sample location were recorded. The location of quality control (e.g. duplicate and inter-laboratory duplicate) sample collection points was also noted.

Field notes were maintained to record all field sampling events and included observations made at each sample location. The field notes are provided in **Appendix E**.

Photographs taken during fieldworks which illustrate relevant sampling and field information are provided in **Appendix F**.

Seawater samples were collected at three locations in the vicinity of the Disposal Ground from the dive boat. The seawater samples were collected from mid-water column into new and decontaminated 10 L metal jerry cans using a peristaltic pump as far forward as was safe off the boat. Seawater was then transferred into laboratory provided containers using a new (and decontaminated using Liquinox^{TM}) stainless steel or high density polyethylene (HDPE) funnel. Dedicated tubing was used for each seawater sample. This methodology minimised the potential for cross contamination associated with use of water pumps, and the metal jerry can is suitable for PFAS sampling (HEPA, 2020).

Porewater samples were extracted from composite samples from two locations at the Loading Site (PW- SB-28 and PW-SB-34). Porewater was unable to be extracted from sediment samples SB-31, SB-32, BP-21, BP-20, SB-29 due to dense sediment with minimum pore space.

Before and between sampling, reusable items such as polycarbonate corers, stainless steel bowls and handheld tools used for processing duplicate and composite samples in the field were decontaminated using Liquinox^{TM}, a phosphate free detergent, and rinsed with clean deionised water (certified by the laboratory to be PFAS-free), to reduce the potential for cross contamination.

All samples were placed on ice in eskies immediately after sampling. All samples were kept, as far as possible, at approximately 4°C during transit to the laboratory. Prior to sampling, assessment of the analytical holding times was made, and the sampling planned accordingly to ensure that holding times were minimised and not breached.

Sediment and seawater samples were transported directly to the laboratory for analytical testing under standard procedures by the following laboratories:

- Primary and associated duplicate QA/QC samples were analysed by Envirolab in Melbourne, Victoria.
- The inter-laboratory duplicate samples were analysed by ALS in Melbourne, Victoria.

Intra-laboratory field duplicate samples were collected at a rate of one per 10 primary samples (or a minimum of one per batch) for seawater and sediment. Intra-laboratory field duplicate samples were collected at a rate of one per 20 primary samples (or a minimum of one per batch) for sediment elutriate samples. The sediment elutriate analysis was primarily to assess the potential for chemicals to desorb from sediment particles to interstitial or overlying water; and therefore, the one in twenty ratio is considered acceptable.

Inter-laboratory duplicate samples were collected at a rate of one per 10 primary samples (or a minimum of one per batch) for seawater and sediment.

For each day of sampling, following decontamination procedures, a rinsate blank was collected by running laboratory prepared deionised water (certified by the laboratory to be PFAS-free) over the

reusable sampling equipment and nitrile gloves used by the divers for collection directly into laboratory prepared sampling containers.

Rinsate samples were collected to assess the effectiveness of the equipment decontamination methods employed (e.g., during sediment sampling). The rinsate samples were analysed for the same suite of analytes as the primary samples. At least one rinsate sample was collected for every ten primary samples collected in accordance with HEPA (2020) recommendations. These included rinsate samples from the following equipment:

- stainless steel bowls and hand tools used for processing samples
- at least one plastic lidded bucket used for 5 kg sediment samples
- each new 10 L jerry can used to collect seawater
- coring equipment in contact with sediment
- nitrile gloves used by the divers (over their diving gloves) during the collection of sediment cores from the SWTP, ambient baseline locations and the Disposal Ground.

Laboratory prepared trip blank samples were used at a frequency of one per day to assess sample handling and storage conditions, and the potential for field cross-contamination between samples. The trip blanks were analysed for the same suite of analytes as the primary samples.

A Chain of Custody (COC) form was completed for each batch of samples, documenting the sample identification number and analytes. COCs and laboratory reports for all samples are provided in **Appendix G**.

Table 4-5 lists the sediment and seawater samples which were collected and lists the sediment samples from which the elutriate and porewater samples were obtained.

Table 4-5 Summary of samples collected

Sample Type	Location	Sample Collection Date	Maximum Depth (mbs)	Samples Analysed for COPC (metals/PFAS/PAHs/ organotins)	Physical Parameters (TOC, OM, PSD, density)	Elutriate Sample
Sediment (Loading Site, Swing Basin)	BH-SB-36	8 September 2021	3.2	BH-SB-36_0.5-1.0 (1a) BH-SB-36_1.5-2.0 (1a) BH-SB-36_2.5-3.0 (1b)	BH-SB-36_0.5-1.0 (1a) BH-SB-36_1.5-2.0 (1a) BH-SB-36_2.5-3.0 (1b)	BH-SB-36_2.5-3.0 (1b)
	BH-SB-35	7 September 2021	5	BH-SB-35_1.0-1.5 (1a) BH-SB-35_2.0-2.5 (1a) BH-SB-35_4.0-5.0 (1b)	-	-
	BH-SB-34	7 September 2021	3.5	BH-SB-34_0.0-0.5 (1a) BH-SB-34_2.0-2.5 (1b) BH-SB-34_2.5-3.0 (1b)	-	BH-SB-34_0.0-0.5 (1a) BH-SB-34_2.0-2.5 (1b) BH-SB-34_2.5-3.0 (1b)
	BH-SB-33	30 August 2021	5	BH-SB-33_0.5-1.0 (1a) BH-SB-33_1.5-2.0 (1a) BH-SB-33_3.0-4.0 (2)	BH-SB-33_1.5-2.0 (1a) BH-SB-33_3.0-4.0 (2)	BH-SB-33_1.5-2.0 (1a)
	BH-SB-32	30 August 2021	5	BH-SB-32_0.0-1.0 (1a) BH-SB-32_2.5-3.0 (1b)	BH-SB-32_0.0-1.0 (1a) BH-SB-32_2.5-3.0 (1b)	BH-SB-32_0.0-1.0 (1a) BH-SB-32_2.5-3.0 (1b)
	BH-SB-31	27 August 2021	5	BH-SB-31_0.5-1.0 (1a) BH-SB-31_2.0-2.5 (1b) BH-SB-31_3.5-4.0 (2)	BH-SB-31_0.5-1.0 (1a) BH-SB-31_2.0-2.5 (1b) BH-SB-31_3.5-4.0 (2)	BH-SB-31_0.5-1.0 (1a) BH-SB-31_3.5-4.0 (2)
	BH-SB-30	27 August 2021	5	BH-SB-30_0.5-1.0 (1a) BH-SB-30_1.5-2.0 (1b) BH-SB-30_4.5-5.0 (2)	BH-SB-30_0.5-1.0 (1a) BH-SB-30_1.5-2.0 (1b) BH-SB-30_4.5-5.0 (2)	-
	BH-SB-29	6 September 2021	6	BH-SB-29_0.0-0.5 (1a) BH-SB-29_2.0-2.5 (1b) BH-SB-29_5.0-6.0 (2)	BH-SB-29_0.0-0.5 (1a) BH-SB-29_2.0-2.5 (1b) BH-SB-29_5.0-6.0 (2)	BH-SB-29_0.0-0.5 (1a) BH-SB-29_2.0-2.5 (1b) BH-SB-29_5.0-6.0 (2)
	BH-SB-28	6 September 2021	6	BH-SB-28_1.0-1.5 (1a) BH-SB-28_2.0-2.5 (1a) BH-SB-28_4.0-5.0 (1b)	BH-SB-28_1.0-1.5 (1a) BH-SB-28_2.0-2.5 (1a) BH-SB-28_4.0-5.0 (1b)	BH-SB-28_1.0-1.5 (1a)
Sediment (Loading Site, Berth Pocket)	BH-BP-22	31 August 2021	7	BH-BP-22_0.0-0.5 (1a) BH-BP-22_2.0-2.5 (1b) BH-BP-22_4.0-5.0 (2)	BH-BP-22_0.0-0.5 (1a) BH-BP-22_2.0-2.5 (1b) BH-BP-22_4.0-5.0 (2)	BH-BP-22_0.0-0.5 (1a) BH-BP-22_2.0-2.5 (1b)
	BH-BP-21	1 September 2021	6	BH-BP-21_0.0-1.0 (1a) BH-BP-21_2.0-3.0 (1b) BH-BP-21_3.0-4.0 (1b)	BH-BP-21_0.0-1.0 (1a) BH-BP-21_2.0-3.0 (1b) BH-BP-21_3.0-4.0 (1b)	BH-BP-21_0.0-1.0 (1a) BH-BP-21_2.0-3.0 (1b) BH-BP-21_3.0-4.0 (1b)
	BH-BP-20	1 September 2021	5	BH-BP-20_0.0-1.0 (1a) BH-BP-20_2.0-3.0 (1b) BH-BP-20_4.0-5.0 (2)	BH-BP-20_0.0-1.0 (1a) BH-BP-20_2.0-3.0 (1b) BH-BP-20_4.0-5.0 (2)	BH-BP-20_0.0-1.0 (1a)
	BH-BP-19	26 August 2021	7	BH-BP-19_0.5-1.0 (1a) BH-BP-19_1.5-2.0 (1a) BH-BP-19_2.5-3.0 (1b)	BH-BP-19_0.5-1.0 (1a) BH-BP-19_1.5-2.0 (1a) BH-BP-19_2.5-3.0 (1b)	-
Sediment (Ambient Baseline locations)	BH-OH-01	19 August 2021	0.5	BH-OH-01_0.0-0.5	BH-OH-01_0.0-0.5	-
	BH-OH-02	19 August 2021	0.5	BH-OH-02_0.0-0.5	BH-OH-02_0.0-0.5	-
	BH-OH-03	19 August 2021	0.5	BH-OH-03_0.0-0.5	BH-OH-03_0.0-0.5	-
	BH-OH-04	19 August 2021	0.5	BH-OH-04_0.0-0.5	BH-OH-04_0.0-0.5	-
	BH-OH-05	19 August 2021	0.5	BH-OH-05_0.0-0.5	BH-OH-05_0.0-0.5	-
	BH-OH-06	19 August 2021	0.5	BH-OH-06_0.0-0.5	BH-OH-06_0.0-0.5	-
	BH-OH-07	19 August 2021	0.5	BH-OH-07_0.0-0.5	BH-OH-07_0.0-0.5	-
	BH-OH-08	19 August 2021	0.5	BH-OH-08_0.0-0.5	BH-OH-08_0.0-0.5	-
	BH-OH-09	19 August 2021	0.5	BH-OH-09_0.0-0.5	BH-OH-09_0.0-0.5	-
	BH-OH-10	19 August 2021	0.5	BH-OH-10_0.0-0.5	BH-OH-10_0.0-0.5	-
	BH-OH-11	19 August 2021	0.1	BH-OH-11_0.0-0.5	BH-OH-11_0.0-0.5	-
	BH-OH-12	19 August 2021	0.5	BH-OH-12_0.0-0.5	BH-OH-12_0.0-0.5	-
	BH-OH-13	19 August 2021	0.5	BH-OH-13_0.0-0.5	BH-OH-13_0.0-0.5	-
	BH-OH-14	19 August 2021	0.5	BH-OH-14_0.0-0.5	BH-OH-14_0.0-0.5	-

Sample Type	Location	Sample Collection Date	Maximum Depth (mbs)	Samples Analysed for COPC (metals/PFAS/PAHs/ organotins)	Physical Parameters (TOC, OM, PSD, density)	Elutriate Sample
Sediment (Disposal Ground)	BH-DG-01	19 August 2021	0.5	-	BH-DG-01_0.5	-
	BH-DG-02	19 August 2021	0.5	-	BH-DG-02_0.5	-
	BH-DG-03	19 August 2021	0.5	-	BH-DG-03_0.5	-
	BH-DG-04	19 August 2021	0.5	-	BH-DG-04_0.5	-
	BH-DG-05	19 August 2021	0.5	-	BH-DG-05_0.5	-
	BH-DG-06	19 August 2021	0.5	-	BH-DG-06_0.5	-
Sediment (SWTP)	BH-SWTP-01	7 September 2021	1.5	BH-SWTP-01_0.0-1.5 (1a)	-	BH-SWTP-01_0.0-1.5 (1a)
	BH-SWTP-02	7 September 2021	1.5	BH-SWTP-02_0.0-1.5 (1a)	-	BH-SWTP-02_0.0-1.5 (1a)
	BH-SWTP-03	7 September 2021	1.5	BH-SWTP-03_0.0-1.5 (1a)	-	BH-SWTP-03_0.0-1.5 (1a)
	BH-SWTP-04	7 September 2021	1.5	BH-SWTP-04_0.0-1.5 (1a)	-	BH-SWTP-04_0.0-1.5 (1a)
	BH-SWTP-05	7 September 2021	1.5	BH-SWTP-05_0.0-1.5 (1a)	-	BH-SWTP-05_0.0-1.5 (1a)
	BH-SWTP-06	7 September 2021	1.5	BH-SWTP-06_0.0-1.5 (1a)	-	BH-SWTP-06_0.0-1.5 (1a)
Pore water from sediment (Loading Site, Swing Basin)	PW-SB-28	6 September 2021	-	PW-SB-28	-	-
	PW-SB-34	7 September 2021	-	PW-SB-34	-	-
Seawater (Disposal Ground)	SW-DG-01	19 August 2018	-	SW-DG-01_210819	-	-
	SW-DG-02	19 August 2018	-	SW-DG-02_210819	-	-
	SW-DG-03	19 August 2018	-	SW-DG-03_210819	-	-

Table Notes:

1. "-" No data, not analysed
2. TOC - Total Organic Carbon
3. OM - Organic Matter
4. PSD – Particle Size Distribution

The following deviations from the approved SAQP are noted along with the implications of the deviations of the objectives of the investigation. These deviations were minor and did not impact on the outcome of the assessment with respect to being able to obtain representative samples and comply with the NAGD (2009).

Table 4-6 Deviations from the SAQP

SAQP Procedure	Deviation	Justification	Implications for the Investigation
At each location, sediment samples will be collected every 0.5 m for the first 2 m and then every 1 m up to 7 mbs.	At the following locations, samples were not collected at 0.5 m intervals within the first 2 m. BH-BP-20 (0.0-1) BH-BP-21 (0.0-1) BH-SB-32 (0.0-1)	There was insufficient sediment collected to enable sampling every 0.5 m.	Minimal The bore logs indicate similar lithology (refer to **Section 5.1.1.2**) and therefore the samples collected are considered representative of Domain 1a layer.
Proposed locations were to be recorded using a GPS accurate within 1 m.	Actual locations did not always match the proposed coordinates.	Barge drift and windy conditions prevented precise locating.	Negligible. Given the dynamic nature of the seabed sediments, precise location positioning is not critical to characterise sediments at the Loading Site, Disposal Ground and ambient baseline locations.
Porewater to be collected from seven samples in the Loading Site (including SWTP)	Pore water samples were obtained from two samples at the Loading Site: PW-SB-28 PW-SB-34 No pore water samples were obtained from the SWTP.	Porewater could not be extracted from all proposed sediment samples due to the physical nature of the material i.e., dense with minimal pore space.	Minimal The purpose of the porewater sampling was to assess bioavailability where sediments concentrations exceeded the DGVs. According to the NAGD (2009), bioavailability can be assessed via pore water and/or elutriate data. 27 elutriate samples were analysed from the Loading Site and analysed for chemical concentrations which exceeded the sediment DGVs.
Seawater samples were to be collected by lowering a new (and decontaminated) 10 L jerry can over the side of the boat and allowing the seawater to fill the jerry can.	Seawater samples were collected using a peristaltic pump with dedicated tubing.	It was determined that a peristaltic pump with measured tubing would enable more accurate (and safer) collection of samples from middle of the water column.	None Dedicated tubing was utilised for each seawater sample and the seawater was pumped directly into the clean (and decontaminated) jerry cans before being transferred into lab provided containers using a new (and decontaminated) stainless steel funnel (as per the SAQP).

4.4.4 Adopted assessment criteria

The following assessment criteria were adopted as the Screening Levels and Water Quality Guidelines:

- Sediment quality default guideline values (DGV) provided by ANZG (2018), as referred to in the NAGD (2009). For organic chemicals (including TBT), analytical concentrations are normalised to 1% total organic carbon (TOC)[4]. Analytical concentrations measured from the <2 mm sediment fraction of a sediment sample were compared against the DGV. The DGV is the concentration below which there is a low risk of unacceptable effects occurring to aquatic ecosystems. The "GV-high" provides an indication of concentrations at which toxicity related adverse effects are expected to be observed. As such the GV-high value should only be used as an indicator of potential high level toxicity issues not as a guideline value to ensure protection of ecosystems.
- According to the *Environmental Reference Standard 2021* (ERS), the Loading Site and Disposal Ground are located in the Geelong Arm of Port Phillip Bay. This area is defined as slightly to moderately modified in relation to water dependent ecosystems which means that the species protection (spp.) value is 95%. Therefore, the marine water DGVs for 95% spp. provided by ANZG (2018), as referred to in NAGD (2009), were adopted for this study. [note, some DGVs have been updated recently and therefore differ from those criteria presented in Coffey (2020) e.g., marine 95% DGV for zinc].

  ANZG (2018) recommend adopting a higher level of species protection for chemicals that bioaccumulate as a "...*practical measure to provide an additional level of protection to account for bioaccumulation*" (i.e., adoption of the 99% spp. DGV). ANZECC & ARMCANZ (2000) (which was superseded by ANZG (2018)) further explains this recommendation by stating "*the 99% protection levels can also be used as default values for slightly-moderately disturbed systems where local data are lacking on bioaccumulation effects*….". The 99% spp. DGVs were adopted for those chemicals known to bioaccumulate such as cadmium, mercury and PFOS.
- PFOS 99% spp. DGVs for marine sediment and pore water published by Simpson et al (2021). These DGVs were derived in accordance with ANZG (2018) methodology and subject to a technical peer-review process; and therefore, in absence of DGV for PFOS in marine sediment and pore water these DGVs are considered suitable for assessment purposes in the *Phase III Sediment Quality Assessment*. The marine sediment PFOS data were normalised to 1% TOC for comparison to the sediment DGV. Adoption of the freshwater low reliability 99% DGV for surface water (i.e., 0.00023 μg/L) is not considered appropriate for comparison to other media such as marine pore water. A copy of the Simpson et al (2021) publication is available at: https://www.sciencedirect.com/science/article/pii/S0048969721010755.
- The HEPA (2020)[5] 99% spp. DGV for PFOS and PFOA were adopted for comparison against seawater and sediment elutriate data, as these media represent concentrations within the water column. However, it is generally recognised that the current PFOS and PFOA 99% spp. DGV have limited reliability due to limitations in the underlying ecotoxicity data and the method used to calculate the 99% spp. DGV. In addition, the DGVs were derived using freshwater ecotoxicity data, and not marine ecotoxicity data thereby further reducing its reliability and applicability.

  The HEPA (2020) PFOS and PFOA DGV were generated using a species sensitivity distribution (SSD) statistical method using the software Burrlioz V2.0 (Campbell et al. 2000). There is greater uncertainty for estimating a 99% spp. DGV, compared to a 95% spp. DGV, from an SSD because:

  - there is less confidence in the SSD model fit at the extremes of the distribution compared with the middle (Batley et al. 2018)
  - the 99% spp. DGV is statistically extrapolated to concentrations that are well below the concentrations that correspond to effects measured in the toxicity studies (Fox et al, 2021).

  The most sensitive species to PFOS exposure was the zebra fish (*Danio rerio*) (Keiter et al. 2012) which is primarily responsible for the very low PFOS 99% spp DGV of 0.00023 µg/L. A recent

[4] Where TOC was below 0.2 %, the TOC adopted equalled 0.2% in accordance with ANZG (2018) methodology.
[5] The PFOS and PFOA DGVs were originally published by Department of Environment and Energy (DoEE, 2015a,b), and the guidelines are still considered a draft document.

review identified a number of limitations to this study which is currently being replicated with a more robust experimental design to provide more confidence in the results (Moore et al. 2020).

- The ANZG (2018) marine water DGV for arsenic (III) is classified as an 'environmental concern' value, and arsenic (V) is classified as a 'low reliability' value. Both arsenic DGVs were derived using the method Assessment Factor approach considered to be the least preferred DGV derivation methodology (ANZG, 2018), where the lowest reported ecotoxicity value was divided by 100 (arsenic (III)) or 200 (arsenic (V)). The arsenic (V) DGV considered ecotoxicity data from five species (two taxa), while the data considered for the arsenic (III) DGV is unknown. Given the detection of arsenic in sediment and elutriate data and the low reliability of the ANZG (2018) DGV, AECOM conducted a literature review to identify an alternative more reliable arsenic marine water DGV which considered more data. The literature review identified the CCME (2001) interim marine water quality guideline of 12.5 µg/L which considered data from 33 species (3 taxa) and incorporated an assessment factor of 10.

In addition, EPA Publication 1828.2 (formerly IWRG 621 Soil Hazard Categorisation and Management) was used to categorise waste material from the investigation works for onshore disposal.

The adopted assessment criteria for select COPC are summarised in **Table 4-7**.

Table 4-7 Assessment criteria for select COPC

COPC	Sediment		Water
	DGV (mg/kg)	GV-High (mg/kg)	DGV 95% (mg/L, unless otherwise specified)
Antimony	2	25	0.27
Arsenic	20	70	0.0125^^^
Cadmium	1.5	10	0.0007^
Chromium	80	370	0.027
Copper	65	270	0.0013
Lead	50	220	0.0044
Mercury	0.15	1	0.0001^
Nickel	21	52	0.07
Silver	1	4	0.0014
Zinc	200	410	0.008
Tributyltin (as Sn)	0.009	0.07	0.006 µg/L
Polycyclic aromatic hydrocarbons (PAHs)	10	50 ^^	NE
Benzo(a)pyrene	NE	NE	0.2 µg/L
PFOS	0.06^	No criteria	6^ µg/L (pore water) 0.00023^ µg/L (seawater and elutriate)

Table Notes

1. NE Not established
2. ^ 99% level of species protection due to potential for bioaccumulation in marine organisms (ANZG, 2018).
3. ^^ The DGV and GV-High for total PAHs include the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene
4. ^^^CCME (2001) Guidelines for the Protection of Aquatic Life, Marine Interim Guideline for arsenic

4.5 Stakeholder engagement

Stakeholders and the community were consulted to support preparation of the project's EES and to inform the development of the project and understanding of its potential impacts. EES Chapter 6: *Stakeholder and community engagement* provides a summary of the project's key engagement activities.

In accordance with the scoping requirements, a Technical Reference Group (TRG) was convened and chaired by DELWP on behalf of the Minister for Planning. The TRG has provided input throughout the EES process. Chapter 6: *Stakeholder and community engagement* provides a summary of the project's key engagement activities.

Table 4-8 summarises the stakeholder engagement activity relating to the *Phase III Sediment Quality Assessment*.

Table 4-8 Stakeholders and approvals

Stakeholder	Role	Consents / Approvals Provided
Viva Energy Gas Australia Pty Ltd	Project Owner Refinery Pier Controller and Security	Approval to access waters around Refinery Pier, provision of shipping schedule & information pertaining to potential structures and services in the area.
Victorian Department of Environment, Land, Water and Planning (DELWP)	Review of project Environmental Management Plan and SAQP (AECOM 2021)	Consent for use and development of Coastal Crown Land under the *Marine and Coastal Act 2018* (MACA) (DELWP reference: SP471963)
Environment Protection Authority Victoria (EPA Vic)	Technical review of the SAQP (AECOM 2021) on behalf of DELWP	Discussion and close out of comments on SAQP
Ports Victoria (formerly Victorian Regional Channels Authority)	Harbour Master Development Manager	Victorian Notice to Mariners regarding the sediment sampling works (No. 244(T) – 2021) Data regarding the Point Wilson Disposal Ground
City of Greater Geelong	Environment & Waste Services, City Services branch	Consent to use the Mackay Street breakwater to St Helens Harbour for loading and unloading of the barge and removal of sediment waste.

An extensive engagement and consultation program was undertaken to ensure that the community and interested stakeholders were informed, involved and able to actively contribute to the development of the project and preparation of the EES. A poster stand at the November 2021 community information session focused on the results of the technical studies on dredging and dredged material disposal. A technical specialist was available to answer questions about potential impacts and proposed mitigation measures. A Study Summary was prepared to summarise the findings of the marine ecology and water quality impact assessment and was made available on the project website.

During the community and stakeholder engagement and consultation sessions the community expressed concern around the scale of dredging and dredged spoil disposal and the potential impacts on Corio Bay as a result of these activities.

Characterisation of sediment to be dredged and an assessment on disposal options is provided in Technical Report B: *Dredged spoil disposal options assessment* and this appendix (Appendix A: *Dredging and offshore contamination assessment* of Technical Report B). Potential impacts on Corio Bay as a result of these activities is investigated and discussed in Technical Report A: *Marine ecology and water quality impact assessment*.

4.6 Assumptions and limitations

4.6.1 Linkages to other EES technical studies

Results from this *Phase III Sediment Quality Assessment* will be used to inform the DSDOA (to be prepared by AECOM) for the project.

During preparation of this report, information from the following EES technical studies were considered:

- Consulting Environmental Engineers (CEE), 2021a*. Investigation of Benthic Ecological Habitats in Corio Bay*, February 2021
- CEE, 2021b. *Viva Energy Gas Terminal Impact Assessment of Dredging*, September 2021
- Worley Services Pty Ltd, 2021, *Viva Geelong Gas Terminal Dredge Study Report*, April 2021

In addition, the following early studies were used to inform the project development prior to the EES and contain data that were included as part of this assessment:

- Coffey Services Australia Pty Ltd, 2020. Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project, 4 December 2020
- Australasian Marine Associates, 2020. *Targets Sediment Investigation, Project Vega 'Privileged and Confidential',* 12 October 2020.

5.0 Existing conditions

5.1 Sediment

5.1.1 Physical characteristics

In accordance with NAGD (2009) assessment methodology, an assessment of the sediment's physical characteristics was undertaken to understand the variability in sediments between the Loading Site, Disposal Ground and ambient background locations. This assessment is required because chemical concentrations are known to vary according to sediment grain-size and organic matter e.g., lower metal concentrations typically found in sediments with low organic matter and fine particles (greater surface area and more binding sites) (Simpson and Batley, 2016). Therefore, to make meaningful comparisons of chemical concentrations between locations, the physical characteristics of the sediments should be similar.

The sediment physical characteristics were assessed via laboratory analysis (**Section 5.1.1.1**) and field-based observations (**Section 5.1.1.2**).

The results for the Loading Site are described for each Domain layer, consistent with the terminology provided in Coffey (2020):

- **Domain 1a (0.0 – 2.5 mbs)**: surface layer of sediments characterised by loose sand or very soft grey clays typically to 2 mbs. This layer is considered to be the 'suspect' layer where COPC concentrations are expected to be the highest.
- **Domain 1b (2.0 – 5.0 mbs)**: deeper more consolidated marine sediments characterised by firm to stiff grey clays. This layer is considered to be a natural layer with some potential for contamination from the overlying layer.
- **Domain 2 (3.0 – 6.0 mbs)**: underlying Moorabool Viaduct Sand formation comprising orange/brown clayey sand and sandy clay. This natural layer is expected to have minimal potential for contamination.

5.1.1.1 Laboratory results

Sediment samples from the Loading Site (20 samples), Disposal Ground (six samples) and ambient baseline locations (14 samples) were analysed for the following physical characteristics:

- particle size distribution (PSD)
- total organic carbon (TOC)
- organic matter (OM)
- density.

The analytical laboratory reports are provided in **Appendix G** and the tabulated data are provided in **Table 1** and **Table 4** of **Appendix C**. A summary of the sediment's physical characteristics is presented in **Table 5-1**.

Table 5-1 Summary of sediment physical characteristics

Study Area	Depth Range (mbs)	PSD[1] Mean	TOC (mg/kg) Range (mean)	OM (%) Range (mean)	Density (g/m^3) Range (mean)
Loading Site (Domain 1a) *n* = 18	0.0 – 2.5	Clay (32%) Silt (38%) Fine sand (25%)	4,600 – 24,000 (12,133)	0.8 – 3.6 (2.1)	2.5 – 2.7 (2.6)
Loading Site (Domain 1b) *n* = 14	2.0 – 5.0	Clay (29%) Silt (29%) Fine sand (23%)	1,100 – 21,000 (6,021)	0.2 – 3.7 (1.1)	2.5 – 2.7 (2.6)

Study Area	Depth Range (mbs)	PSD[1] Mean	TOC (mg/kg) Range (mean)	OM (%) Range (mean)	Density (g/m^3) Range (mean)
Loading Site (Domain 2) *n* = 6	3.0 – 6.0	Clay (35%) Silt (28%) Fine sand (30%)	900 – 5200 (2,117)	0.2 – 0.9 (0.35)	2.6- 2.8 (2.7)
SWTP *n* = 7	0 – 1.5	Clay (21%) Silt (34%) Fine sand (21%)	13,000 – 24,000 (17,714)	2.2 – 4.2 (3.0)	2.5 – 2.6 (2.6)
Disposal Ground *n* = 6	0.0 – 0.5	Clay (27%) Silt (41%) Fine sand (29%)	6,300 – 8,200 (7,183)	1.1 – 1.4 (1.2)	2.6 (2.6)
Ambient baseline locations *n* = 14	0.0 – 0.5	Clay (9%) Silt (25%) Fine sand (48%)	1,200 – 6,400 (3,800)	0.2 – 1.1 (0.6)	2.6 (2.6)

Table Notes

1. The total number of samples represent the primary samples collected.
2. Clay: <2 µm; Silt: 2-75 µm; Fine sand: 75-300 µm

5.1.1.2 Field observations

Photographs of the sediment cores obtained are presented in Plates 1 to 48 in **Appendix F,** and the sediment bore logs provided in **Appendix D**.

The general surface and subsurface geology at the Loading Site (Swing Basin, Berth Pocket), SWTP, ambient baseline locations and Disposal Ground are summarised in **Table 5-2**. No specific odours were reported from the sediment samples and no significant organic material was reported as being present apart from at the SWTP locations.

Table 5-2 Sediment lithology – field observations

Lithology	mbs	Domain Layer (Coffey, 2020)
Loading Site (Swing Basin and Berth Pocket)		
Grey/green sandy SILT, soft, shells[2]	0 – 2.5	Domain 1a
Silty CLAY with sand, stiff, shell fragments	1.5 – 5.0[1]	Domain 1b
White, plastic CLAY and grey/green, light grey gravelly SAND	3 - 6	Domain 2
SWTP		
Grey silty CLAY	1.5	Domain 1a
Ambient Baseline Locations		
Grey/green, high plasticity CLAY with shells	0 – 0.5	Not applicable
Disposal Ground		
Grey/green, high plasticity CLAY with shells	0 – 0.5	Not applicable

Table Notes

1. Domain 1b extends to deeper levels in BG-SB-28 and BH-SB-35 (up to 5 mbs).
2. The soft silt surface layer at the Loading Site is likely to be recently deposited marine sediments.

5.1.1.3 Summary

A review of the information presented **Section 5.1.1.1** and **Section 5.1.1.2** indicates the following:

- The proportion of clay (27-35%), silt (29-41%) and fine sand (21-29%) fractions were similar at the Loading Site and Disposal Ground sampling locations; this is to be expected as the sediment layer at the Disposal Ground represents sediment that has been previously dredged from Corio Bay and deposited at the Disposal Ground (CEE, 2021b).
- The proportion of clay, silt and find sand did not differ significantly with depth within the different Domain sediment layers at the Loading Site.
- The ambient baseline locations reported a greater proportion of fine sands (48%) than the Loading Site and Disposal Ground, and a lower proportion of clay material (9%). Greater variability in PSD was also noted at the ambient baseline locations.
- Particles greater than 300 µm (medium sand) comprised a minor proportion of the sediment matrix at all locations sampled (3-18%).
- The densities of sediments collected from all locations were similar (2.6-2.7 g/m^3).
- OM content decreased with depth at the Loading Site and was generally similar at all locations for the 0-0.5 mbs depth interval. These results are consistent with those reported by Coffey (2020) for the same depth interval at the Loading Site. The highest OM content (4.2%) was reported in a sample collected closest to shore (SWTP-07).
- The percentage of OM and TOC concentrations were greater at the Loading Site (Domain 1a) and Disposal Ground compared to the ambient baseline locations, potentially due to a larger proportion of fine sand at the ambient baseline locations.
- The TOC at the Loading Site varied from approximately 900 mg/kg in the deeper sediments (Domain 2) to 24,000 mg/kg at shallower depths. In comparison, TOC in sediments collected at the ambient baseline and Disposal Ground sample locations ranged between 1,200 to 6,400 mg/kg.

The physical characteristics of the Loading Site and Disposal Ground are generally very similar. Sediment physical characteristics at the ambient baseline locations are also broadly similar but with a higher percentage of fine sands.

5.1.2 Sediment concentrations

Data presented in this section represents the combined sediment data collected as part of this investigation and data reported by Coffey (2020) [6] also collected from the Loading Site. These two data sets were combined for the *Phase III Sediment Quality Assessment* because they are both part of the Domain 1a layer (within the dredging footprint), and both data sets were required to satisfy the NAGD (2009) assessment and reporting requirements. In addition, the PFAS sediment and elutriate data reported by AMA (2020) for the Loading Site[7] were combined with the PFAS data collected as part of this investigation (noting that PFAS data were not collected during the Coffey (2020) investigation).

The Coffey (2020) report stated that "*overall, we consider the data collected in the sediment investigation is of an acceptable standard for the purpose for the investigation. Whilst some data quality issues were identified these are not considered to impact on the overall conclusions from the investigation*."

The AMA (2020) report stated that "*It can be concluded that the data from the QA/QC process and sediment quality testing confirm that the results are reliable and can be used for the sediment quality assessment*."

AECOM has relied upon Coffey's and AMA's assessment when combining the datasets such that the combined data set is considered reliable to inform the investigation (refer to **Section 5.4**).

[6] Excluding the Coffey data which were collected in areas of the Loading Site which were removed from the proposed dredge area.
[7] The AMA (2020) PFAS sampling locations in the Outer Harbour were considered too far away from the Disposal Ground (approximately 7 to 12 km) and not representative of ambient baseline for this investigation.

Analysis of COPC was undertaken for sediments in the Loading Site (**Section 5.1.2.1**) and ambient baseline locations (**Section 5.1.2.2**), and not the Disposal Ground because NAGD (2009) does not require chemical characterisation of an already established sediment disposal ground.

The sediment laboratory analytical reports are presented in **Appendix G** and the tabulated data are presented in **Appendix C**. The 95% upper confidence limit (UCL) concentrations were calculated using USEPA's statistical software ProUCL (version 5.1) and the outputs are provided in **Appendix I**.

5.1.2.1 Loading Site

Domain 1a and SWTP (0- 2.5 mbs)

The maximum and 95% UCL sediment concentrations reported for the Loading Site (Domain 1a) are summarised in **Table 5-3.** The data are compared against the DGVs described in **Section 4.4.4**.

Table 5-3 Loading Site – Domain 1a (including SWTP) sediment quality

COPC	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	DGV (mg/kg)
	AECOM (2021) Data		Coffey (2020), AMA (2020)[4] and AECOM (2021) Data		
Antimony	**3**	1.887	**5.4**	1.561	2
Arsenic	**24**	13.87	**39**	15.94	20
Cadmium	**2**	0.866	**4.5**	0.857	1.5
Chromium	67	36.9	72	46.09	80
Copper	59	25.06	59	20.2	65
Dibutyltin as Sn	<LOR	--	5.3	1.397	NE
Lead	**200**	**74.32**	**210**	**71.95**	50
Mercury	**0.76**	**0.317**	**0.76**	**0.267**	0.15
Monobutyltin as Sn	<LOR	--	2.3	1.305	NE
Nickel	**35**	20.59	**46**	**25.16**	21
Silver	<LOR	--	0.2	0.108	1
Tributyltin as Sn	<LOR	--	0.00071	0.00059	0.009
Zinc	140	72.71	160	76.8	200
PFOS (1%TOC)	0.0005	0.00023	0.0024	0.00042	0.06
PAHs (sum) (1% TOC)	0.39	0.163	0.66	0.249	10

Table Notes

1. **Bold and green highlight** – Exceeds DGV
2. "--" - UCL not calculated due to all concentrations being below the laboratory LOR.
3. NE – Not established
4. AMA (2020) data for PFOS only

A review of the combined sediment data set presented in **Table 5-3** shows that:

- The maximum concentrations of antimony, arsenic, cadmium, lead, mercury and nickel exceed the DGV at depths ranging from surface to 2.5 mbs, refer to **Figure 6**.
- The 95%UCL concentrations were exceeded for:
  - lead from the surface to 1.0 mbs at four locations in the Swing Basin/ Berth Pocket (BH-BP-20, BH-SB-31, BH-SB-33, BH-SB-34) and three locations from surface to 1.5 mbs in the SWTP (BH-SWTP-03, BH-SWTP-04, BH-SWTP-05)
  - mercury from the surface to 1.0 mbs at four locations (BH-BP-20, BH-BP-21, BH-SB-31, BH-SB-34) and in six locations from the surface to 1.5 mbs in the SWTP (BH-SWTP-01, BH-SWTP-02, BH-SWTP-03, BH-SWTP-04, BH-SWTP-05, BH-SWTP-06)
  - nickel at depths ranging from surface to 2.0 mbs (Coffey data only).
- PFOS was detected above the laboratory limit of reporting (LOR) (0.0001 mg/kg) in 19 samples at depths ranging between the surface and 1.5 mbs. Concentrations for other PFAS were below the laboratory LOR.
- As a result of the assessment of sediments from this Domain, lead, mercury and nickel were identified as COPC in Domain 1a and were carried forward into the next stage of the investigation i.e. comparison to ambient baseline levels for sediments of comparable grainsize (**Section 6.1.2**).
- All other analytes assessed in sediment collected from Domain 1a were either reported at concentrations less than the laboratory LOR or below their respective DGV.

Domain 1b (2.0 - 5.0 mbs)

The maximum and 95% UCL sediment concentrations reported for the Loading Site Domain 1b are summarised in **Table 5-4.** The data are compared against the DGVs described in **Section 4.4.4**.

Table 5-4 Loading Site – Domain 1b sediment quality

COPC	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	DGV (mg/kg)
	AECOM (2021) Data		Coffey (2020) and AECOM (2021) Data		
Antimony	**3**	1.731	**3**	1.176	2
Arsenic	**32**	16.71	**32**	16.29	20
Cadmium	0.2	0.143	0.2	0.125	1.5
Chromium	54	34.08	67	40.28	80
Copper	21	12.19	21	9.9	65
Dibutyltin as Sn	<LOR	--	<LOR	--	NE
Lead	44	14.93	44	11.29	50
Mercury	**0.16**	0.0417	**0.16**	0.047	0.15
Monobutyltin as Sn	<LOR	--	0.94	--	NE
Nickel	**34**	**21.35**	**38**	**23.91**	21
Silver	<LOR	--	<LOR	--	1
Tributyltin as Sn	<LOR	--	<LOR	--	0.009

COPC	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	Maximum Conc. (mg/kg)	95% UCL Conc. (mg/kg)	DGV (mg/kg)
	AECOM (2021) Data		Coffey (2020) and AECOM (2021) Data		
Zinc	37	28.02	40	28.08	200
PFOS (1% TOC)	<0.0001	--	--	--	0.06
PAHs (sum) (1%TOC)	<0.01	--	--	--	10

Table Notes

1. **Bold and green highlight** – Exceeds DGV
2. "--" - UCL not calculated due to all concentrations being below the LOR or insufficient data to perform statistics.
3. NE – Not established

A review of the combined sediment data set presented in **Table 5-4** shows that:

- The maximum concentrations of antimony, arsenic, mercury and nickel exceed the DGV at depths ranging from 2.0 to 4.0 mbs, refer to **Figure 6**.
- The 95% UCL concentrations were exceeded for nickel only at depths ranging from 2.0 to 4.0 mbs.
- PFAS and PAHs were not detected above the laboratory LOR in any samples.
- As a result of the assessment of sediments from this Domain, nickel was the only COPC identified for Domain 1b to be carried forward into the next stage of the investigation, i.e. comparison to ambient baseline levels for sediments of comparable grainsize (**Section 6.1.2**).
- All other analytes assessed in sediment collected from Domain 1b were reported at concentrations either less than the laboratory LOR or below their respective DGV.

Domain 2 (3.5 – 6.0 mbs)

The maximum sediment concentrations reported for the Loading Site Domain 2 are summarised in **Table 5-5.** The 95%UCL concentration could not be calculated for the Domain 2 samples due to the small sample size (i.e., *n* < 6 samples) [note, a smaller footprint is proposed in the Domain 2 layer therefore less samples were required to be collected from this layer]. The data are compared against the DGV described in **Section 4.4.4**.

Table 5-5 Loading Site – Domain 2 sediment quality

COPC	Maximum Concentration (mg/kg)	Maximum Concentration (mg/kg)	DGV (mg/kg)
	AECOM (2021) Data	Coffey (2020) and AECOM (2021) Data	
Antimony	**2**	**2**	2
Arsenic	**21**	**21**	20
Cadmium	<LOR	0.2	1.5
Chromium	27	67	80
Copper	10	10	65
Dibutyltin as Sn	<LOR	<LOR	NE
Lead	6.5	32	50

COPC	Maximum Concentration (mg/kg)	Maximum Concentration (mg/kg)	DGV (mg/kg)
	AECOM (2021) Data	Coffey (2020) and AECOM (2021) Data	
Mercury	0.04	0.1	0.15
Monobutyltin as Sn	<LOR	<LOR	NE
Nickel	**22**	**38**	21
Silver	<LOR	<LOR	1
Tributyltin as Sn	<LOR	<LOR	0.009
Zinc	33	42	200
PFOS (1%TOC)	<0.0001	<0.0001	0.06
PAHs (sum) (1% TOC)	<0.01	<0.01	10

Table Notes

1. **Bold and green highlight** – Exceeds DGV
2. NE – Not established

A review of the combined sediment data set presented in **Table 5-5** shows that:

- The maximum concentrations of arsenic and nickel exceed the DGV at depths ranging from 4.0 to 6.0 mbs.
- The maximum antimony concentration was equal to the DGV, refer to **Figure 6**.
- PFAS and PAHs were not detected above the laboratory LOR in any samples.
- As a result of the assessment of sediments from this Domain, antimony, arsenic and nickel were identified as COPC in Domain 2 and were carried forward into the next stage of the investigation, i.e. comparison to ambient baseline levels for sediments of comparable grainsize (**Section 6.1.2**).
- All other analytes assessed in sediment collected from Domain 2 were reported at concentrations either less than the laboratory LOR or below their respective DGV.

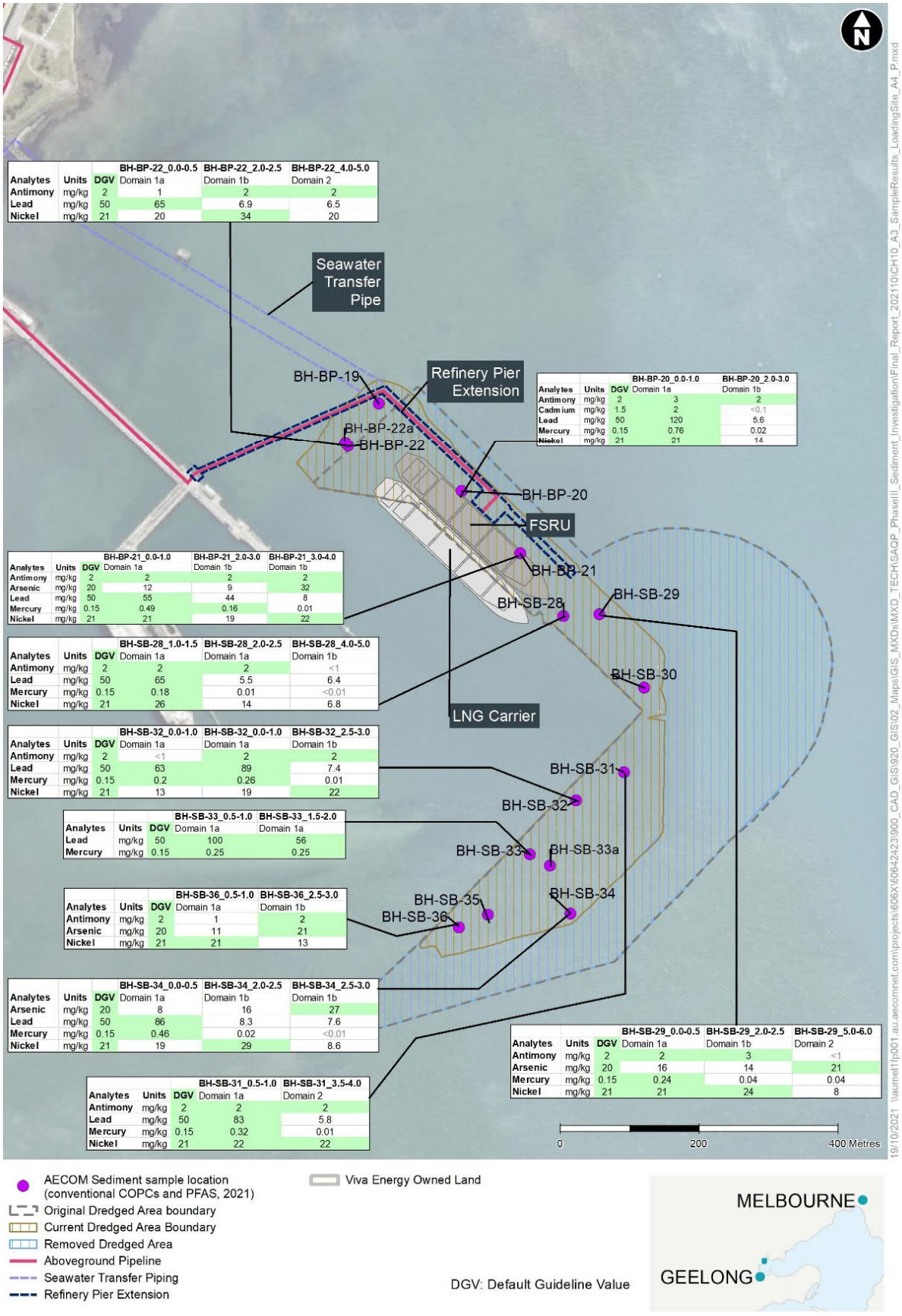

Figure 6 Loading Site (Berth Pocket and Swing Basin) sediment sample results

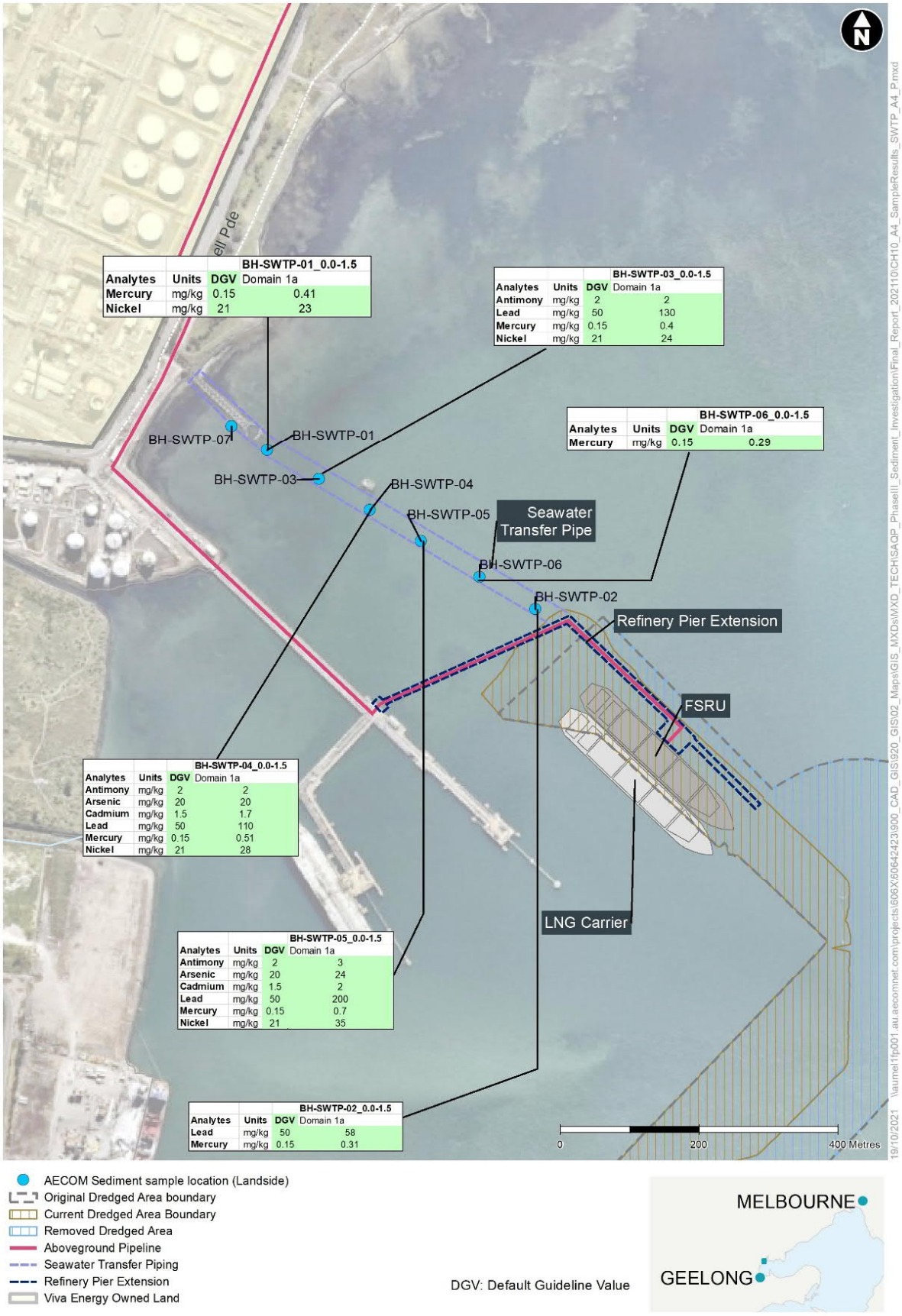

Figure 7 Loading Site (SWTP) sediment sample results

5.1.2.2 Ambient Baseline

The maximum and 80th percentile[8] sediment concentrations reported for ambient baseline locations are summarised in **Table 5-6**. The ambient baseline sediment concentrations are compared against the DGVs described in **Section 4.4.4**.

Table 5-6 Ambient baseline sediment quality

COPC	Maximum Concentration (mg/kg)	80th Percentile Concentration (mg/kg)	DGV mg/kg
Antimony	<LOR	--	2
Arsenic	5.5	4.4	20
Cadmium	0.1	--	1.5
Chromium	27	16.4	80
Copper	9.3	6.3	65
Dibutyltin as Sn	<LOR	--	NE
Lead	9.5	7.1	50
Mercury	0.05	0.04	0.15
Monobutyltin as Sn	<LOR	--	NE
Nickel	14	8.2	21
Silver	<LOR	--	1
Tributyltin as Sn	<LOR	--	0.009
Zinc	32	22.4	200
PFOS (1% TOC)	0.0011	0.0009	0.06
PAHs (sum) (1% TOC)	<0.01	--	10

Table Notes

1. "--" - UCL not calculated due to all concentrations being below the LOR or insufficient data for statistics.
2. NE – Not established

A review of the data presented in **Table 5-6** indicates that:

- All COPC concentrations are below the assessment criteria or below the laboratory LOR.
- PFOS was the only PFAS detected above the laboratory LOR.
- In accordance with Phase II of the NAGD (2009) phased assessment process (refer to **Plate 1**), the COPC identified in sediments from the Loading Site (i.e. Domains 1a, 1b and 2) were then compared against the data from the ambient baseline locations as part of **Section 6.1.2**.

5.1.3 Excess waste material from sediment sampling

Once the sediment samples were collected from the cores, some excess (waste) sediment remained at the end of the investigation. To enable disposal of this waste material, three representative sediment samples were collected for classification purposes in accordance with *EPA Publication 1828.2 Waste Disposal Categories – characteristics and thresholds* (EPA 1828.2) (formerly IWRG 621 Soil Hazard Categorisation and Management).

One sample (Waste 03) was analysed for the full suite of chemicals listed in EPA Publication 1828.2 (i.e., PFAS, PAHs, phenols, TRH, monocyclic aromatic hydrocarbons (MAHs), metals, chlorinated hydrocarbons, organochlorine compounds (OCCs), organochlorine pesticides (OCPs), cyanide and

[8] NAGD (2009) requires calculation of the 80th percentile concentration of sediment collected from ambient baseline locations.

organotins). The other two waste classification samples were analysed for a suite more reflective of the COPC likely to be present in the sediment material based on the data review presented in the AECOM (2021a) SAQP (i.e., metals, PAHs, organotins).

The laboratory reports are presented in **Appendix G**, and the tabulated data are presented in **Table 3**, **Appendix C**.

All analytical concentrations were reported below the laboratory LOR or the waste classification 'Threshold Concentration' for Fill Material with the exception of arsenic in one sample (Waste02) at a concentration of 23 mg/kg, marginally above the Threshold Criteria for Fill Material (i.e., 20 mg/kg).

PFOS was reported marginally above the laboratory LOR (<0.0002 mg/kg) in Waste03 at a concentration of 0.0005 mg/kg. All other PFAS were reported below their respective laboratory LORs. There is no Threshold Criterion for PFOS in EPA 1828.2; however, the EPA Victoria's Interim position statement on PFAS (EPA Publication 1669.4, October 2020) states that the criteria for reuse of soils containing PFAS is less than the laboratory LOR of 0.002 mg/kg.

These results were provided to an accredited waste consigner to enable appropriate classification and the waste was subsequently transported and disposed of at a licensed facility.

5.2 Seawater

Seawater samples were collected from three locations at the Disposal Ground (SW-DG-01, 02, 03) for chemical analysis (three samples were analysed) to assess the suitability of the seawater during extraction of elutriate samples from sediments collected from the Loading Site.

The maximum and mean seawater concentrations are summarised in **Table 5-7.** The analytical reports are presented in **Appendix G** and the tabulated data are presented in **Table 2** of **Appendix C**.

The seawater concentrations are compared against the DGVs described in **Section 4.4.4**.

Table 5-7 Seawater quality

COPC	Maximum Concentration (mg/L)	Mean Concentration (mg/L)	DGV (mg/L, unless otherwise specified)
Antimony	<0.002	<0.002	0.27
Arsenic	0.003	0.003	0.0125
Cadmium	<0.002	<0.002	0.0007
Chromium	0.002	0.002	0.027
Copper	**<0.002**	**<0.002**	0.0013
Lead	<0.001	<0.001	0.0004
Mercury	<0.00005	<0.00005	0.0001
Monobutyltin as Sn	0.04 µg/L	0.04 µg/L	NE
Nickel	<0.002	<0.002	0.07
Silver	**<0.002**	**<0.002**	0.0014
Tributyltin as Sn	<0.002 µg/L	<0.002 µg/L	0.006 µg/L
Zinc	0.004	0.004	0.008
PFOS	0.002 µg/L	0.002 µg/L	0.00023 µg/L
PAHs (sum)	<0.2 µg/L	<0.2 µg/L	0.2 µg/L

Table Notes

1. **Bold and green highlight** – Exceeds DGV
2. NE – Not established

A review of the data presented in **Table 5-7** indicates that:

- All metal and PAHs (sum) concentrations were below the DGVs, apart from copper and silver where the laboratory LORs were greater than the DGV.
- Detectable concentrations of arsenic, chromium, monobutyltin and zinc were reported in the majority of seawater samples but were below the DGVs.
- Detectable PFOS was reported in all three samples at the same concentration (0.002 µg/L PFOS) above the adopted DGV (refer to **Section 4.4.4** for a discussion regarding the low reliability and low applicability of the DGV). In addition, three other PFAS (PFHxS, PFHpA and PFOA) were reported above the laboratory LOR at concentrations ranging between 0.0004 and 0.0009 µg/L. Detection of these PFAS were not recorded in the sediment samples collected from any location (including the Loading Site) indicating ubiquitous concentrations of PFAS in seawater across Corio Bay.
- Detectable concentrations of monobutylin were reported in all three samples at the same concentration (0.04 µg/L).

Overall, the seawater samples collected from the Disposal Ground are considered to represent baseline ambient seawater conditions and are suitable to extract the elutriate from sediment samples collected from the Loading Site.

5.3 Bioavailability Data

5.3.1 Elutriate results

Sediment elutriate results provide an indication of the potential for chemicals to desorb from sediment particles to interstitial or overlying water. NAGD (2009) states that elutriate tests "...*are used to simulate the maximum contaminant release occurring during disposal of sediments at sea*."

Elutriate samples were analysed from selected sediment samples collected from the Berth Pocket (BH-BP-20, 21 and 22) and the Swing Basin (BH-SB-28, 29, 31, 32, 33, 34) at the Loading Site, using the seawater collected from the Disposal Ground (refer to **Section 5.2**). In accordance with the NAGD (2009) assessment process, elutriate analysis was performed for the following COPC which reported sediment COPC 95% UCL concentrations (or the maximum concentration if insufficient data were available for statistics) greater than the DGV (as discussed in **Section 5.1.2**):

- antimony
- arsenic
- lead
- mercury
- nickel.

In addition, PFAS were analysed in elutriate samples for comparison against the ANZG (2018) 99% spp. DGV; refer to **Section 4.4.4** for a discussion regarding the low reliability and low applicability of this DGV.

The elutriate analytical reports are presented in **Appendix G** and the tabulated data are presented in **Table 2**, **Appendix C**. The maximum elutriate concentrations are presented in **Table 5-8** and on **Figure 8.**

Consistent with sediment data analysis, the elutriate data from this study and data reported in Coffey (2020)[9] were combined for calculation of the mean[10] concentration (*n* = 31 total elutriate samples). The PFOS elutriate data from this study and the AMA (2020) study were combined for calculation of the

[9] Excluding the Coffey elutriate data which were collected in areas of the Loading Site which were removed from the proposed dredge area.
[10] NAGD (2009) requires that the mean elutriate concentration be compared against the DGV. Where the concentration was less than the laboratory LOR, half of the LOR was used in the calculation of the mean.

mean concentration. A comparison of the maximum and mean concentrations against the adopted DGVs (discussed in **Section 4.4.4**) is presented in **Table 5-8**.

Table 5-8 Elutriate water quality

COPC	Maximum Conc. (mg/L) AECOM (2021) Data	Maximum Conc. (mg/L) Coffey (2020) Data	Mean[3] Conc. (mg/L) Combined Data	Mean Seawater Conc. (mg/L)	DGV (mg/L, unless otherwise specified)
Antimony	0.011	0.1	0.0066	<0.002	0.27
Arsenic	**0.019**	0.01	0.0044	0.003	0.0125
Lead	0.001	0.007	0.0006	<0.001	0.0044
Mercury	<0.00005	<0.0001	-	<0.00005	0.0004
Nickel	0.005	0.022	0.002	0.07	0.07
PFOS[4]	0.0099 µg/L	0.006 µg/L	0.004 µg/L	0.002 µg/L	0.00023 µg/L

Table Notes

1. **Bold and green highlight** – Exceeds DGV
2. NA: Chemical not analysed in the elutriate because sediment concentration did not exceed the DGV.
3. Mean concentration for primary samples. Half of the laboratory LOR was used in calculation of the mean in accordance with NAGD (2009) requirements.
4. Combined dataset for PFOS includes current investigation and AMA (2020) PFOS data.

A review of the elutriate data presented in **Table 5-8** indicates that:

- The maximum arsenic concentration marginally exceeds the DGV in the AECOM dataset from sediment samples collected at four locations between depths of 0.0 and 3.0 mbs. However, the mean arsenic concentration considering both elutriate data sets does not exceed the DGV.
- The mean and maximum PFOS elutriate concentrations exceeded the low reliability DGV and were a similar concentration to the ambient baseline PFOS concentration in Corio Bay seawater.
- In accordance with Phase III of the NAGD (2009) phased assessment process (refer to **Plate 1**), the data from the elutriate samples were used to assess the bioavailability of the COPC remaining following comparison of the COPC concentrations identified in sediments from the Loading Site (i.e. Domains 1a, 1b and 2) against the data from the ambient baseline locations (refer to **Section 6.2**).

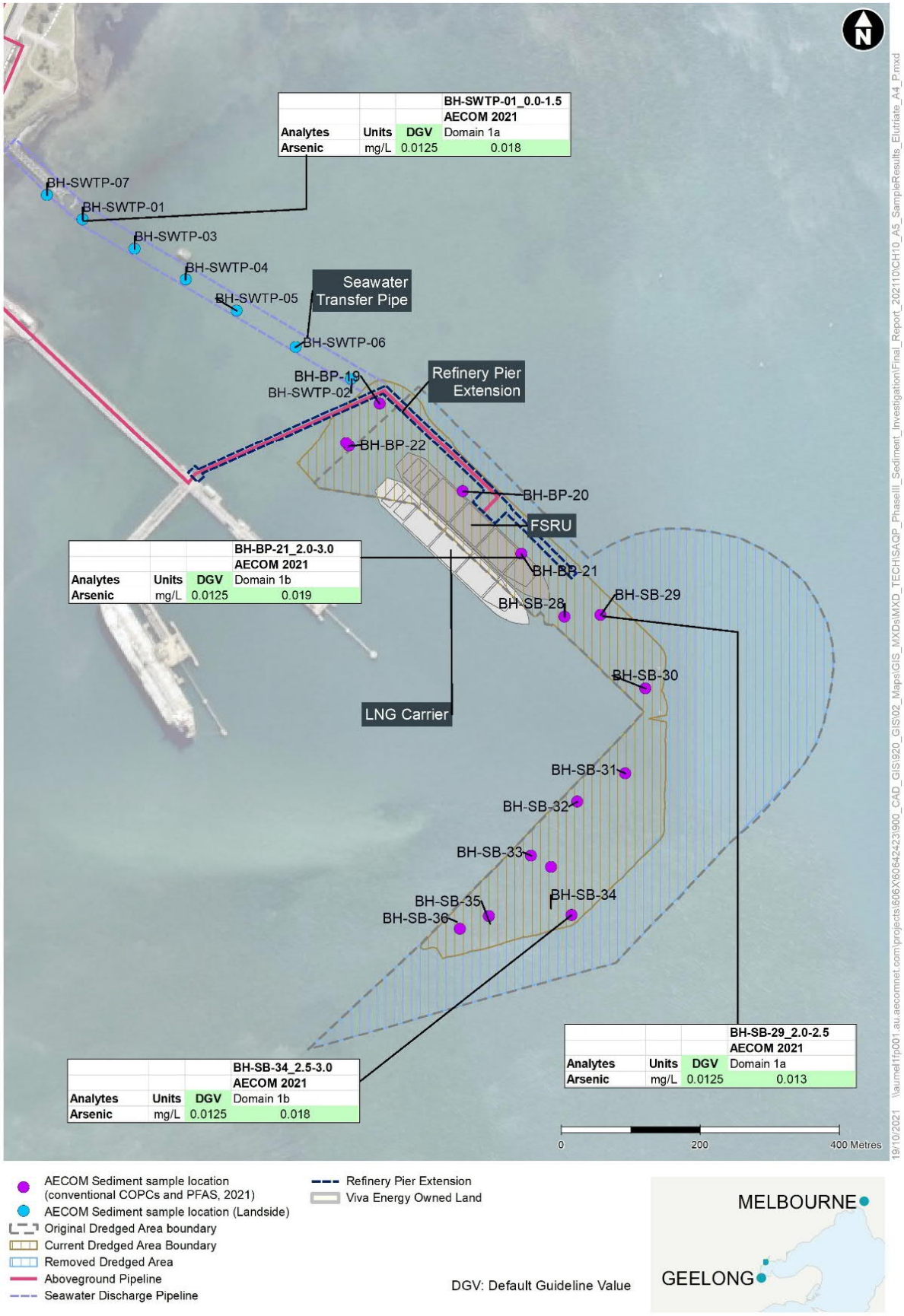

Figure 8 Elutriate Sample Results

5.3.2 Porewater results

In accordance with Phase III of the NAGD (2009) phased assessment process (refer to **Plate 1**), where COPC concentrations in sediment samples exceed the DGVs, analysis of porewater samples from the sediment is one method to further assess the bioavailability, and hence potential toxicity, of these COPC.

Seven porewater samples were initially proposed for analysis however the laboratory was unable to extract porewater from five of the samples due to the density of the sediments and corresponding small pore space. Two samples were successfully extracted and analysed from sediment collected in the Swing Basin (PW-SB-28 and PW-SB-34).

The porewater analytical reports are presented in **Appendix G** and the tabulated data are presented in **Table 2**, **Appendix C**. **Table 5-9** presents the maximum porewater concentration obtained from the same sediment sample.

Table 5-9 Pore water quality

Analyte	Maximum Porewater Concentration (mg/L)	Porewater Sample ID	DGV (mg/L, unless otherwise specified)
Antimony	0.002	PW-SB-34	0.27
Arsenic	0.006	PW-SB-28	0.0125
Cadmium	<0.0001	-	0.0007
Lead	<0.001	PW-SB-34 PW-SB-28	0.0044
Mercury	<0.00005	-	0.0001
Nickel	<0.001	PW-SB-34	0.07
PFOS	0.0046 µg/L	PW-SB-28	6 µg/L

Table Notes

1. NA: Chemical not analysed in the elutriate because sediment concentration did not exceed the DGV

A review of the porewater and elutriate data presented in **Table 5-9** indicates that:

- COPC concentrations analysed in porewater were all below the DGV.
- Porewater and elutriate concentrations are the same order of magnitude for metal concentrations.
- PFOS concentrations were reported below DGV and are a similar concentration to PFOS in sediment elutriate samples.
- In accordance with Phase III of the NAGD (2009) phased assessment process (refer to **Plate 1**), the data from the porewater samples were used to assess the bioavailability of the COPC remaining following comparison of the COPC identified in sediments from the Loading Site (i.e. Domains 1a, 1b and 2) against the sediment data from the ambient baseline locations (refer to **Section 6.2**).

5.3.3 Chelex® results

To further explore the potential bioavailability of metal concentrations in porewater, the two porewater samples (refer to **Section 5.3.2**) were submitted to Envirolab for chelex® testing. This analysis method enables a more accurate predication of metal bioavailability (and therefore aquatic ecotoxicity) than by analysis of elutriate and porewater concentrations alone. The chelex® method involves passing the water sample (0.45 µm filtered) through a column of chelating resin (Chelex-100) to remove the weakly bound, labile or potentially bioavailable forms (i.e., the bioavailable fraction).

Envirolab is not NATA accredited for chelex® analysis for arsenic or antimony and therefore these concentrations are not reported.

The laboratory reports are provided in **Appendix G**, and the tabulated data are summarised in **Table 5-10**.

Table 5-10 Chelex® results

COPC	Concentration before Chelex (mg/L)	Concentration after Chelex (mg/L)	Concentration of Chelex retained (mg/L)	DGV (mg/L)
PW-SB-28				
Cadmium	<0.0001	<0.0001	NA	0.0007
Nickel	0.002	0.001	<0.001 (15% retained)	0.07
Lead	<0.001	<0.001	NA	0.0044
Mercury	<0.0001	<0.0001	NA	0.0001
PW-SB-34				
Cadmium	<0.0001	<0.0001	NA	0.0007
Nickel	0.001	0.001	<0.001 (30% retained)	0.07
Lead	<0.001	<0.001	NA	0.0044
Mercury	<0.0001	<0.0001	NA	0.0001

Table Notes

1. NA: Chemical not analysed in the elutriate because sediment concentration did not exceed the DGV

The chelex® data presented in **Table 5-10** indicates only 15-30% of the nickel concentration is in a bioavailable form available for uptake and subsequent ecotoxicity to sediment dwelling organisms. Concentrations of other metals (i.e. cadmium, lead and mercury) were reported at concentrations below the laboratory limit of detection following the chelex® analysis, indicating that the bioavailable portion of these metals are below the DGVs.

The samples were used to assess the bioavailability of the COPC remaining following comparison of the COPC concentrations identified in sediments from the Loading Site (i.e. Domains 1a, 1b and 2) against the data from the ambient baseline locations (refer to **Section 6.2**).

The bioavailable nickel concentration is below the laboratory limit of detection and the DGV, and no further assessment is required.

5.4 Data Quality Assurance/Quality Control

Appendix H presents the data quality assurance/quality control (QA/QC) assessment process and results. Overall, the QA/QC assessment concluded the following:

- All sample locations (and depths) presented in the SAQP were investigated with the inclusion of seven additional samples at the SWTP.
- Samples were collected using the methods defined in the SAQP for sediment and pore water.
- The method for collecting the seawater samples was slightly modified to improve the accuracy of sampling from the middle of the seawater column whilst still minimising the potential for cross-contamination.
- Duplicate and triplicate samples were collected in accordance with the SAQP.
- Rinsate and trip blanks were collected in accordance with the SAQP.

- All rinsate blank concentrations were reported below the laboratory LOR apart from chromium, lead, zinc, monobutylin, PFOS, 6:2 FTS and 8:2 FTS. These concentrations are likely to have originated from the water provided by the laboratory or from the sampling equipment. Comparing the rinsate sample results with the samples collected during the respective days indicate that the low concentrations have not impacted the primary sample results.
- All PFAS concentrations were reported below the laboratory LOR in nine trip blank samples indicating a low potential for cross contamination to have occurred due to sample transport.
- Samples were analysed and reported as requested on the COC (presented in **Appendix G**).
- Laboratories used were NATA accredited for the analysis performed (Envirolab and ALS).
- Laboratory LORs were generally sufficiently low to enable assessment against adopted DGVs with the exception of silver and copper in water. These concentrations were less than the laboratory LORs and are assumed to therefore be below the criteria. Sample receipt temperatures were within the recommended range (≤6°C) in three out of seven sample batches, however the COPC analysed for in these batches (metals) are not volatile and therefore the temperature outside the required range is not likely to affect the results.
- Elevated relative percent differences (RPDs) were reported between the primary samples and secondary and triplicate samples for some metals, PAHs and PFOS. Where the primary sample is not the highest value, this is considered to not impact the interpretation of the results for the following reasons:
    - the criteria were not exceeded in either sample
    - the concentration of the secondary sample was a similar order of magnitude to the primary sample.

Overall, AECOM considers the data collected during the *Phase III Sediment Quality Assessment* to be reliable to fulfil the objectives of the study.

6.0 Sediment Quality Assessment

The assessment of sediment quality was performed in accordance with Phase II and Phase III recommended in the NAGD (2009):

- Phase II: Assessment of sediment chemistry, presented in **Section 6.1**.
- Phase III: Elutriate and bioavailability testing, presented in **Section 6.2**.

Consistent with the NAGD (2009) assessment process presented in **Section 4.2.2**, an assessment of acute/chronic ecotoxicity, bioaccumulation and/or benthic community assemblages (i.e. Phase IV and Phase V) is only required if the Phase III results indicate a potential for ecotoxicity to aquatic biota.

6.1 Phase II - Assessment of Sediment Chemistry

6.1.1 Comparison to DGVs

The NAGD (2009) states that the 95% UCL concentration of sediment concentrations are to be compared against the DGV to assess suitability for ocean disposal. The 95% UCL concentrations calculated for the Loading Site (combined data set for this study and Coffey (2020)) are presented in **Section 5.1.2.1**.

The following COPC reported 95% UCL concentrations greater than the DGV within the Loading Site:

- Domain 1a: lead, mercury and nickel.
- Domain 1b: nickel.
- Domain 2: the 95% UCL concentration could not be calculated due to a small data set. However, the maximum concentrations of antimony, arsenic and nickel marginally exceeded their respective DGV.

All other COPC in sediment collected from the Loading Site were either less than the laboratory LOR or below their respective DGV.

The NAGD (2009) states that "*If the 95% UCL of a contaminant exceeds the specified Screening Level, it is a Contaminant of Potential Concern (COPC) and comparison to ambient baseline levels for sediments of comparable grainsize is then required*." This comparison is presented in **Section 6.1.2** for those COPC which had 95% UCL concentrations (or maximum for Domain 2 sediments) greater than the DGVs (i.e., antimony, arsenic, lead, mercury and nickel).

6.1.2 Comparison to Ambient Baseline

The NAGD (2009) states that "*If the mean of the sediment concentrations for the substances in question are at or below the 80th percentile of their ambient baseline levels in vicinity of the disposal site, the sediment is considered to be chemically acceptable for ocean disposal even though the relevant Screening Level(s) were exceeded*." However, if the mean concentration from the Loading Site is greater than the ambient baseline 80th percentile concentration, sediment elutriate analysis is required (i.e., Phase III assessment).

Therefore, to make this assessment, the 80th percentile (ambient baseline) and mean (Loading Site) sediment concentrations were calculated using the combined AECOM and Coffey (2020) dataset. These results are summarised in **Table 6-1**.

Table 6-1 Comparison to ambient baseline summary results

COPC	Mean Conc. (Loading Site) (mg/kg)	80th Percentile Conc. (ambient baseline) (mg/kg)	Proceed to Phase III
Antimony	1	1	No
Arsenic	**13.6**	4.2	Yes
Lead	**33**	7.0	Yes

COPC	Mean Conc. (Loading Site) (mg/kg)	80th Percentile Conc. (ambient baseline) (mg/kg)	Proceed to Phase III
Mercury	**0.12**	0.04	Yes
Nickel	**22**	8.2	Yes

Table Notes

1. **Bold and green highlight** – Mean at Loading Site exceeds 80th percentile at Ambient Site.

A review of the data presented in **Table 6-1** indicates that arsenic, lead, mercury and nickel required a bioavailability assessment in accordance with the NAGD (2009) Phase III methodology. The results of this assessment are presented in **Section 6.2**.

It is noted that sediment concentrations of antimony, arsenic and nickel are similar in all three Domains at the Loading Site (refer to **Section 5.1.2.1**) suggesting these concentrations represent naturally occurring levels. Therefore, although maximum concentrations of these metals/metalloids are greater than the 80th percentile ambient baseline concentrations, these exceedances may have been influenced by the finer sediment grainsize and higher organic matter content at the Loading Site in comparison to the sandier low organic matter ambient baseline sediment conditions.

6.2 Phase III - Bioavailability Assessment

The potential for bioavailability was assessed via analysis of sediment elutriate, porewater and chelex® testing (refer to **Section 5.3**). The NAGD (2009) states that "*The mean values from individual test procedures in Phase III* [i.e., sediment elutriate data] *will be compared to the specified assessment criteria*."

When considering the combined dataset in accordance with the NAGD (2009) phased assessment process, the mean elutriate concentrations (presented in **Section 5.3.1)** for all COPC, with the exception of PFOS, were below their respective DGVs indicating a low potential for ecotoxicity associated with the disposal of sediments from the Loading site at the Disposal Ground.

PFOS was detected above the 99% spp. DGV in elutriate samples, however this is not considered to represent an ecotoxicity concern during sediment dredging and disposal activities because:

- PFOS sediment concentrations were below the 99% spp. DGV, and therefore in accordance with NAGD (2009) assessment process elutriate analysis would not be required
- PFOS (and other PFAS) is considered to be ubiquitous in Corio Bay seawater as demonstrated by the PFAS concentrations reported in seawater which are at a similar concentration to PFOS sediment elutriate
- the PFOS 99% spp. DGV is considered to be conservative and unreliable with limited applicability to marine biota in Corio Bay
- the PFOS concentrations were all reported below the direct ecotoxicity DGV (i.e., the 95% spp. DGV).

Therefore, in accordance with the NAGD (2009) methodology, the sediments proposed to be dredged at the Loading Site are considered to be suitable for ocean disposal at the Point Wilson Disposal Ground.

6.2.1 Consideration of Coffey (2020) elutriate data

The mean elutriate concentrations for silver (0.002 mg/L) and zinc (0.14 mg/L) in the Coffey (2020) data set were detected above their respective DGVs. It is noted that sediment concentrations of silver and zinc in the Coffey (2020) dataset did not exceed the DGVs and therefore according to the NAGD (2009) phased assessment process, elutriate analysis was not required for these metals.

Elutriate testing conditions involve a 1:4 dilution of wet sediment to seawater, and are recognised by NAGD (2009) as conservative because they '…*will greatly overestimate water quality impacts given that, within the four-hour period, dilutions of the order of a hundred time or more (and often much more)*

would normally be expected." Coffey (2020) considered that a dilution greater than the test conditions (up to 20-fold dilution) is plausible given the thickness of the water column at the Disposal Ground (>9 m, CEE (2021b)).

Therefore, given that these elutriate tests were not initially required, are discrete, isolated occurrences, and are likely to be significantly diluted by the dredging process, the results are not considered significant.

7.0 Conclusions

This *Phase III Sediment Quality Assessment* characterises sediment quality associated with the construction phase of the project to inform the preparation of the EES. The project would involve localised dredging of approximately 490,000 m^3 of sediment in Corio Bay at the Loading Site. Several sediment disposal options are being considered with disposal at the existing Ports Victoria Point Wilson Disposal Ground in this report) the current preferred option.

For any proposed sediment dredging in Australia, sediment quality must be evaluated in accordance with national regulations primarily the NAGD (2009). This *Phase III Sediment Quality Assessment* report evaluated whether sediment from the proposed Loading Site is suitable for disposal at the Disposal Ground in accordance with NAGD (2009) assessment and reporting requirements.

Fieldwork was conducted by AECOM between 19 August and 8 September 2021 to collect sediment, pore water and seawater samples to inform the assessment. Data generated from this fieldwork were combined with data reported by Coffey (2020) and AMA (2020) because all three data sets were required to satisfy the NAGD (2009) assessment and reporting requirements.

The NAGD (2009) sets out a phased methodology for the assessment of potential contaminant impacts during dredging activities that may pose risks to ecological receptors. While initial results from the sediment sampling identified some chemical concentrations that exceeded the assessment criteria, the NAGD (2009) phased approach sets out a process to further examine the potential toxicity to ecological receptors. These further test results identified no potential adverse impacts to ecological receptors at both the Loading Site and Disposal Ground during dredging activities.

On the basis of the Sediment Quality Assessment undertaken in accordance with the NAGD (2009), it is concluded that the sediments proposed to be dredged at the Loading Site are suitable for offshore disposal at the Point Wilson Disposal Ground.

Information from this *Phase III Sediment Quality Assessment* will be used to inform a DSDOA to be prepared by AECOM in a separate report.

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Appendix A

Sampling, Analysis and Quality Plan

Prepared for
Viva Energy Australia Pty Ltd
ABN: 46 004 610 459

Sampling, Analysis and Quality Plan

Viva Energy Gas Terminal Project

07-Jul-2021
Viva Energy Vega

Sampling, Analysis and Quality Plan

Viva Energy Gas Terminal Project

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List of Acronyms

Term	Description
AECOM	AECOM Australia Pty Ltd
ASC NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended (2013)
ANZG	Australian and New Zealand Guidelines
ASS	Acid Sulfate Soils
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DAWE	Department of Agriculture, Water and Environment
DDT	Dichlorodiphenyltrichloroethane
DMG	Dredged material ground
DO	Dissolved Oxygen
DQI	Data Quality Indicators
DQO	Data Quality Objective
DSDOA	Dredged Spoil Disposal Options Assessment
DELWP	Victorian Department of Environment, Land, Water and Planning
EC	Electrical Conductivity
EES	Environmental Effects Statement
EPBC	Environment Protection and Biodiversity Conservation
FSRU	Floating storage and regasification unit
HEPA	Heads of Environment Protection Authorities Australia and New Zealand
LNG	Liquified Natural Gas
LOR	Limit of Reporting
mbs	Metres below seabed
NAGD	National Assessment Guidelines for Dredging
NASSG	National Acid Sulfate Soils Guidance
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEMP	National Environmental Management Plan
NEPM	National Environment Protection Measure

Term	Description
NM	Nautical Miles
OCPs	Organochlorine Pesticides
ORP	Oxidation Reduction Potential
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PFAS	Per- and Poly-Fluoroalkyl Substances
PFAS NEMP	PFAS National Environmental Management Plan
PFHxS	Perfluorohexane sulfonic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
RPDs	Relative Percent Differences
QA/QC	Quality Assurance and Quality Control
SAQP	Sampling, Analysis and Quality Plan
SH&E	Safety, Health and Environment
SHEMP	Safety, Health and Environment Management Plan
SOPs	Standard Operating Procedures
SWMS	Safe Work Method Statements
TBT	Tributyltin
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
US EPA	United States Environmental Protection Agency
Viva Energy	Viva Energy Australia Pty Ltd
VRCA	Victorian Regional Channels Association

1.0 Introduction

Viva Energy Australia Pty Ltd (Viva Energy) has engaged AECOM Australia Pty Ltd (AECOM) to undertake a Dredged Spoil Disposal Options Assessment (DSDOA) for the Viva Energy Gas Terminal Project (the project). The DSDOA will be prepared as part of a broader set of studies to be undertaken as part of the Environment Effects Statement (ESS) for the project.

Based on a preliminary screening of sediment disposal and management options, and discussions with the Victorian Regional Channels Authority (VRCA) disposal of sediment at the existing VRCA Point Wilson Dredged Material Ground (DMG) is currently the preferred option. However, further investigation is required to assess if this is a feasible option.

This Sampling, Analysis and Quality Plan (SAQP) has been prepared to obtain data to further assess whether the Point Wilson DMG is a suitable option and inform the DSDOA.

1.1 Background

AECOM understands that Viva Energy is planning to develop a floating gas terminal using a ship known as a floating storage and regasification unit (FSRU) which would be continuously moored at Refinery Pier in Corio Bay, Geelong.

Key components of the project include:

- Extension of the existing Refinery Pier with an approximately 570 m long angled pier arm, new berth and ancillary pier infrastructure including high pressure gas marine loading arms (MLAs).
- Continuous mooring of a FSRU at the new Refinery Pier berth to store and convert liquefied natural gas (LNG) into natural gas. LNG carriers would moor alongside the FSRU and unload the LNG.
- Construction and operation of approximately 2.5 km of aboveground gas pipeline on the pier and within the Viva Energy Geelong Refinery site connecting the FSRU to the new treatment facility.
- Construction and operation of a treatment facility on refinery premises including gas metering and analysis, and odorant and nitrogen injection (if required).
- Construction and operation of an underground gas transmission pipeline, approximately 4 km in length, connecting to the South West Pipeline at Lara.

It is understood that the project would involve localised dredging of approximately 490,000 m^3 of sediment in Corio Bay to provide a berth pocket and swing basin at the proposed extension to Refinery Pier for Berth No. 5 (i.e. Loading Site). Several sediment disposal options are being considered with disposal at the existing VRCA Point Wilson DMG (Disposal Ground) the current preferred option, based on a preliminary assessment and discussions with VRCA.

It is understood that the project requires an EES under the *Environment Effects Act 1978 (Vic)* and is also a 'controlled action' requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* The project will be assessed in accordance with the bilateral agreement between the Victorian and Commonwealth Governments under the *Environment Effects Act 1978* administered by the Victorian Department of Environment, Land, Water and Planning (DELWP). The main stakeholders involved in the project approval process include the Commonwealth Department of Agriculture, Water and Environment (DAWE), the DELWP, the Victorian Environment Protection Authority (EPA) and the VRCA. AECOM understands that from 1 July 2021, VRCA and Victorian Ports Corporation (Melbourne) will combine to become Ports Victoria.

Initial engineering design estimated approximately 1.1 million m^3 of dredged material would be required to be removed adjacent to the existing shipping channel to provide sufficient water depth at the new Refinery Pier berth and within the swing basin to allow for the LNG carriers to turn prior to berthing. Following further berthing simulations for multiple vessel types in a variety of weather conditions, and further design development, it was determined that a LNG carrier would be able to safely back up in a considerably smaller swing basin resulting in a reduction in the estimated volume of dredging to approximately 490,000 m^3. A comparison between the original dredge footprint and the proposed

dredge footprint is shown in Figure A1, (**Appendix A**). Sediment investigations based on the original dredge footprint have been performed at the Loading Site by AMA (2020) and Coffey (2020) which identified low levels of per-and poly-fluoroalkyl substances (PFAS) and elevated concentrations of some heavy metals/metalloids when compared with the adopted regulatory assessment criteria (where available). The next step is to undertake a DSDOA to determine the most appropriate option for disposal of the dredged material.

In general accordance with the *National Assessment Guidelines for Dredging* (2009), the DSDOA will comparatively assess alternatives to ocean disposal (e.g. onshore reuse, disposal and/or treatment) as well as disposal at identified ocean disposal sites. As part of this assessment, a staged approach is proposed on the basis that the scope of each stage of the work is informed by the previous stage. The staged approach for the DSDOA is outlined below.

- Stage 1: Data Review (**Section 3.0** of this report)
  - Review of the available reports in order to assess the appropriateness and quality of the sediment data collected at the Loading Site and Point Wilson Disposal Ground to inform the DSDOA.
  - Identification of data gaps (if any identified) relating to the quality and quantity of available data used to inform the DSDOA. The aim of the Sampling, Analysis and Quality Plan (SAQP) (Stage 2) will be to address these data gaps.
- Stage 2: Development of a SAQP (**Section 5.0** of this report)
  - Development of a SAQP to address the data gaps identified in Stage 1
  - Identification of relevant permits and approvals to be obtained by the field team
  - Engagement with DELWP, EPA and VRCA to present the SAQP.
- Stage 3a: Fieldwork (*Phase III Sediment Investigation*)
  - The fieldwork scope will be performed in accordance with the SAQP (following approval by DELWP).
- Stage 3b: *Phase III Sediment Quality Assessment*
  - Following the completion of Stage 3a, the data obtained from this phase of work will be utilised to assess the suitability of placing the dredged material at the Point Wilson Disposal Ground.
- Stage 4: Preparation of the DSDOA.

This SAQP encompasses Stages 1 and 2 of the scope described above.

1.2 Proposed Dredging and Disposal

Dredging is proposed to be undertaken in Corio Bay to the east of the Geelong Refinery, adjacent to the existing Refinery Pier and shipping channel. The proposed localised dredging is required to remove sediments to:

- Create a berth pocket for the proposed extension to Refinery Pier for Berth No. 5
- To increase the existing swing basin.

The proposed dredging extent is shown on **Figure 1** below, as indicated by the red shading.

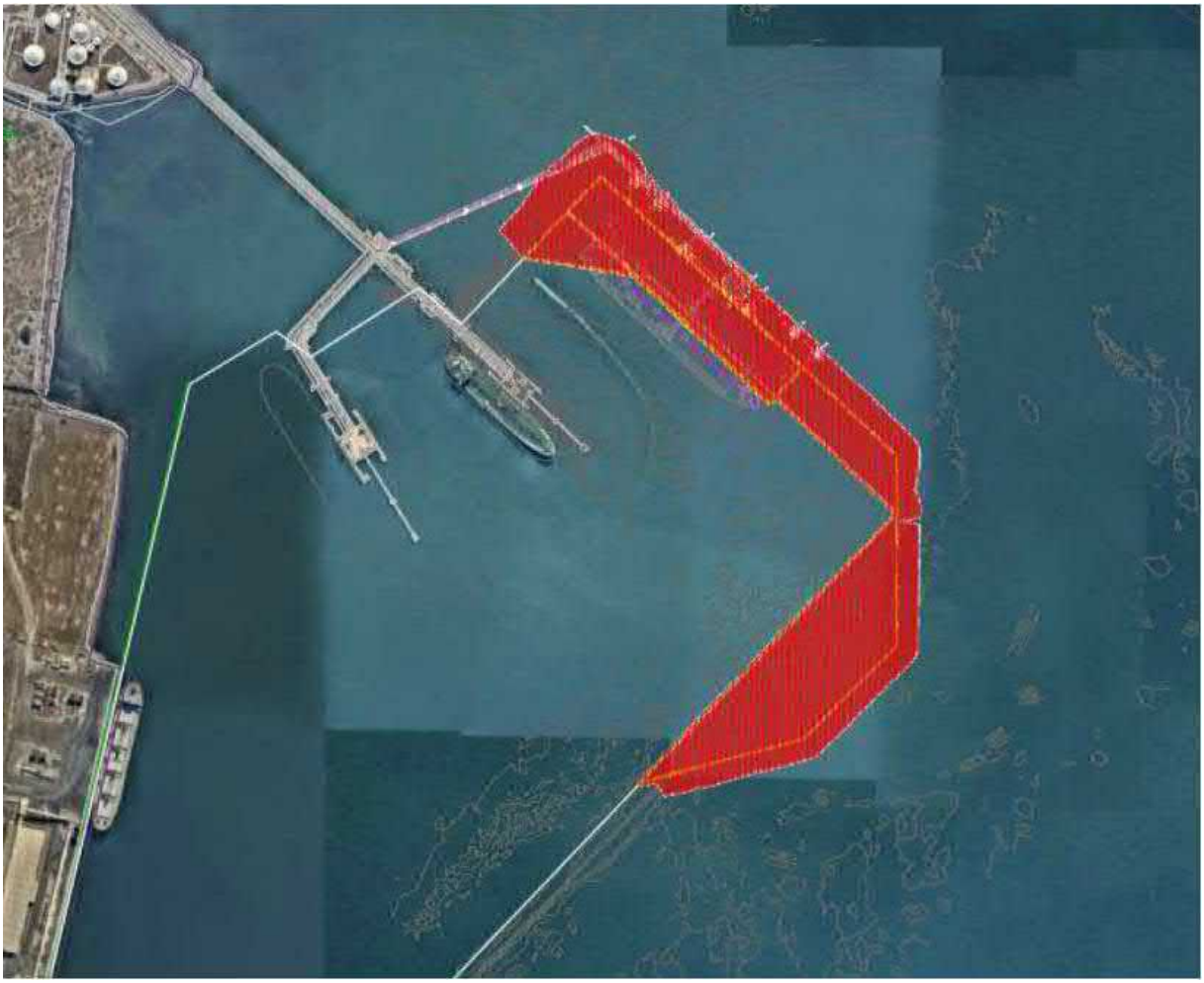

Figure 1 Proposed Dredge Footprint (from *Viva Geelong Gas Terminal, Dredge Study Report,* Worley, 2021a).

An estimated 490,000 m^3 (*in situ* volume) of dredged material would be required to be removed adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to manoeuvre (Worley, 2021a). The new berth pocket would be dredged to a depth of -13.1 metres Inner Harbour Chart Datum and the swing basin would be dredged to a depth of -12.7 metres Inner Harbour Chart Datum (Worley, 2021b).

It is understood that the current preference, subject to the findings of the DSDOA, is to dispose of all dredged material at the existing VRCA Point Wilson Disposal Ground (Disposal Ground). The Disposal Ground is approximately 14 nautical miles (NM) (26 km) from the dredge site (refer to **Figure 2** below). Placement of dredge material is assumed to be by bottom dumping from barges (as has previously occurred at the Disposal Ground), with no requirements for bunding, layering or capping of material (Worley, 2021a).

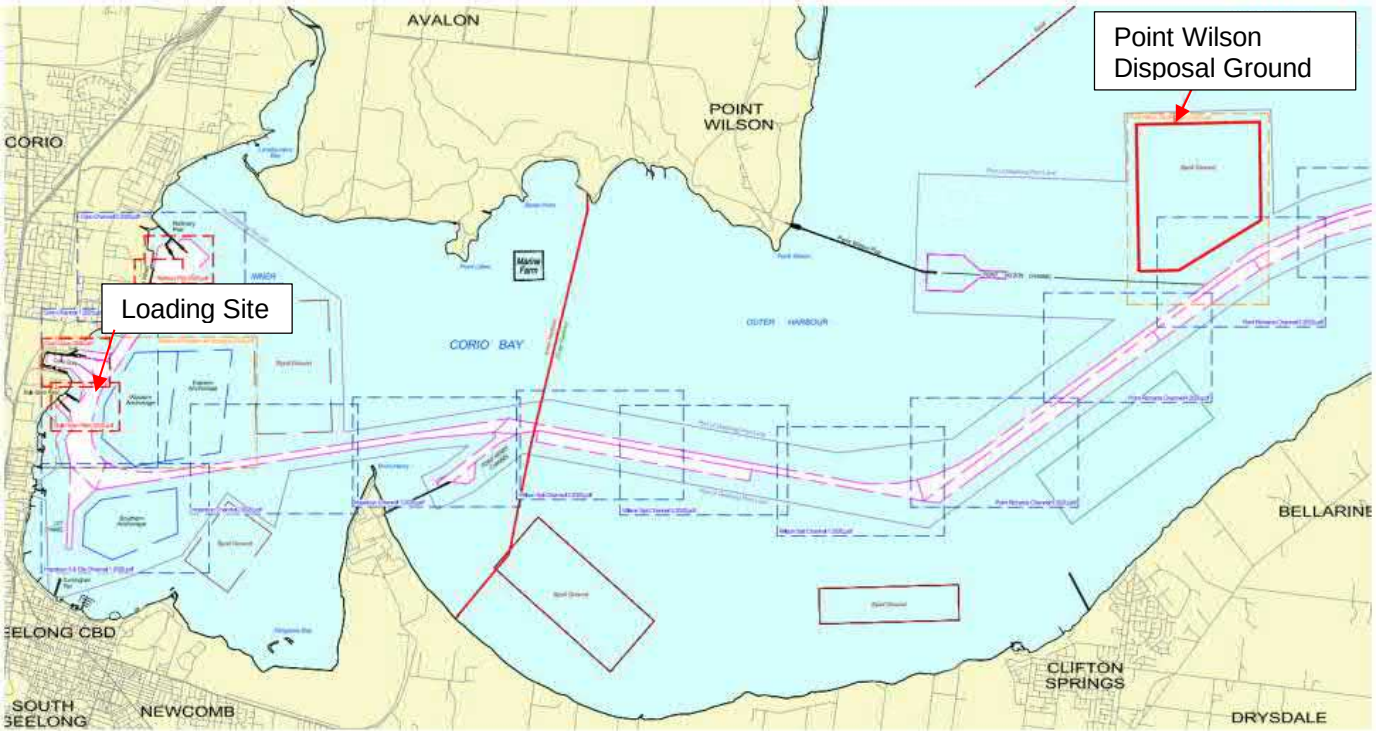

Figure 2 **Location of Point Wilson Disposal Ground (from *Viva Geelong Gas Terminal, Dredge Study Report,* Worley, 2021a).**

2.0 Regulatory Framework

The following guidelines apply to the SAQP:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT.
- HEPA, 2020. *PFAS National Environmental Management Plan 2.0*, February 2020. Heads of EPA Australian and New Zealand (HEPA).
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- Simpson SL and Batley GE (2016) Sediment Quality Assessment: A Practical Guide, Second Edition. CSIRO.
- Simpson et al (2018) *National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management.* Department of Agriculture and Water Resources, Canberra ACT. June 2018.

2.1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality provides guidance on managing water quality or sediment quality (ANZG, 2018). These include default guideline values (DGV) for water quality and sediment quality as well as a framework for deriving guideline values. The DGVs are referenced by other guidelines that apply to the DSDOA, such as the National Assessment Guidelines for Dredging (NAGD).

2.2 National Assessment Guidelines for Dredging

The National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) provides guidance on the assessment and management of dredged material to protect and preserve the marine environment from pollution related to dumping at sea. This is to meet the requirements of the following Commonwealth Acts:

- *Environment Protection (Sea Dumping) Act 1981*
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The NAGD describes a phased approach to the assessment of potential contaminants as presented in **Figure 3** below:

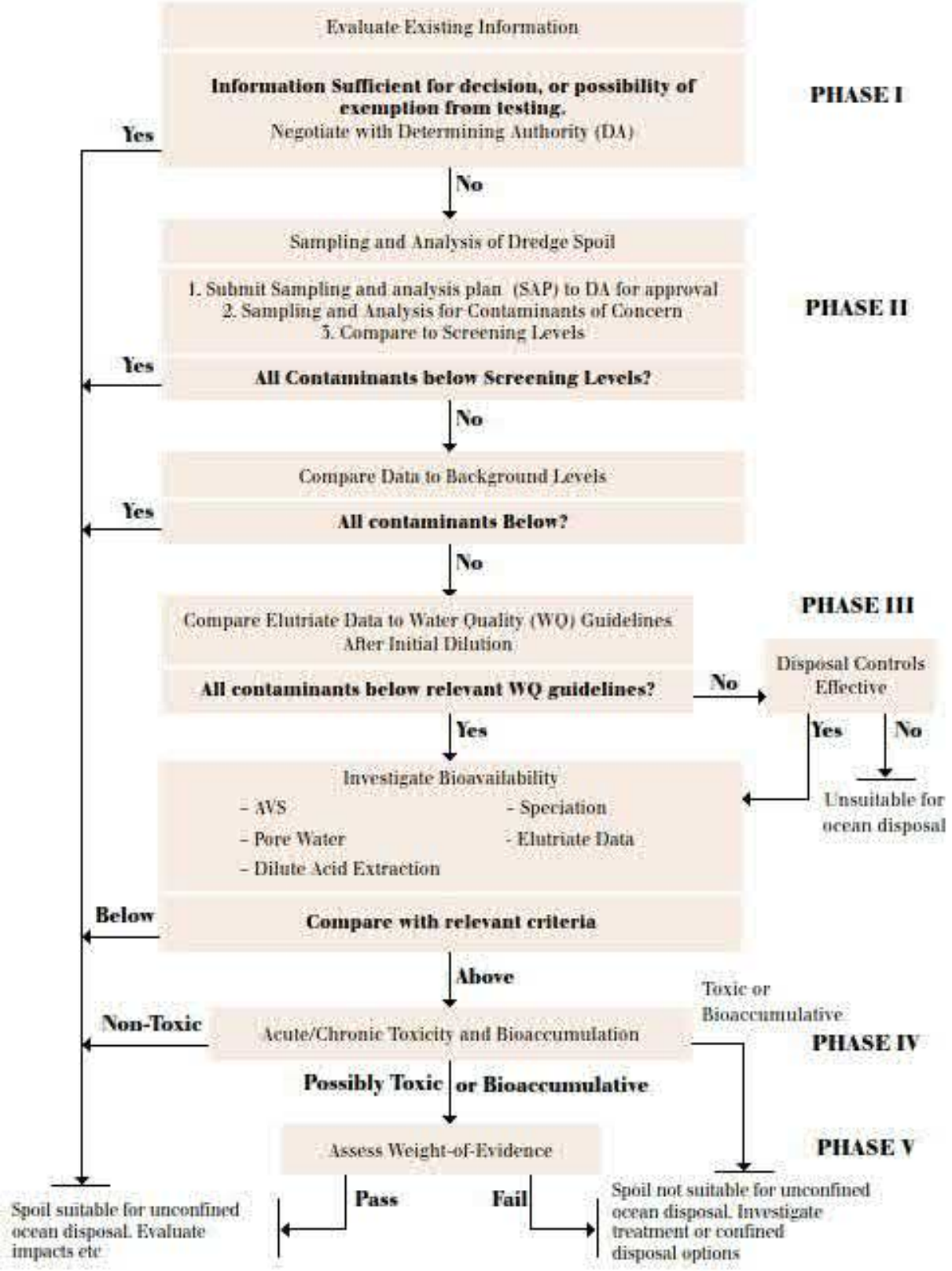


Figure 3 Assessment of Potential Contaminants – (NAGD, 2009)

This report addresses Phase I, Phase II, and Phase III of NAGD (2009) assessment approach.

2.3 National Acid Sulfate Soils Guidance

The National Acid Sulfate Soils Guidance (NASSG) provides national guidance regarding the assessment and management of acid sulfate soils and sediments (ASS). The NASSG includes the following key guidance document of relevance to the DSDOA:

- National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management (Simpson et al, 2018).

This guideline provides a framework for the assessment and management of ASS during dredging projects to avoid environmental harm and includes a tiered assessment framework, which is shown in **Figure 4** overleaf.

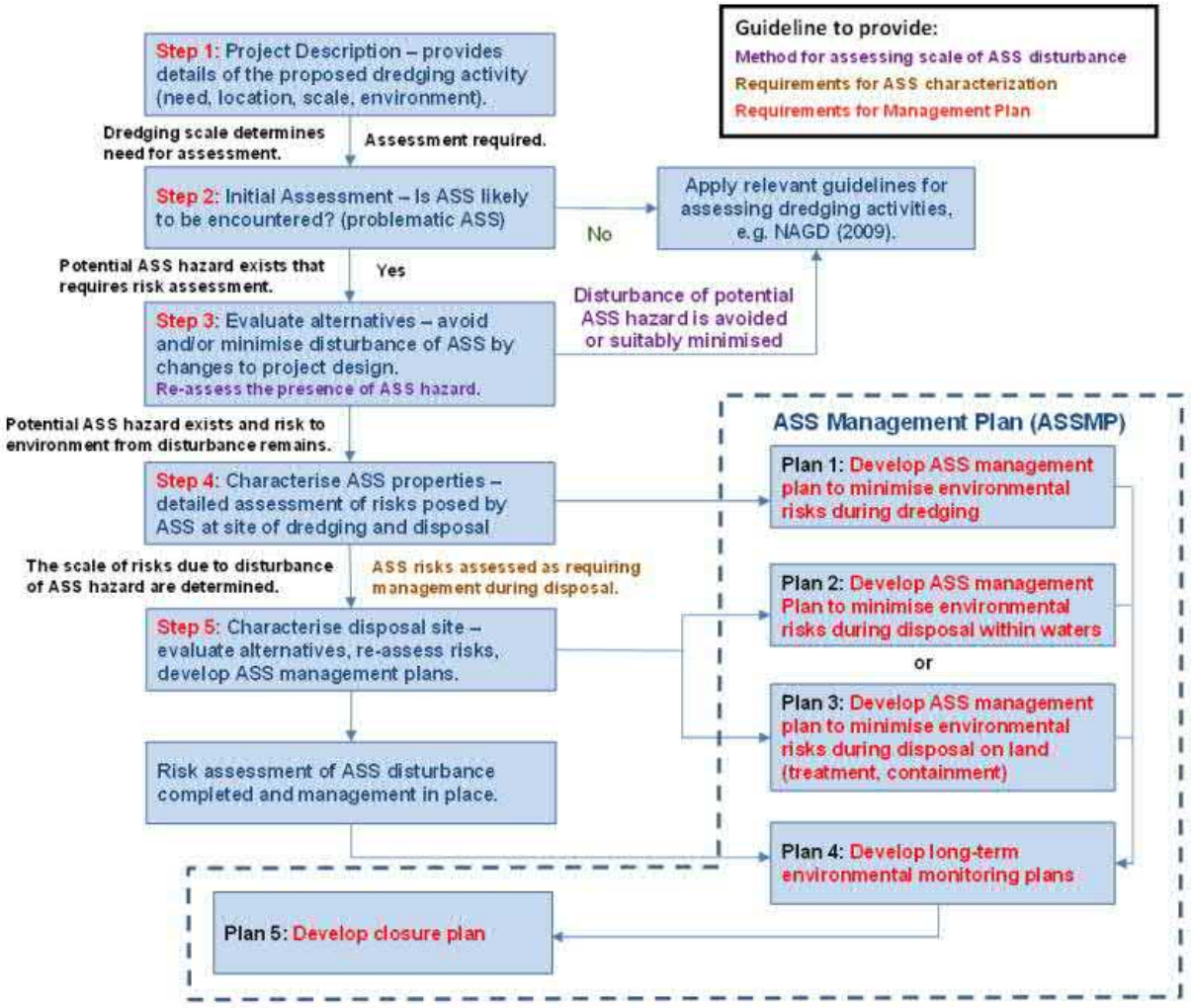


Figure 4 Flowchart for Proposed Assessment Framework (*National Acid Sulfate Soils Guidance: Guidelines for the Dredging of Acid Sulfate Soil Sediments and Associated Dredge Spoil Management*, Simpson et al., 2018)

Step 1 and 2 from the assessment framework outlined in the NASSG were addressed in the *Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project* (Coffey, 2020). This document is discussed further in **Section 3.2.**

3.0 Data Review

3.1 Contaminants of Potential Concern

Based on information from historical activities near the Loading Site, the following contaminants of potential concern (COPCs) have been identified:

- Metals and metalloids: antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc
- Tributyltin (TBT)
- Total Recoverable Hydrocarbons (TRH)
- Polynuclear Aromatic Hydrocarbons (PAHs): 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(e)pyrene, benzo(k)fluroanthene, chrysene, coronene, dibenz(a.h)anthracene, fluoranthene, fluorene, indeno(1.2.3.cd)pyrene, naphthalene, perylene, phenanthrene, pyrene, benzo(g,h,i)perylene and benz(a)anthracene)
- Organophosphorus Pesticides (OPPs)
- Organochlorine Pesticides (OCPs): total dichlorodiphenyltrichloroethane (DDT), dieldrin, chlordane, lindane, endrin
- Polychlorinated Biphenyls (PCBs)
- PFAS: perfluorobutane sulfonic acid (PFBS), perfluorohexane sulfonic acid (PFHxS), perfluorooctane sulfonic acid (PFOS), perfluorobutanoic acid (PFBA), perfluoropentanoic acid (PFPeA), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorooctanoic acid (PFOA), 4:2 fluorotelomer sulfonic acid (4:2 FTS), 6:2 fluorotelomer sulfonic acid (6:2 FTS), 8:2 fluorotelomer sulfonic acid (8:2 FTS), and10:2 fluorotelomer sulfonic acid (10:2 FTS).

3.2 Previous Investigations

The following documents associated with the Loading Site were reviewed:

Data for the Loading Site

- AMA (2020) *Targeted Sediment Investigation, Project VEGA*. 12 October 2020
- Coffey (2020) *Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project*. 4 December 2020
- Worley (2021a) *Viva Geelong Gas Terminal, Dredging Study*. 8 April 2021

Other Historic Reports

- Cardno (2011) Corio Bay Safety Adjustment Program – Turbidity from Dredging. 23 November 2011
- The University of Melbourne (2011) Environmental Risk Assessment for VRCA Corio Bay Channel Safety Adjustment Program. 11 March 2011.
- URS (2014) *Sediment Investigation Sampling and Analysis*. 18 July 2014
- Worley Parsons Services Pty Ltd (2011a) Corio Bay Safety Adjustment Program – SAP Implementation Report. 19 October 2011
- Worley Parsons Services Pty Ltd (2011b) Corio Bay Safety Adjustment Program – Factual Report on Geotechnical Investigation. 22 February 2011

Data from some of these reports were not relevant due to their location outside of the Loading Site. Relevant findings from previous investigations undertaken at the Loading Site and/or Disposal Ground area summarised in **Table 1.**

Table 1 Summary of Previous Investigations

Objectives and Scope of Work	Findings	Comment
Corio Bay Safety Adjustment Program – SAP Implementation Report (Worley Parsons 2011a)		
• To characterise the physical and chemical properties of sediment that was likely to be the subject of a future dredge proposal, including ambient baseline samples near the Disposal Ground (aka Outer Harbour Disposal Ground). • Sediment sample collection at seven locations representing background near the Disposal Ground. • Collection of seawater from the Disposal Ground for analysis and use in elutriate testing.	• Metals, TPH, and various PAHs were detected in background sediment samples at concentrations less than the ANZG sediment guideline values, except for arsenic and nickel. • The 95% upper confidence limit (UCL) for nickel in sediment was greater than the ANZG (2018) sediment DGV. • Arsenic and nickel were detected in seawater at concentrations less than the ANZG (2018) water DGV. • No elutriate testing was completed on background sediment samples.	• Samples were collected more than 10 years ago and consequently are likely no longer representative of current conditions. • The ambient baseline locations are approximately 4.5 km to the southwest of the Disposal Ground.
Sediment Investigation Sampling and Analysis (URS 2014)		
• To characterise the physical and chemical properties of sediment that was likely to be the subject of a future dredge proposal, including ambient baseline samples near the Disposal Ground. • Sediment sample collection at seven locations representing background near the Disposal Ground. • Collection of three bulk seawater samples from the Disposal Ground for analysis and use in elutriate testing.	• Metals and various PAHs were detected in background sediment samples at concentrations less than the ANZG (2018) sediment DGV. • Arsenic and nickel were detected in seawater at concentrations less than the ANZG (2018) water DGV. • No elutriate testing was completed on background sediment samples.	• Samples were collected more than five years ago and likely no longer representative of current conditions. • The ambient baseline locations are approximately 1 to 2 km to the north and west of the Disposal Ground.
Targeted sediment investigation (AMA 2020)		
• To implement a targeted sediment investigation, which considers the sampling and analysis approach specified in the NAGD (2009). • Discuss whether the PFAS concentrations reported exceed ambient background levels in the Geelong Arm of Port Phillip Bay and where applicable, 95% and 99% species protection levels (HEPA, 2020) (i.e. elutriate and porewaters) for offshore disposal; and Health Investigation Levels (NEPC, 2013) and Ecological Soil Guideline Values (HEPA, 2020) for onshore disposal. • Sediment sample collection at 20 locations spanning the original berth pocket and swing areas. • Sediment sample collection at 10 locations representing background reference areas in the Geelong Arm of Port Phillip Bay. • Collection of one bulk seawater sample for analysis and use in elutriate testing. • Elutriate testing on six sediment samples.	• All samples collected between 0 and 1 metre below seabed (mbs). • PFAS were detected at 11 locations within the dredge area: - PFOS: 0.00017 to 0.0030 milligrams per kilogram (mg/kg) (normalised to 1% total organic carbon). - PFHxS: 0.002 mg/kg (one location only). - No other PFAS were detected above laboratory reporting limits within the Loading Site. • No PFAS were detected above laboratory reporting limits in sediment samples collected from ambient baseline locations. • PFAS were detected in all elutriate samples: - PFOS: 0.0025 to 0.0060 micrograms per litre (µg/L) - PFHxS: 0.0009 to 0.0015 µg/L - PFHpA: 0.0008 to 0.0012 µg/L - PFOA: 0.0009 to 0.0019 µg/L. • PFAS were detected in seawater: - PFOS: 0.0025 µg/L. - PFHxS: 0.0009 µg/L. - PFOA: 0.0009 µg/L. • For onshore disposal, the PFOS and PFOA concentrations reported in sediments in the Loading Site were below adopted guidance values.	• Sample locations are shown on **Figures A1 and A2, Appendix A.** • Of the 20 sample locations, only 15 remain in the Loading Site (following reduction in area to be dredged). • All detected PFOS concentrations in sediment were below the benthic 99% species protection (spp.) value of 0.060 mg/kg normalised to 1% organic carbon (Simpson et al, 2021, discussed further in **Section 6.0**). • All detected PFOS concentrations in elutriate and seawater were below the benthic estuarine/marine 99% spp. value of 6 µg/L and the 95% spp. value of 25 µg/L (Simpson et al, 2021). • Location of ambient baseline samples is not in the immediate vicinity of the Disposal Ground (i.e. approximately 7 to 12km from the Disposal Ground).

Objectives and Scope of Work	Findings	Comment
Sediment Contamination Assessment - Geelong LNG Regasification Terminal Project (Coffey 2020)		
• Conduct sediment sampling and analysis. • Characterise the presence and nature of contaminated sediment in the original area to be dredged. • Identify the presence and nature of acid sulfate soils in the area to be dredged. • Identify the preliminary waste hazard categorisation for the material proposed to be dredged in consideration of EPA (2019) Victoria Industrial Waste Resource Guidelines. • Evaluate the suitability of the sediments to be dredged for off-shore or on-shore disposal. • Sediment coring for collection of whole sediment samples at 18 locations within the berth pocket area and 27 locations within the swing basin area. • Collection of two bulk seawater samples for analysis and use in elutriate testing. • Elutriate testing on 15 sediment samples.	• Three sediment domains established: - Layer 1a: shallow recent marine sediments characterised by loose sand or very soft to soft grey clays; 'suspect'* layer; 76 samples analysed from 0 to 2.5 mbs. - Layer 1b: deeper more consolidated marine sediments characterised by firm to stiff grey clays; natural layer with some potential for contamination due to overlying 'suspect' layer of recent sediment; 25 samples analysed from 0.5 to 3 mbs. - Layer 2: underlying Moorabool Viaduct Sand formation, which comprised orange brown clayey sand and sandy clay; natural layer; eight samples analysed from 3 to 7 mbs. • OPPs, OCPs and PCBs were not detected above the laboratory limit of reporting (LOR) in any samples. TRH were detected in seven of 115 samples at concentrations below the ANZG (2018) sediment DGV. • Antimony, arsenic, cadmium, lead, mercury, nickel, and TBT exceeded the ANZG (2018) sediment DGV: - 95%UCL within Layer 1a exceeded sediment DGV for lead, mercury, nickel, and TBT. - 95%UCL within Layer 1b and Layer 2 exceeded sediment DGV for: arsenic and nickel. - Arsenic and nickel concentrations were similar in all layers, indicating naturally occurring background levels. This observation was supported by previous investigations. • Arsenic and zinc in elutriate and seawater exceeded the ANZG (2018) water DGV - Arsenic concentrations indicated significant contamination (95% UCL between 1x to 5x water DGV), but at least partly associated with background. - Zinc concentrations indicated very significant contamination (95%UCL >5x water DGV). • It is likely that all sediments could be classed as non-acid sulfate soil for on-shore management, but assessment required if drying or oxidation of dredge material proposed. • Preliminary waste hazard categorisation indicated all domains are potentially categorised as 'Fill Material' for on- shore management. • There is potential for adverse environmental impacts associated with the disturbance of sediments to be dredged.	• Sample locations are shown in **Figure A1, Appendix A.** • Of the 45 sediment sample locations, only 23 (16 in the berth pocket and seven in the swing area) remain in the Loading Site (following reduction in area to be dredged), including: - Layer 1a: 35 samples analysed - Layer 1b: 12 samples analysed - Layer 2: six samples analysed • Of the 15 sediment samples that underwent elutriate testing, only five remain in the Loading Site (following reduction in area to be dredged). • Because TPH, OPPs, OCPs, and PCBs were not detected or detected very infrequently and at concentrations below DGVs, it is unlikely they would be encountered in future sampling.

*The term 'suspect' is used in accordance with NAGD (2009), Appendix A, contaminant level classifications of 'probably contaminated', 'suspect' or 'probably clean'.

3.3 Data Gaps

Based on the information available to date (as presented in **Sections 3.1** and **3.2**), a number of key data gaps were identified by AECOM as relevant to the Loading Site, Disposal Ground and ambient baseline locations. These data gaps are presented in **Table 2**, as well as actions proposed to address these data gaps, where applicable.

The rationale for the work detailed in the SAQP (presented in **Section 5.0**) is to address these data gaps.

Table 2 Data Gaps

Data Gap	Detail and Proposed Actions to Address Data Gap
Age of ambient baseline data for conventional COPCs	Previous investigations characterised sediment for conventional COPCs in limited locations considered to represent ambient baseline conditions, but the data are more than five years old and are unlikely to represent current conditions. *Collection of ambient baseline sediment samples near the Disposal Ground for analysis of conventional COPCs and sediment quality characteristics such as grain-size and total organic carbon (TOC).*
Location of ambient baseline samples analysed for PFAS	Ambient baseline locations analysed for PFAS are not in the immediate vicinity of the Point Wilson Disposal Ground (i.e. approximately 7 to 12 km from the Disposal Ground). The PFAS concentrations are representative of ambient baseline conditions in the Geelong Arm of Port Phillip Bay. *Assume these PFAS data are a conservative representation of ambient baseline conditions near the Disposal Ground, which potentially has higher PFAS concentrations due to historical sediment disposal.*
Number of sample locations at Loading Site	In accordance with NAGD (2009) Table 6, Appendix D, a minimum of 28 sample locations is required for the proposed dredge volume of 490,000 m^3. From previous investigations, there are 23 sample locations with analytical data for conventional COPCs and 15 sample locations with analytical data for PFAS only. In accordance with NAGD (2009), Table 7, Appendix D, a minimum of seven sample locations is required for elutriate testing given the historical concentrations reported in sediment and proposed dredge volume. From previous investigations, there are five sample locations with elutriate data for conventional COPCs and four samples locations with elutriate data for PFAS only. *Collection of sediment samples at the Loading Site and seawater at Disposal Ground for elutriate testing to satisfy minimum data requirements stipulated in NAGD (2009).*
Depth of samples analysed for PFAS at the Loading Site	A previous investigation found that the 'suspect' layer at the Loading Site extends from 0 to 2.5 mbs (Coffey, 2020). PFAS analytical data are available only from 0 to 1 mbs at the Loading Site and therefore PFAS data to the maximum dredge depth is unknown. *Collection of sediment samples at the Loading Site deeper than 1 mbs for PFAS analysis.*

Data Gap	Detail and Proposed Actions to Address Data Gap
Current sediment and water column conditions at Disposal Ground	Information regarding the physical and chemical characteristics of the water column and sediments at the Disposal Ground are unknown, and are required to satisfy NAGD (2009) data requirements. *Collection of seawater and sediment samples within the proposed Disposal Ground to determine the physical characteristics of sediments and chemical characteristics of the water column at the Disposal Ground and satisfy NAGD (2009) data requirements.*
Bioavailability potential of COPCs in sediment to be dredged	Limited analysis to understand COPC bioavailability was conducted by Coffey (2020) i.e. elutriate testing of sediments collected from the Loading Site. These data are not considered sufficient to provide an understanding of COPC bioavailability as per NAGD (2009) guidelines. *Collection of sediment from the area to be dredged for porewater and elutriate analysis to satisfy NAGD (2009) data requirements, including Chelex* testing for metals and metalloids.*
Ecotoxicity and bioaccumulation potential of COPCs in sediment to be dredged	It is unknown whether the COPCs in sediment to be dredged have the potential to result in unacceptable acute or chronic ecotoxicity and/or bioaccumulate (as per Phase IV of the NAGD (2009) assessment steps presented in **Figure 3** above). *In accordance with the NAGD (2009) step-wise assessment process, it is unknown whether ecotoxicity and/or bioaccumulation testing is required until an assessment of COPC bioavailability (Phase III) has been completed. No additional fieldworks or analysis are proposed at this stage of the project*.
Benthic community structure at Disposal Ground	The benthic community structure (and presence of protected/ endangered species) is unknown at the Disposal Ground. However, given the Disposal Ground has historically been used for ocean sediment disposal it is assumed that benthic community characterisation is not required. AECOM understands that sediment was most recently disposed at Point Wilson Disposal Ground in 2017. It is understood that this comprised 160,000 m^3 dredged material from the eastern side of Corio Channel. *No additional fieldworks are proposed to characterise benthic community structure at the Disposal Ground. Publicly available studies will be reviewed to assess the potential impact to benthic communities potentially present within the anticipated dispersion footprint of dumped sediments outside the Disposal Ground. Example reports include (but not limited to):* • *Victorian Marine Habitat Database: Seagrass Mapping of Port Phillip Bay (Blake and Ball 2001)* • *Benthos of the Muddy Bottom Habitat of the Geelong Arm of Port Phillip Bay, Victoria (Carey and Watson 1993)* • *Seamap Australia – A national seafloor habitat classification scheme (Lucieer et al. 2017).*
Special handling and disposal considerations of contaminated sediments	Previous investigation identified a 'suspect' layer within sediment from 0 to 2.5 mbs at the Loading Site (Coffey 2020). *Collection and analysis of sediment samples within 0 to 2.5 mbs at the Loading Site to further characterise the 'suspect' layer and inform whether sediment from this layer may require special handling and disposal considerations.*

* The Chelex method results in an estimation of the bioavailability by determining the affinity of the metals for a Chelex resin under certain conditions http://www.clw.csiro.au/publications/cecr/Fact_Sheet_Water_Quality_Assessment.pdf

4.0 Data Quality Objectives

The *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013 (NEPC, 2013) (Schedule B2 Guideline on Site Characterisation) specifies that the nature and quality of the data produced in an investigation will be determined by the Data Quality Objectives (DQOs). As referenced by NEPC (2013), the DQO process is detailed in the United States Environmental Protection Agency (US EPA) *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4: EPA/240/B-06/001), February 2006.*

The US EPA defines the process as *'a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect'.*

The process of establishing appropriate DQOs is defined according to the following seven steps outlined in **Table 3**:

Table 3 The Seven Steps In Defining DQOs

Step	Data Quality Objective Step
1	***State the problem*** – Define the problem that necessitates the study.
2	***Identify the goal of the study*** – State how environmental data will be used in meeting objectives and solving the problem, identify study questions, define alternative outcomes.
3	***Identify information inputs*** – Identify data and information needed to answer study questions.
4	***Define the boundaries of the study*** – Specify the target population and characteristics of interest, define spatial and temporal limits, scale of inference.
5	***Develop the analytic approach*** – Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.
6	***Specify performance or acceptance criteria*** – Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.
7	***Develop the plan for obtaining data*** – Select the resource-effective sampling and analysis plan that meets the performance criteria.

The approach adopted relative to the seven steps presented in **Table 3** is discussed below.

4.1 Step 1 – State the Problem

Additional data characterising the physical and chemical attributes of sediment from the Loading Site, Disposal Ground and ambient baseline locations are required to conduct Phases I, II, and III as prescribed by the NAGD (2009).

The additional data collected by implementing this SAQP will allow an assessment as to whether the dredged material would be suitable for unconfined ocean disposal.

4.2 Step 2 – Identify the Goal of the Study

The goal represents the key steps/issues that need to be reviewed/considered in order to resolve the problem identified in Step 1.

The questions to be addressed by the *Phase III Sediment Investigation* include:

- How do the physical characteristics of the dredge material from the Loading Site compare to those at the Disposal Ground?

- How do the chemical characteristics of the dredge material from the Loading Site compare to those at ambient baseline locations and sediment DGVs?
- If chemical concentrations in the dredge material exceed sediment DGV, how do the bioavailable concentrations compare to marine water quality DGV?
- Following a review of the data collected as part of Phases I, II and III (as outlined in the SAQP), are additional data required to assess the potential for acute and chronic ecotoxicity and/or bioaccumulation in accordance with NAGD (2009)?

4.3 Step 3 – Identify the Information Inputs

To allow assessment of the data against the study goals listed in Step 2, the following will be considered:

- Existing information describing sediment chemical concentrations and sediment type/characteristics in the Loading Site and ambient baseline locations.
- Details of the proposed dredging works, including area, depths, dredging methodology, estimated volumes of dredged material / spoil requiring management and preliminary proposed dredged material management plans.
- New data to be collected and observations made during the *Phase III Sediment Investigation* field works to be conducted as proposed in **Section 5.0**.

4.4 Step 4 – Define the Boundaries of the Study

The spatial boundaries of the *Phase III Sediment Investigation* are:

- Lateral: Loading Site and Outer Harbour up to 2 km from the Disposal Ground as shown in **Figures A1** and **A2, Appendix A**.
- Vertical: sampling depths will vary spatially:
  - Sediment samples will be collected from 0 to 7 mbs
  - Pore water will be extracted from sediment samples
  - Seawater samples will be collected from the middle of the water column.

4.5 Step 5 – Develop the Analytical Approach

The decision rule to evaluate the concentrations of COPCs in sediment, pore water and seawater is based on the following:

- If the laboratory quality assurance/quality control (QA/QC) data are within the acceptable ranges, the data will be considered suitable for use
- If the field QA/QC data are within the acceptable ranges, the data will be considered suitable for use.

The decision on the acceptance of the analytical data will be made on the basis of the Data Quality Indicators (DQIs) as follows:

- **Precision:** A quantitative measure of the variability (or reproducibility) of data.
- **Accuracy**: A quantitative measure of the closeness of reported data to the “true” value.
- **Representativeness**: The confidence (expressed qualitatively) that data are representative of each media sampled.
- **Completeness**: A measure of the amount of useable data from a data collection activity.
- **Comparability**: The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.

4.5.1 Precision

Suitable criteria and/or performance indicators for assessment of precision include:

- Performance of intra-laboratory duplicate sample sets through calculation of relative percentage differences (RPDs)
- Performance of inter-laboratory duplicate sample sets through calculation of RPDs
- The RPDs will be assessed as acceptable if less than or equal to 30% as per ASC NEPM 2013 Schedule B3. Where the results show greater than 30% difference, a review of the cause will be conducted (ASC NEPM 2013). It is noted that RPDs that exceed this range may be considered acceptable where:
    - results are less than 10 times the LOR (no limit)
    - results are less than 20 times the LOR and the RPD is less than 50%
    - heterogeneous materials are encountered.

4.5.2 Accuracy (Bias)

The closeness of the reported data to the “true” value is assessed through review of performance of:

- Method blanks, which are analysed for the analytes requested for in the primary samples
- Matrix spikes and surrogate recoveries
- Laboratory control samples.

4.5.3 Representativeness

To ensure the data produced by the laboratory are representative of conditions encountered in the field, the following steps will be taken by the laboratory, and subsequently reviewed by AECOM:

- Laboratory-prepared trip blank samples will be utilised in the field to assess sample handling and storage conditions, and the potential for field cross-contamination between samples.
- Method blank samples will be utilised by the laboratory to confirm there are no unacceptable instances of laboratory cross-contamination.
- Review of RPD values for field and laboratory duplicates (sediment, pore water and surface water only) to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneity.
- The appropriateness of collection methodologies, handling, storage, and preservation techniques will be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation.

4.5.4 Completeness

In validating the degree of completeness of the analytical data sets acquired during the program, the following is considered:

- Whether standard operating procedures (SOPs) for sampling protocols have been adhered to
- Copies of all Chain of Custody (CoC) documentation are reviewed and presented
- Whether the target numbers of samples proposed in the SAQP (presented in **Section 5.0**) are able to be collected.

It can therefore be considered whether the proportion of “useable data” generated in the data collection activities is sufficient for the purposes of assessing the problem as stated in Step 1 above.

4.5.5 Comparability

Given that assessment data can comprise several data sets from separate sampling events (for example, Targeted Sediment Investigation [AMA 2020], Sediment Contamination Assessment [Coffey 2020 and the *Phase III Sediment Investigation*), issues of comparability between data sets are reduced

through adherence to SOPs and regulator endorsed or made guidelines and standards on each data gathering activity. SOPs for sampling of environmental media are provided in **Appendix B**.

4.5.6 Assessment of Data Quality

The quality of data collected as part of the sampling will be assessed on a range of factors including:

- Documentation and data completeness
- Data quality – comparability, representativeness, precision and accuracy of the analytical data.

The target for data completeness is to achieve 95% of data as suitable for use.

The acceptance criteria for DQIs for samples are specified in **Table 4**.

Table 4 Acceptance Criteria for Data Quality Indicators for Sample Analysis

Data Quality Indicators	Acceptance Criteria
Rinsate blanks (where sampling equipment is reused)	COPC concentrations less than the laboratory LOR.
Field intra-lab and inter-lab duplicates	The RPDs will be assessed as acceptable if less than or equal to 30% as per the ASC NEPM 2013 Schedule B3. Where the results show greater than 30% difference a review of the cause will be conducted (ASC NEPM 2013). It is noted that RPDs that exceed this range may be considered acceptable where: • results are less than 10 times the LOR (no limit) • results are less than 20 times the LOR and the RPD is less than 50% • heterogeneous materials are encountered.
Laboratory duplicates	RPDs less than: • 20% for high level laboratory duplicates (i.e. >20 x LOR) • 50% for medium level laboratory duplicates (i.e. 10 to 20 x LOR).
Matrix spikes	Recoveries between 70-130% of the theoretical recovery or as nominated in the laboratory's quality control (QC) report, based on laboratory historical databases.
Method blanks	Less than the laboratory LOR.
Laboratory control samples	Recoveries between laboratories specified range for each particular analyte / analytical suite.

In addition, the data will be collected by experienced AECOM field staff (and marine ecology sub-contractors), and National Association of Testing Authorities, Australia (NATA) accredited laboratories will be employed in all laboratory programs for sediment, porewater and surface water analysis.

4.6 Step 6 – Specify Performance or Acceptance Criteria

Specific limits for this *Phase III Sediment Investigation* are in accordance with guidance endorsed by state and national regulators, appropriate indicators of data quality, and standard procedures for field sampling and handling.

This step also examines the certainty of conclusive statements based on the new data collected from the Loading Site, ambient baseline locations, and the Disposal Ground. This should include the following points to quantify tolerable limits:

- A decision can be made based on a certainty assumption of 95% confidence in any given data set. A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative.

A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area. Decision errors may include:

- Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this, the following measures are proposed:
  - field staff to follow SOPs when collecting samples, including decontamination of tools, and use of appropriate sample containers and preservation methods
  - clear and thorough completion of field records including sampling field sheets and CoCs
  - laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis
  - Laboratories to report QA/QC data for comparison with the DQIs established for the investigation.

4.7 Step 7 – Optimise the Design for Obtaining Data

The methodology presented in the SAQP (presented in **Section 5.0**) is designed to meet the objectives described in **Section 5.1** and to achieve the nominated DQOs. Optimisation of the data collection process will be achieved by:

- Working closely with the analytical laboratories and sampling equipment suppliers to ensure that appropriate procedures and processes are developed and implemented prior to and during the field work, to ensure that sample handling, and transport to and processing by the analytical laboratories is appropriate.
- Conducting sampling according to set SOPs for the type of sampling being conducted (e.g. sediment and surface water sampling).

5.0 Sampling, Analysis and Quality Plan

5.1 Objectives

The objectives of the *Phase III Sediment Investigation* are to undertake the following tasks in accordance with NAGD (2009) requirements:

- Characterise the physical and chemical properties of sediment that is likely to be the subject of a future dredge proposal within the berth pocket and swing basin at the Loading Site (refer to **Figure A1**, **Appendix A**)
- Characterise COPC concentrations in locations considered to represent ambient baseline conditions
- Assess the potential for adverse ecological impacts due to sediment disposal at the Disposal Ground.

Since the focus of the *Phase III Sediment Investigation* is to assess the suitability of sediment for ocean disposal, collection of data for ASS assessment or waste classification for onshore disposal is not included in the SAQP.

The objective of this SAQP is to document the scope and specific procedures to be employed during the investigation, including the proposed sampling locations, field methodologies and laboratory protocols to be adopted during the *Phase III Sediment Investigation*.

5.2 Scope of Works

The following scope of work will be completed for the *Phase III Sediment Investigation* within the Loading Site and Disposal Ground:

- Collection of sediment samples at the Loading Site
- Collection of sediment samples at ambient baseline locations
- Collection of sediment and seawater samples at the proposed Disposal Ground.

Guidance provided in the following documents will be referenced during the *Phase III Sediment Investigation*:

- Commonwealth of Australia (2009) *National Assessment Guidelines for Dredging* (NAGD)
- The Heads of EPA Australia and New Zealand (HEPA) (2020) *PFAS National Environmental Management Plan, Version 2.0*
- National Environment Protection Council (1999) National Environment Protection (*Assessment of Site Contamination*) Measure, *Schedule B2: Guideline on Site Characterisation* (as amended in May 2013)
- Simpson SL, Batley GE (2016) Sediment Quality Assessment, A Practical Guide, Second Edition. CSIRO, Bangor, NSW.
- Standards Australia (AS5667.1-1998): *Water quality – Sampling – Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*
- Victorian Environment Protection Authority (2009) Publication IWRG701, *Sampling and Analysis of Waters, Wastewaters, Soils and Wastes.*

5.3 Safety, Health and Environment Management Plan (SHEMP)

A SHEMP will be developed for this investigation describing the health and safety arrangements for activities being undertaken by personnel. Safe work method statements (SWMSs) will be developed for the tasks considered in this SAQP and included as part of the SHEMP.

The SHEMP will be made available to all workers during work activities which will also document the managerial procedures and environmental safeguard controls associated with the fieldwork to be conducted as part of the investigation.

The SHEMP complies with the requirements of the AECOM's corporate Safety, Health, and Environment (SH&E) Policy and SH&E Management System.

The implementation of the tasks described in this SAQP must be undertaken in conjunction with the SHEMP, SWMSs and AECOM SOPs. Refer to **Appendix B** for AECOM's SOPs for sampling of sediment and surface water. Specific access requirements will be discussed with Viva Energy as part of the planning phase for the *Phase III Sediment Investigation.*

5.4 Sample Locations and Rationale

All proposed sample locations are illustrated on **Figures A1** and **A2, Appendix A**.

Table 5 provides a breakdown of the proposed sample locations, environmental media to be sampled and the justification for the proposed sample locations to inform the DSDOA.

As discussed in **Table 1**, TPH, OPPs, OCPs, and PCBs were not detected or detected very infrequently and at concentrations below DGVs during previous investigations conducted by Coffey (2020). Therefore, it is unlikely these COPCs would be encountered in future sampling and are consequently not included in this *Phase III Sediment Investigation*.

Table 5 Sample Locations and Rationale

Location / Justification	Number of Locations			Depth Interval (mbs); Collection Method	Analyte Suites					
	Sediment	Pore Water	Seawater		Total Organic Carbon (TOC)	Particle Size Distribution; Particle Density	Metals Metalloids, and Organotins	PAHs	PFAS	Ammonia
Loading Site										
To supplement the AMA (2020) and Coffey (2020) data to satisfy NAGD (2009) requirement of 28 sample locations for 490,000 m^3 of dredge material	13	-	-	0-7; Barge and drill rig	X	X	X	X	X	
	-	7	-	0-7; Extracted from sediment samples			X	X	X	X
Ambient Baseline Locations										
To satisfy NAGD (2009) requirement of ambient baseline characterisation	14[1]	-	-	0-0.5; Hand-held core collected by divers	X	X	X	X	X	
Disposal Ground										
To satisfy NAGD (2009) requirement of Disposal Ground physical characterisation, and seawater for elutriate testing	6[2]	-	-	0-0.5; Hand-held core collected by divers	X	X				
	-	-	3	Mid water column; container collected from boat			X	X	X	

[1] Based on power analysis (as per the 2009 Dredging Guidelines) and to enable transects through the disposal ground.
[2] Minimum number of locations required.

5.5 Equipment Required for Sampling

The following equipment will be used during the fieldwork. All sampling equipment, including field staff clothing will be confirmed to be free of any PFAS.

Table 6 Sampling Equipment

Equipment Item	Reason for Equipment Use
Stainless steel bowl and hand trowel	Processing split and composite samples in the field.
Brush, bucket, Liquinox™ and laboratory supplied deionised water (with laboratory certificates demonstrating it to be PFAS free)	Decontamination of bowl and trowel and any other reusable sampling equipment (do not use Decon 90 – use Liquinox™) between the collection of samples.
Zip lock bags, buckets, jerry cans, and sample jars	Storage of samples.

5.6 Sample Collection and Handling

5.6.1 Sediment and Pore Water Sampling with Barge-Mounted Drill Rig (Loading Site)

It is proposed the that sediment sampling be undertaken using a barge mounted drill rig using a combination of drill techniques as follows:

- Vibracoring (for top metre from seabed, based on techniques used during the Coffey (2020) investigation)
- Piston sampling
- Wash boring (if necessary).

The drilling methods will use continuous casing to prevent hole collapse.

Sediment cores will be recovered to the required depth or refusal. At each location, sediment samples will be collected every 0.5 m for the first 3 m and then every 1 m up to 7 mbs. Whole sediment samples will be collected through the vibracore and piston samplers.

Pore water samples will be extracted by the laboratory from composite sediment samples. Each composite sediment sample for pore water extraction will comprise approximately 5 kg of sediment from a single sample location or bore hole. If necessary, a single composite sample may contain sediment from multiple sample locations to obtain the 5 kg of sediment required by the laboratory for pore water analysis.

5.6.2 Sediment Sampling by Divers (Ambient Baseline and Disposal Ground)

It is proposed to collect samples from ambient baseline locations and the proposed Disposal Ground using a diver-assisted handheld polycarbonate corer. The depth of the cores will be targeted to 0.5 mbs.

5.6.3 Sediment Sample Handling

Sediment will be collected and handled in a manner that ensures field personnel safety, and the integrity of the sample itself. A copy of the SOP for sediment sampling is provided in **Appendix B**.

Field personnel will describe the nature of each sediment sample (sediment type, colour, staining, etc.) and log in accordance with Unified Soil Classification System (USCS).

Discrete sediment samples, i.e. from a single depth interval at a single location, will be placed in laboratory prepared containers suitable for the analytes included in the analytical suite.

Composite sediment samples will be placed into large zip lock bags or laboratory-supplied containers (made of either stainless steel or high-density polyethylene [HDPE]).

Following collection, the sample containers will then be placed directly into an insulated ice chest containing ice, for transportation to the analytical laboratories.

5.6.4 Seawater Sampling

A boat will be used to travel to the proposed Disposal Ground to collect the seawater required for elutriation testing. Seawater samples will be collected by lowering a new (and decontaminated) 10 L jerry can (made of either stainless steel or high-density polyethylene) over the side of the boat and allowing seawater to fill the jerry can. Seawater can then be transferred into laboratory provided containers using a new (and decontaminated) stainless steel or HDPE funnel. This methodology minimises the potential for cross contamination associated with use of water pumps, and the materials are suitable for PFAS sampling.

A summary of the number of samples to be collected for each media is presented in **Table 7** below.

Table 7 Number of Samples Proposed for Each Medium

Medium	Proposed No. Of Primary Samples to be Collected	Proposed No. of Primary Samples to be Analysed	Proposed No. of Duplicate Samples to be Collected	Proposed No. of Duplicate Samples to be Analysed[3]	Total Sample Numbers to be Analysed[3]
Sediment	150 Across 33 locations[1]	59[2]	15 intra-laboratory duplicates 15 inter-laboratory duplicates	6 intra-laboratory duplicates 6 inter-laboratory duplicates	71
Pore water	7	7	1 intra-laboratory duplicates 1 inter-laboratory duplicates	1 intra-laboratory duplicates 1 inter-laboratory duplicates	9
Seawater	3	3	1 intra-laboratory duplicates 1 inter-laboratory duplicates	1 intra-laboratory duplicates 1 inter-laboratory duplicates	5

Notes:
1. 13 locations at the Loading Site, samples will be collected at 0.5 m intervals until 3 mbs and every metre thereafter until 7 mbs (10 samples per location), 14 ambient baseline sediment samples from 0-0.5 mbs and 6 disposal ground sediment samples from 0-0.5 mbs.
2. Loading Site: Two (2) samples will be analysed from the top 2.5 m from each location as well as one (1) sample from depths greater than 2m. All ambient baseline (14) and disposal ground (6) sediment samples will be analysed.
3. All other primary samples will be placed on hold with the laboratory for subsequent analysis as required. Additional analysis may be requested if 'hot spots' are detected or if further characterisation is required.

5.6.5 Decontamination

Before and between sampling, reusable items such as polycarbonate corers, stainless steel bowls and hand tools used for processing split and composite samples in the field will be decontaminated using Liquinox™, a phosphate free detergent and rinsed with clean deionised water (certified by the laboratory to be PFAS-free), to reduce the potential for cross contamination.

For each day of sampling, following decontamination procedures, a rinsate blank will be collected by running laboratory prepared deionised water (certified by the laboratory to be PFAS-free) over the reusable sampling equipment for collection directly into laboratory prepared sampling containers (this is further discussed in **Section 5.10.2**).

5.6.6 Sample Handling and Transport to Laboratory

AECOM personnel will attempt to reduce potential heterogeneity in the sample media matrix by dividing the sample collected between primary and intra-laboratory jars or bottles during sampling. All samples will be placed on ice in eskies immediately after sampling.

All samples will be kept, if possible, at approximately 4°C during transit to the laboratory. Prior to sampling, assessment of the analytical holding times will be made and the sampling planned accordingly to ensure that holding times are minimised and not breached.

Samples will be transported directly to the laboratory for analytical testing under standard CoC procedures by the following laboratories:

- Sediment and seawater: primary and associated duplicate QA/QC samples will be analysed by Envirolab Services Pty Ltd (Envirolab) in Melbourne, Victoria. The inter-laboratory duplicate samples will be analysed by ALS in Melbourne, Victoria.

QA/QC sampling is discussed in **Section 5.10**.

Sample containers, volumes and holding times are presented in **Table 8**.

Table 8 Sample Containers, Sample Volumes and Sample Holding Times

Medium	Sample Type	Analysis Suite	Container Type (Preservation)	Holding Time
Sediment	Discrete; and for elutriate testing	Particle size distribution, particle density	1 kg in zip lock bag (double bagged)	None
		Metals and metalloids, TOC	3 x 250 ml glass jar	28 days
		PAH, organotins		14 days
		PFAS	250 ml plastic jar	60 days
Sediment	Composite for pore water extraction	Dissolved metals, Chelex metals, speciated arsenic, organotins, PFAS, ammonia	Approximately 5 kg of composite sediment in large zip lock bag (double bagged) or PFAS-free plastic lidded bucket	N/A
Seawater	Discrete	Total and dissolved metals	125 ml plastic bottle (nitric acid field filtered)	28 days
		Organotins	500ml amber jar with hydrochloric acid preservative	7 days
		PAHs	2 x 200 ml unpreserved amber	14 days
		PFAS (trace level)	2 x 60 ml PFAS bottle	28 days
	For elutriate analysis	Total and dissolved metals, organotins, PAH, PFAS (trace level)	10 L jerry can	7 days to 28 days

5.7 Logistics

The laboratory-supplied sample containers will be shipped from the laboratory to the AECOM office in Melbourne prior to the commencement of fieldwork. All primary samples will be transported by courier to the primary laboratory (Envirolab) at the completion of fieldwork under a CoC. All inter-laboratory duplicate samples will be couriered directly to the secondary laboratory Australian Laboratory Services Pty Ltd (ALS) under a separate CoC for analysis.

5.8 Waste Management

It is not expected that waste will be generated as part of the *Phase III Sediment Investigation* fieldworks. It is also proposed waste associated with the decontamination procedure be placed in containers, which will be transported to an established location at the Geelong Refinery for future management. It is proposed nitrile gloves and other such material that are used in sampling also be transported to the Geelong Refinery and disposed in covered skip bins for future management / disposal.

5.9 Sample Nomenclature

Table 9 outlines the sample nomenclature for each type of primary sample. In general, the identification will be the medium by sample location), followed by the depth of sample (for sediment), followed by the date in YYMMDD format.

Samples collected from the berth pocket and swing basin at the Loading Site will continue using the nomenclature established in the *Sediment Contamination Assessment* (Coffey 2020). Location numbering within the Berth Pocket will start at BH-BP-19. Location numbering within the Swing Basin will start at BH-SB-28.

Table 9 Sample Nomenclature – Primary Sampling

Sample Type	Location (example)	Example ID
Sediment	Berth Pocket: BH-BP-19	BH-BP-19_0.5-1.0_210701
	Swing Basin: BH-SB-28	BH-SB-28_0.5-1.0_210701
	Outer Harbour: BH-OH-01	BH-OH-01_0.0-0.5_210701
	Disposal Ground: BH-DG-01	BH-DG-01_0.0-0.5_210701
Pore water	Berth Pocket: PW-BP-19	PW-BP-19_210701
	Swing Basin: PW-BP-28	PW-SB-28_210701
Seawater	Disposal Ground: SW-DG-01	SW-DG-01_210701

Table 10 outlines the sample nomenclature for each type of QA/QC sample. In general, the identification will be the QC number (e.g. QC100, QC200), followed by the date in YYMMDD format.

Table 10 QA/QC Sample Nomenclature

Sample Type	QC Series	Example ID
Intra-laboratory Duplicate	QC1xx	QC100_210701
Inter-laboratory Duplicate	QC2xx	QC200_210701
Rinsate	QC3xx	QC300_210701
Trip Blank	QC4xx	QC400_210701

To ensure QA/QC sample information is correctly documented, a QA/QC Sample Register will be used to document:

- Date of sample collection
- Name of person the sample was collected by
- QA/QC sample number (e.g. QC100)
- QA/QC sample type (i.e. duplicate, inter-laboratory duplicate, rinsate, trip blank)

- Parent (or Primary) sample ID
- Sample matrix (e.g. water or sediment)
- Analysing laboratory name (e.g. Envirolab or ALS).

5.10 Quality Assurance / Quality Control Sampling

Laboratory QA/QC for each batch of samples will include a method blank and a matrix spike. Standard reference materials for use as a control matrix are not available for PFAS.

5.10.1 Field Duplicate and Inter-Laboratory Duplicate Samples

Intra-laboratory field duplicate samples will be collected at a rate of one per 10 primary samples (or a minimum of one per batch) for pore water, surface water and sediment. Inter-laboratory duplicate samples will be collected at a rate of one per 10 primary samples (or a minimum of one per batch) for the same media types.

5.10.2 Rinsate Samples

Rinsate samples are collected to assess the effectiveness of the equipment decontamination methods employed (e.g. during sediment sampling). The rinsates will be analysed for the same suite of analytes as the primary samples.

At least one rinsate sample will be collected for every ten primary samples collected in accordance with HEPA (2020) recommendations. These will include rinsate samples from the following equipment:

- Stainless steel bowls and hand tools used for processing samples
- At least one plastic lidded bucket used for 5 kg sediment samples
- Each new 10 L jerry can used to collect seawater
- Coring equipment in contact with sediment.

5.10.3 Trip Blank Samples

Laboratory prepared trip blank samples will be used at a frequency of one per day to assess sample handling and storage conditions, and the potential for field cross-contamination between samples. The trip blanks will be analysed for the same suite of analytes as the primary samples.

5.11 Fieldwork Documentation

5.11.1 Field Notes

Field notes will be maintained to record all field sampling events and include observations made at each sample location. The field notes will be summarised as an appendix to the *Phase III Sediment Investigation* report. Field notes will include information specific to the sample media as follows:

- Sediment samples –the depth of the sample collected, the water and sediment colour and odour. The sediment types observed at each sample location will be described using the USCS and compiled into a bore log for each location.
- Water samples - comments on the observed characteristics of the sample (e.g. colour, turbidity, odour, sheen) and the approximate water depth where the sample was taken will be recorded.

The GPS coordinates for each sample location will be noted. The location of quality control (e.g. duplicate and inter-laboratory duplicate) sample collection points will also be noted.

Photographs taken during fieldworks which illustrate relevant sampling and field information will be provided in the *Phase III Sediment Investigation* report.

5.11.2 Sample Labels

Sample containers will be labelled, as a minimum, with the following information:

- AECOM project number

- Name of sampler
- Sample ID
- Date of sample collection.

An indelible felt pen will be used for labelling, to ensure that the lettering is not erased during transit to the laboratory.

5.11.3 Chain of Custody Forms

A CoC form will be completed, documenting the sample identification number and analytes. The CoC documents the chain of events from sample collection to delivery at the laboratory and provides a traceable account of sample handling. The CoC form will be signed by both the sample collector and the receiving laboratory.

The CoC form will include the following information:

- AECOM project number
- Date and time of sample collection
- Sample ID
- Type of containers
- Name of sampler
- Laboratory to be used
- Analyses required
- Any comments
- Signatures of the sampler and laboratory receiver.

In the event that additional samples are collected during the field investigations due to observations made by the field team, (i.e. samples not proposed in this SAQP), Viva Energy will be provided the rationale for collection of those samples and proposed laboratory analyses. Viva Energy's approval will be sought to include these samples on the CoC and to dispatch these samples to the laboratory.

Upon receipt of the original documents accompanying the samples at the laboratory, the laboratory will provide a sample receipt document (noting the temperature of samples upon receipt, analyses required and any non-conformances) and return the signed CoC form to AECOM to confirm analyses to be performed and the due date for the analytical results.

5.11.4 Sampling Documentation

Field sampling sheets will be completed for each location, and will include the following information (as appropriate for the media being sampled):

- Name of sampler
- Sample location
- Date /time of sampling
- Prevailing weather conditions
- Sampling method
- Observations of the sampled media (as described in **Section 5.11.1**)
- Sampling photos will be collected as appropriate.

6.0 Assessment Criteria

Analytical concentrations reported for the *Phase III Sediment Investigation* will be compared against the following assessment criteria:

- Sediment quality DGV provided by ANZG (2018), as referred to in the NAGD (2009). For organic chemicals (including TBT), analytical concentrations will be normalised to 1% organic carbon. Analytical concentrations measured from the <2 mm sediment fraction of a sediment sample will be compared against the DGV.
- Marine water DGVs for 95% spp. provided by ANZG (2018), as referred to in the NAGD (2009). The 99% spp. DGVs will be adopted for those chemicals known to bioaccumulate such as PFAS.
- PFOS 95% and 99% spp. DGVs for marine sediment and pore water published by Simpson et al (2021) *Chronic effects and thresholds for estuarine and marine benthic organism exposure to perfluorooctane sulfonic acid (PFOS)-contaminated sediments: Influence of organic carbon and exposure routes*. These DGVs were derived in accordance with ANZG (2018) methodology and subject to a technical peer-review process; and therefore, in absence of DGV for PFOS in marine sediment and pore water these concentrations are considered suitable for assessment purposes in the *Phase II Sediment Investigation*. A copy of the Simpson et al (2021) publication is available at: https://www.sciencedirect.com/science/article/pii/S0048969721010755

Laboratory limits of reporting for the analyte suites have been reviewed by AECOM and are noted to be below the associated DGVs.

7.0 Reporting

The data obtained from *Phase III Sediment Investigation* fieldworks (Stage 3a) will be used to inform the *Phase III Sediment Quality Assessment* (Stage 3b) to assess the suitability of placing the dredged material at the Point Wilson Disposal Ground.

The *Phase III Sediment Quality Assessment* report will document the following:

- Scope of work completed (and any deviations from the SAQP described in **Section 5.0**)
- Field observations including photographs
- Laboratory analytical certificates
- QA/QC data assessment
- Tabulated comparison of analytical data to adopted assessment criteria (presented in **Section 6.0**)
- Bore logs
- Remaining data gaps (such as ecotoxicity testing and/or bioaccumulation analysis) and recommendations to close the data gaps (if required)
- Conclusions as to the acceptability or unacceptability of the dredge material for unconfined disposal at the Disposal Ground using existing and newly collected data

The *Phase III Sediment Quality Assessment* will be used to inform the Dredged Sediment Disposal Options Assessment report (Stage 4).

8.0 References

AMA (2020) *Targeted Sediment Investigation, Project VEGA*. 12 October 2020.

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

Blake & Ball, 2001. *Victorian Marine Habitat Database: Seagrass Mapping of Port Phillip Bay.*

Cardno (2011) *Corio Bay Safety Adjustment Program – Turbidity from Dredging*. 23 November 2011.

Carey & Watson 1993*, Benthos of the Muddy Bottom Habitat of the Geelong Arm of Port Phillip Bay, Victoria.*

Coffey (2020) *Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project*. 4 December 2020.

HEPA (2020) PFAS National Environmental Management Plan 2.0, February 2020. Heads of EPA Australian and New Zealand (HEPA).

Lucieer et al. 2017, *Seamap Australia – A national seafloor habitat classification scheme.*

NAGD (2009) *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, ACT.

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

Simpson et al (2018) *National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management.* Department of Agriculture and Water Resources, Canberra ACT. June 2018.

Simpson SL, Liu Y, Spadaro DA, Wang X, Kookana RS, Batley GE (2021) Chronic effects and thresholds for estuarine and marine benthic organism exposure to perfluorooctane sulfonic acid (PFOS)-contaminated sediments: Influence of organic carbon and exposure routes. *Science of the Total Environment*, 776: 146008.

Simpson SL, Batley GE (2016) Sediment Quality Assessment, A Practical Guide, Second Edition. CSIRO, Bangor, NSW.

URS (2014) *Sediment Investigation Sampling and Analysis - Investigation of Future Channel Improvement Options.* 18 July 2014.

The University of Melbourne (2011*) Environmental Risk Assessment for VRCA Corio Bay Channel Safety Adjustment Program*. 11 March 2011.Worley Parsons Services Pty Ltd (2011b) *Corio Bay Safety Adjustment Program – SAP Implementation Report*. 19 October 2011.

Worley Parsons Services Pty Ltd (2011a) *Corio Bay Safety Adjustment Program – Factual Report on Geotechnical Investigation*. 22 February 2011

Worley (2021a) *Viva Geelong Gas Terminal, Dredge Study Report*. 20 April 2021.

Worley (2021b) *Viva Geelong Gas Terminal, Dredging Plan Drawing.* 19 April 2021 (reference: 411010-00168-CS-DLP-0001, Rev.A).

9.0 Limitations

AECOM Australia Pty Ltd (AECOM) has prepared this Data Review and SAQP for the Viva Energy Australia in accordance with the usual care and thoroughness of the consulting profession.

The report is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this SAQP.

This Data Review and SAQP has been prepared by AECOM, an independent consultant engaged by Viva Energy, based on information and sources described in the document. The proposed scope and methodology for the Sampling Program set out in the SAQP are based on information available to AECOM at the time of writing, including publicly available information and data reports prepared for the Project.

The report is prepared in accordance with the scope of work and for the purpose outlined in the project scoping document dated 06 May 2021.

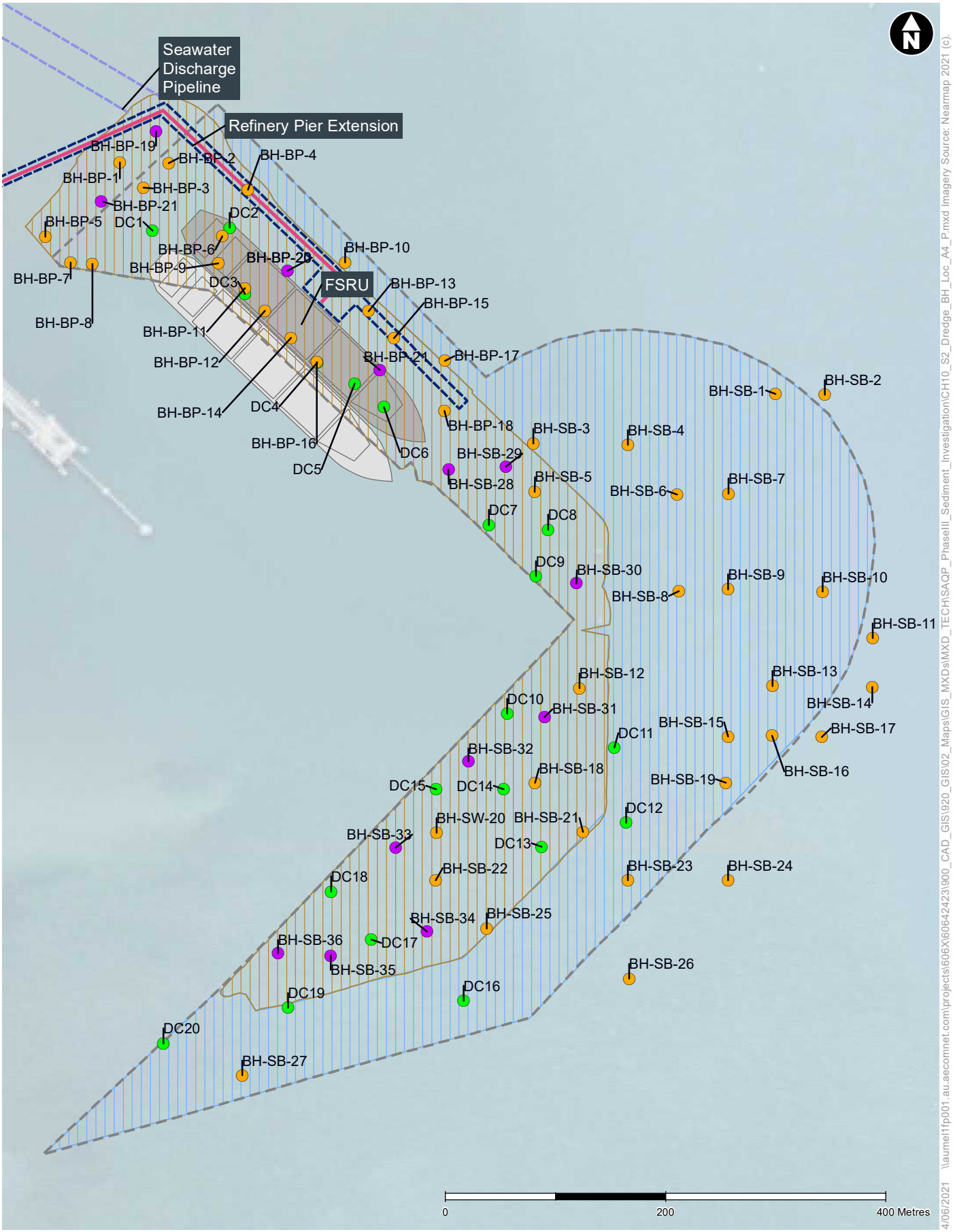
The methodology to be adopted and sources of information used by AECOM are outlined in the SAQP. Where this document indicates that information has been provided to AECOM by third parties, AECOM has verified or checked that information to the extent required for the purposes of developing this SAQP. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This SAQP was prepared between 10 May 2021 and 06 July 2021 for the Sampling Program fieldwork program to be conducted during in August to September 2021. In the event that delays in implementing this SAQP are incurred, and / or conditions change, the suitability of the scope and methodology provided in this SAQP should be reviewed.

Other than permitted disclosures by Viva Energy to State Agencies and Government Authorities for information purposes, AECOM does not represent that this SAQP is suitable for use by any third party. It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements.

Appendix A

Figures



Proposed sediment sample location (conventional COPCs and PFAS, 2021)
Sediment sample location (conventional COPC, 2020)
Sediment sample location (PFAS, 2020)
Original Dredged Area boundary
Current Dredged Area Boundary

Removed Dredged Area
Aboveground Pipeline
Seawater Discharge Pipeline
Refinery Pier Extension
Viva Energy Owned Land

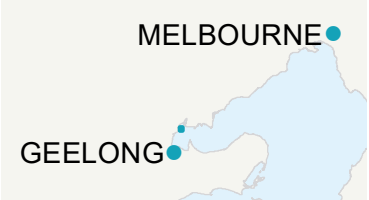
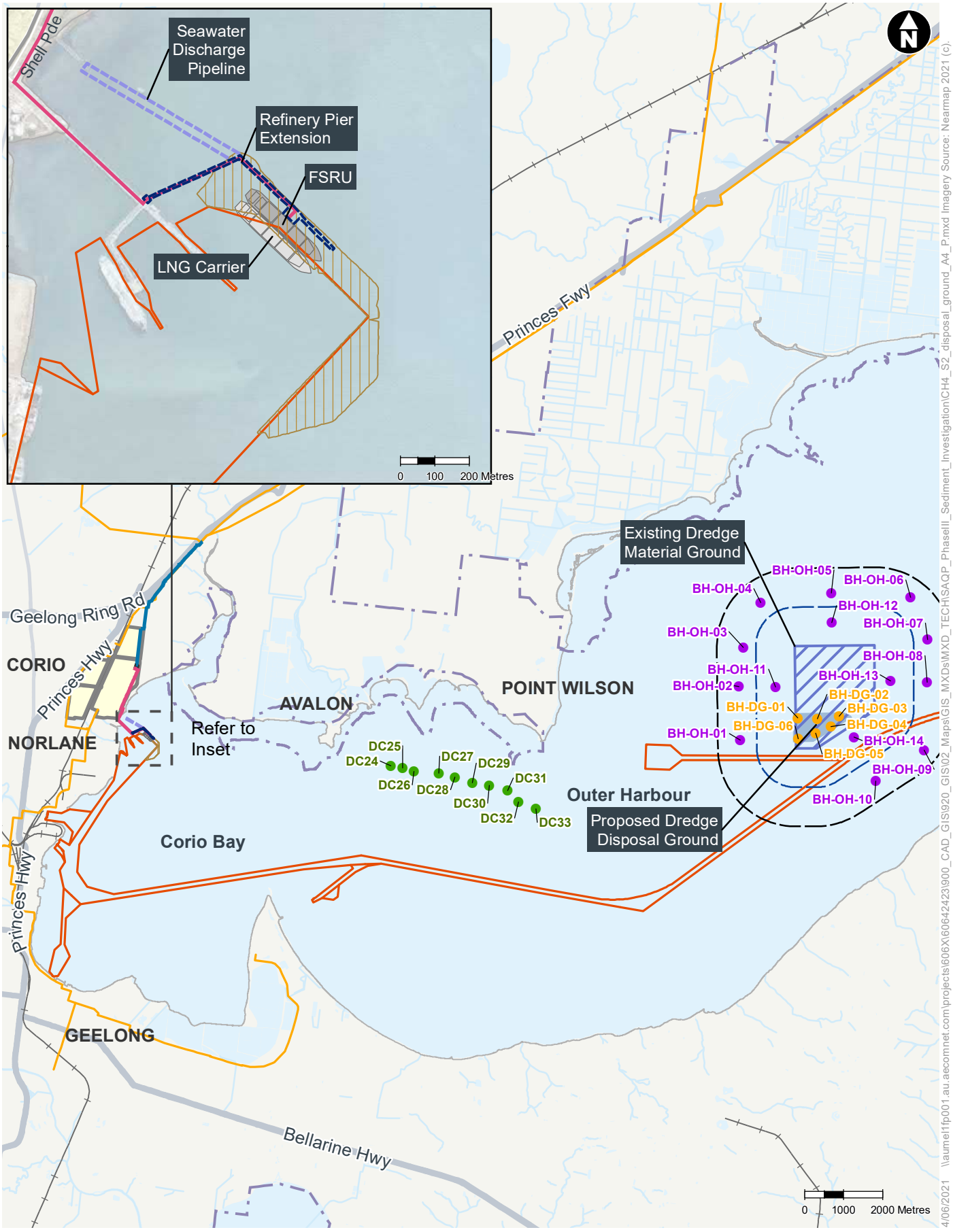


Figure A1 Loading Site Sample Locations



4/06/2021 \\aumel1fp001.au.aecomnet.com\projects\606X\60642423\900_CAD_GIS\920_GIS\02_Maps\GIS_MXDs\MXD_TECH\SAQP_PhaseII_Sediment_Investigation\CH4_S2_disposal_ground_A4_P.mxd Imagery Source: Nearmap 2021 (c).

Figure A2 Ambient Baseline and Disposal Ground Sample Locations

Appendix B

Standard Operating Procedures

ANZ

FQM - Deep Sediment Sampling – Piston Coring

Q4AN(EV)-303-PR1

1.0 Purpose and Scope

To collect accurate and representative samples of benthic sediment using a piston corer in order to determine the presence or absence of contamination.

This Field Instruction describes the methodology for the collection of sediment samples via piston coring.

2.0 References

a. National Assessment Guidelines for Dredging (2009). Commonwealth of Australia, Canberra 2009.

b. AS/NZS 5667.12:1999. Water Quality Sampling Part 12: Guidance on sampling of bottom sediments

c. Photo Ionisation Detector (PID) Q4AN(EV)-003-PR1.

d. Lower Explosive Limit (LEL) Detector Q4AN(EV)-004-PR1.

e. Soil Logging and Classification Q4AN(EV)-113-PR1.

f. Sediment Sampling Record Q4AN(EV)-301-FM1.

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this Field Instruction. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified. Any faults shall be reported to the Project Manager (PM) or the equipment supplier as soon as they are identified. The field lead is responsible for inducting all subcontractors onto AECOM' HSEP, and ensuring that they fulfil all HSE requirements.
Project Manager	The PM is responsible for using fit for purpose equipment and in developing work scope and services to be delivered to a client within the designated timeline. The PM should check (or designate another to check) to see if sampling has been undertaken at or in the vicinity of the Site in the past and to check applicable geological maps.
Office HSE Advisor	The Office Health, Safety and Environment (HSE) Advisor is an assigned person in each office and is responsible for reviewing and approving Health, Safety and Environment (HSE) Plans, monitoring the implementation of HSE Plans, interface with project managers in matters of health and safety, and investigating reports of incidents or accidents.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task include:

- Piston corer (aluminium core or polycarbonate tubing); and
- Cut resistant gloves.

4.1.1 Optional Equipment

Optional or supplemental equipment:

- Vessel or waders;
- Weighted tape measure ;
- Core catchers;
- Sample extrusion push rod;

- Personal flotation device;
- Photo Ionisation Detector (PID) and
- Lower Explosive Limit (LEL) detector.

4.1.2 Photo Ionisation Detector (PID)

Refer to Photo-Ionisation Detector (PID) Q4AN(EV)-003-PR1, for applicability, operation and calibration of a PID.

4.1.3 Lower Explosive Limit (LEL) Detector

The Lower Explosive Limit (LEL) Detector may be required when undertaking the collection of sediment samples to obtain additional field data or for health and safety requirements, i.e. required monitoring equipment in the site specific Health, Safety and Environment Plan. The use of optional equipment should be determined by the PM, PIC and/or HSE Advisor.

Refer to Lower Explosive Limit (LEL) Detector Q4AN(EV)-004-PR1, for applicability, operation and calibration of an LEL Detector.

4.2 Materials

Materials and consumables that may be required to complete this task include:

- Aluminium mixing bowl ;
- Deionised water;
- Digital Camera;
- Digital thermometer;
- Phosphate free detergent (e.g. Decon 90);
- Potable water;
- Scrubbing brush;
- Solid contaminated waste bags;
- Scrubbing brush;
- Buckets;
- Esky;
- Ice ;
- Paper towels;
- Permanent marker pens;
- Sample jars and bottles;
- Snap lock bags;
- Spray bottle for deionised water;
- Steel measuring tape; and
- White board and markers.

5.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

Any variations to this Fieldwork Instruction that are required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

5.1 General

Piston coring may be completed from a vessel or via wading into shallow waters. Selection of the most appropriate sampling method should be made during the development on the Sampling and Analysis Plan and will be dependent on water depth and sediment stability.

There are two main types of piston corers used to collect sediment samples. One corer consists of a stainless steel core barrel (usually 1.2 m in length) fixed to the push rod and the other utilises disposable polycarbonate tubing. Both corers involve the retraction of a piston in the core barrel as the core is inserted in the sediment.

5.2 Work Area Set-up

Prior to use, the work area and/or survey vessel must be thoroughly inspected and cleaned. Any evident sources of contamination (such as copper or brass, or galvanised or oily surfaces) should be cleaned, covered in plastic and taped down to avoid accidentally contaminating any sample. During sampling, the workspace area must be regularly hosed down with water to minimise contamination.

5.3 Decontamination

The decontamination process will depend on the type of piston corer being used i.e. stainless steel or polycarbonate tubes. The piston corer and/or polycarbonate tubes should be decontaminated prior to use and between collecting each sample by the following procedure.

5.4 Sampling Equipment

5.4.1 Stainless Steel Piston Corer

1. Decontaminate the piston corer and or additional equipment (core catchers, tape measure) with a scrubbing brush in a solution of potable water or seawater and detergent (phosphate free and biodegradable, e.g. Decon 90).
2. Rinse the piston corer with potable water or seawater over another bucket and collect the rinse water for later disposal as contaminated waste.
3. Rinse the piston corer with deionized water over a bucket for later disposal as contaminated waste. The deionised water should preferably be supplied by the laboratory with a batch number for traceability.
4. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the probe after rinsing or sheen in the wash solution buckets.

5.4.2 Polycarbonate Piston Corer

Note that the National Assessment Guidelines for Dredging (NAGD) (2009) requires polycarbonate core barrels to be decontaminated using dilute acid (e.g. 0.1M HCl), then rinsed with deionised water and a suitable solvent (e.g. Isopropyl alcohol) before the commencement of sampling. This should only be undertaken for investigations using polycarbonate liners and where compliance with NAGD (2009) is required.

5.5 Sediment Sampling – Piston Coring

This step provides the methodology for the sampling of sediment using a piston corer from a vessel. Piston coring via wading involves the same processes detailed below with the exception of the details relating to working from a vessel.

1. Determine the depth of water by lowering the weighted tape measure over the side of the vessel in order to determine number of extension rods that will be required to collect the sample.
2. Set up the piston corer with the required length of polycarbonate tubing (if being used) and situate the piston towards the lower 1/3 of the core barrel. Ensure there are no knots or tangles in the piston string prior to deploying.
3. Lower the piston corer over the side of the vessel adding extension rods as required. Aim to stop lowering the piston corer before it comes into contact with the sediment in order to prepare for sample collection.
4. The method of obtaining the best possible sample will differ depending on the substrate encountered during sampling however, in all cases the operator/s should attempt to keep the piston corer as vertical as possible and should pull the piston string at approximately the same rate as the corer is being lowered. This often works best with two people sampling however, vessel stability should be considered at all times.
5. When the piston corer has reached the required extent the piston string should be pulled up as tightly as possible to create suction within the core tube. Once the piston string is tight, the piston corer may be retrieved by pulling manually or using a winch or similar ensuring that the piston string is under tension at all times. Extension rods should be removed as the sample is being retrieved.
6. When the sample has been retrieved the core barrel should be laid horizontally in preparation for sample processing. If polycarbonate tubes were used, photos may be taken of the core before extruding. The method of sample extrusion will depend on the type of corer used but will generally involve the removal of the core catcher and piston and subsequent extrusion of the sample via gravity or pushing the sample with a push rod onto a clean sample processing area. Sample extrusion should be completed such that the sample integrity is maintained as undisturbed as possible.
7. Use a measuring tape to measure the whole core length and relate this to the depth the corer was extended into the sediment to determine core recovery. Note that sample may fall out of the bottom of the core barrel upon retrieval due to mixing with water.
8. The sediment profile should be logged and photographed prior to collecting samples. All sediment types, changes in colour or texture, presence and description of shell and invertebrate fragments, core loss, sediment sample intervals, PID readings etc. should be recorded on a the sediment log. Please refer to Q4AN(EV)-113-PR1 for further information as to the minimum requirements for information to be logged. Photos should include a whiteboard and measuring tape detailing the project and sample details including job number, sample ID, sample interval, date and time as a minimum.

9. Sediment samples should be collected at intervals as outlined in the sampling plan. This is usually at 0.5 m intervals down profile in sediment investigations. If insufficient sample is collected to fill the required sample jars, additional cores should be collected as close to the original sample location as practicable. The resulting sample/s should be composited in relation to their respective sample intervals. The composite samples should be thoroughly mixed in an aluminium mixing bowl in order to homogenise the sample as much as possible prior to placing into the sample container.
10. If duplicate and triplicate samples are required split the homogenised sample mass by 33:33:33 for primary, duplicate and triplicate sampling after homogenisation. An attempt to put equal quantities of sediment material into each jar should be made from each interval. Ensure the jar is completely full and cap the jar immediately to minimise volatile loss.
11. Sediment samples should be immediately sealed and labelled then packed appropriately in ice, which has been picked up prior to the sampling event, in an esky for delivery to the laboratory. A copy of the Chain of Custody (COC) should be placed in a snap lock bag and put inside the esky prior to sealing the esky. The temperature of several sediment samples should be taken using a digital thermometer for later comparison with the laboratory records. Ensure the lids of the jars are sealed tight to prevent the ingress of any water associated with melting of the ice, consider placing the jars in individual snap lock bags.
12. Care should be taken not to overfill the esky with samples as the samples will not cool sufficiently for analysis. A security seal should be applied to the esky together with the sampler's details including a job number, date sampled, sampler and phone number and details of any short holding times.
13. Excess sediment should be disposed of in the appropriate manner depending on the level of contamination. Contaminated wastes should be collected in waste drums or skips and removed from site by a licensed waste contractor. Ensure the waste drums are appropriately labelled, sealed and placed in a secure area.

6.0 Troubleshooting

I have encountered stiff clays which are difficult to sample

Review sampling technique. Vibrocoring or sonic coring may be more appropriate sample methodologies.

I am not recovering much sample

Consider using a core catcher and make sure the piston is under tension when it is being retrieved.

The piston corer is difficult to retrieve

Consider employing the use of a winch or similar.

7.0 Revision History

Revision date	Affected sections	Description of change
May 2, 2016	All	Conversion to AECOM Australia Pty Ltd.

FQM - Sediment Sampling – Vibrocore

1.0 Purpose and Scope

To collect accurate and representative site specific samples of **unconsolidated** sediment during vibrocore sampling to determine the presence or absence of contamination.

This Field Instruction describes the methodology for the collection of sediment samples during vibrocoring.

Vibrocoring can be an appropriate method in certain geologies such as unconsolidated sediment to a maximum depth of around 9 m. Vibrocoring may not be an appropriate method for all geologies or sites especially where depths beyond 9 m is required and where consolidated sediments or hard clays are likely to be encountered. A review of historical logs should be conducted prior to adopting vibrocoring as a sampling method.

Vibrocoring is a specialised sampling method and there are only a few companies that have the capabilities and previous experience in performing the sampling.

Vibrocoring can be slow when hard material is encountered, and samples may appear to expand or contract down the profile, so that shorter or longer core samples are obtained compared to the depth of penetration of the core barrel. Discussion with the operator is required to determine accurate sample intervals.

2.0 References

a. NAGD (2009) *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, 2009.

b. ANZECC/ARMCANZ 2000a, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand, October 2000.

c. ANZECC/ARMCANZ 2000b, *Australian Guidelines for Water Quality Monitoring and Reporting*. Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand, October 2000.

d. ANZECC/NHMRC 1992 *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian & New Zealand Environment & Conservation Council and National Health & Medical Research Council.

e. AS4482.1-2005 *Guide to the sampling and investigation of potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds.*

f. AS/NZS (1999): Australian/New Zealand Standard AS/NZS 5667.12:1998. *Water Quality — Sampling — Guidance on Sampling of Bottom Sediments.* Standards Australia, Homebush, NSW.

g. Photo-Ionisation Detector (PID) Q4AN(EV)-003-PR1.

h. Lower Explosive Limit (LEL) Detector Q4AN(EV)-004-PR1.

i. Logging and Classification Q4AN(EV)-113-PR1.

j. Sediment Sampling Record Q4AN(EV)-301-FM1.

3.0 Responsibilities

Role	Responsibility
Fieldwork Staff	To apply the methods detailed in this Field Instruction. To ensure equipment is in good working order prior to use, is maintained according to supplier's advice and is appropriately calibrated or verified. Any faults shall be reported to the Project Manager (PM) or the equipment supplier as soon as they are identified. The field lead is responsible for inducting all subcontractors onto URS' HSEP, and ensuring that they fulfil all HSE requirements.
Project Manager	The PM is responsible for using fit for purpose equipment and in developing work scope and services to be delivered to a client within the designated timeline. The PM should check (or designate another to check) to see if sampling has been undertaken at or in the vicinity of the Site in the past and to check applicable geological maps.
Office HSE Advisor	The Office Health, Safety and Environment (HSE) Advisor is an assigned person in each office and is responsible for reviewing and approving Health, Safety and Environment (HSE) Plans, monitoring the implementation of HSE Plans, interface with project managers in matters of health and safety, and investigating reports of incidents or accidents.
Vibrocore Operator (subcontractors)	The subcontractors engaged by URS are responsible for executing their designated roles safely, in line with the requirements of their own JSAs and the URS HSEP. The operator is responsible for maintaining and operating all equipment in a safe manner as well as ensuring that useable cores are recovered wherever possible.

4.0 Equipment and Materials

4.1 Equipment

Equipment required to complete this task includes:

- Vessel mounted vibrocore;
- Circular Saw;
- Wire Cutting Line; and
- Spatula.

A Photo Ionisation Detector (PID) and Lower Explosive Limit (LEL) detector may be required to complete this task.

4.1.1 Photo Ionisation Detector (PID)

Refer to Photo-Ionisation Detector (PID) Q4AN(EV)-003-PR1, for applicability, operation and calibration of a PID.

4.1.2 Lower Explosive Limit (LEL) Detector

The Lower Explosive Limit (LEL) Detector may be required when undertaking the collection of sediment samples to obtain additional field data or for health and safety requirements, i.e. required monitoring equipment in the site specific Health, Safety and Environment Plan. The use of optional equipment should be determined by the PM, PIC and/or HSE Advisor.

Refer to Lower Explosive Limit (LEL) Detector Q4AN(EV)-004-PR1, for applicability, operation and calibration of an LEL Detector.

4.2 Materials

Materials and consumables that may be required to complete this task include:

- Nitrile Gloves;
- Circular saw cutting blades;
- Potable water;
- Buckets;
- Phosphate free detergent (e.g. Decon 90);
- Deionised water;
- Scrubbing brush;
- Paper towel;
- Steel brush;
- Stainless steel mixing bowl;
- Hard hat (when required);
- Safety goggle and face shield
- Cut resistant gloves;
- Spray bottle for deionised water;
- Personal Flotation Device (PFD);
- Snap lock bags;
- White board and markers;
- Steel measuring tape;
- Long sleeves/legs;
- Solid contaminated waste bags;
- Alcohol wipes;
- Sample jars and bottles;
- Contaminated waste container;
- Digital Camera;
- Ice;
- Esky;
- Steel capped boots; and
- Permanent Marker Pens (thick and thin).

5.0 Fieldwork Instruction

(PRINT THIS SECTION FOR USE IN THE FIELD)

Any variations to this Fieldwork Instruction that are required to meet project specific objectives should be identified by the Project Manager prior to fieldworks and an amended uncontrolled instruction provided to fieldwork staff. Variations made in the field by fieldwork staff should be documented in the site notes and communicated to the Project Manager.

5.1 General

Work surfaces should be covered with clean plastic sheeting. When sampling, contact with zinc anodes, surfaces coated with antifouling paint, metal-containing sunscreens or engine exhausts must be rigorously avoided. Disposable nitrile gloves should be used and changed after each sample and disposed of into a designated consumable waste drum.

5.2 Survey Vessel

Prior to use, the survey vessel must be thoroughly inspected and hosed down. Any evident sources of contamination (such as copper or brass, or galvanised or oily surfaces) should be cleaned, covered in plastic and taped down to avoid accidentally contaminating any sample. During sampling, the vessel workspace area must be regularly hosed down with seawater to minimise contamination.

5.3 Decontamination

The spatula and stainless steel mixing bowl shall be decontaminated prior to use and between collecting each sample by the following procedure.

5.3.1 Sampling Equipment

1. Remove excess dirt with a stiff steel brush prior to decontamination, transferring any sediment into a waste drum for disposal.
2. Wash sampling equipment using a plastic scrubbing brush in a bucket with a solution of potable water and detergent (phosphate free and biodegradable, e.g. Decon 90).
3. Rinse the equipment with potable water over another bucket and collect the rinse water for later disposal as contaminated waste.
4. The wash solution needs to be renewed when the decontamination process becomes ineffective, e.g. product on the equipment after rinsing or sheen in the wash solution buckets.

5.3.2 Vibrocoring Equipment

All polycarbonate core liners should be decontaminated in accordance with the NAGD (2009) guidelines. Decontamination should involve rinsing with dilute acid (e.g. 0.1M HCl), deionised water, a suitable solvent (e.g. isopropyl alcohol) and finally rinsed with potable water. The liquids used for decontamination purposes should be collected in a bucket and poured into a liquid container for disposal offsite as a contaminated liquid if appropriate.

5.4 Sediment Sampling - Vibrocoring

This step provides the methodology for the sampling of sediment using vibrocoring methods.

1. Wherever possible, commence sampling from areas of least impact to greatest impact so as to reduce the effect of any potential cross–contamination that may occur between sample locations.
2. Prior to vibrocoring, ensure that Dial Before You Dig and/or Admiralty Charts have been referred to in order to minimise the potential for sub-marine service strike.
3. Set up a clear work area for the sample cores to be processed. Cores require cutting with the circular saw. Cut along the length of the core then rotate core approximately 90˚ and cut length again. Run wire cutting line from top of core to bottom to assist splitting core. Split core in two (lengthways) for sample processing. When cutting the core, use discrete step cuts, so as to avoid dragging the cutting tool through multiple strata. Ensure any cutting instruments which are re-used are decontaminated between cores.
4. Prior to sample processing the core should be photographed and logged. Rotate the two cut halves so that the cut surfaces are facing up. Logs should work down the profile (i.e. from surface to depth). A tape measure should be included in the photograph to show depth intervals.
5. Measure the whole core length, note that vibrocore can cause certain formations to compact or expand so that the length of the core obtained may not match the length of the core barrel. Similarly recovery of core may be limited by loss of sediment through the core catcher and/or displacement rather than capture of fine saturated sediments in the upper sediment profile. Communication with the operator will also allow determination of any core losses.
6. Consult the SAP to determine the sampling intervals and exactly what type and how many sub-samples are required to be collected from the sediment core. Sediment investigations frequently not only require one set of samples to be collected for screening against the sediment quality guidelines, they also require additional sets of samples for other analysis, i.e. particle size distribution, bioavailability, elutriate and ecotoxicological. Also consider QA/QC requirements, i.e. field duplicate and triplicate samples. Supplementary sediment cores may be needed to provide the volume of material required for lab testing. If this is the case, make sure samples are collected from the same sampling interval from all cores and homogenized as part of the sub-sampling process. Also, consider the need to collect an appropriate volume of seawater in appropriately cleaned containers for any elutriate testing.
7. Sub-samples must not transect different stratigraphic units as logged in the geological profile; therefore actual sampling intervals are dependent on stratigraphy encountered in the cores. A new sample should be collected at the top of every stratigraphic unit.
8. Soil samples should be collected using stainless steel spoons or nitrile gloves at the intervals specified in the work plan. Homogenised samples should be thoroughly mixed in a steel mixing bowl. If sampled lithology is loose i.e. sand, samples can be collected and homogenised by hand using fresh nitrile gloves. Homogenisation should be avoided if VOCs are part of the analytical suite. In this case, an attempt should be made to keep the sediment samples relatively undisturbed to reduce volatilization effects. Gently remove the sediments and carefully place them in the jar(s).
9. Samples must be placed in appropriately cleaned and preserved containers provided by the testing laboratory. Sample jars should be filled with zero headspace unless they are due to be frozen (for long term storage) in which case, only fill half full to allow for expansion. If the analytical suite includes ecotoxicological or acid sulfate soil testing, collect separate samples in snap-lock bags (provided by the laboratory for ecotox. testing) – the acid sulfate soil samples should be frozen ASAP to limit sample degradation. The sediment profile should be logged as sampling is occurring. All sediment types, changes in colour or texture, evidence of fill material, depths, drilling difficulty, water inflow or loss, core loss, sediment sample intervals, PID readings etc. should be recorded on the sediment core log. .
10. Sediment samples should be immediately sealed and labelled then packed appropriately in ice, which has been picked up prior to the sampling event, in an esky for delivery to the laboratory. A copy of the Chain of Custody (COC) should be placed in a snap lock bag and put inside the esky prior to sealing the esky. Ensure the lids of the jars are sealed tight to prevent the ingress of any water associated with melting of the ice, consider placing the jars in individual snap lock bags.

11. Care should be taken not to overfill the esky with samples as the samples will not cool sufficiently for analysis. A security seal should be applied to the esky together with the sampler's details including a job number, date sampled, sampler and phone number and details of any short holding times. Ensure that appropriate sample nomenclature is used to identify each sample.
12. Excess sediment should be disposed of in the appropriate manner depending on the level of contamination. Contaminated wastes should be collected in waste drums or skips and removed from site by a licensed waste contractor. Ensure the waste drums are appropriately labelled, sealed and placed in a secure area.

6.0 Troubleshooting

I have encountered large shell fragments or consolidated materials which are difficult to sample

Shell fragments or consolidated materials may inhibit the splitting of the cores using the wire cutting tool. In this case remove the top of the cut core barrel and collect the sample. Use the spatula or other tool to prise open the core, making sure that this tool is decontaminated between sample intervals.

Poor core recovery

In the event that core recovery is poor, it should be determined in consultation with the vibrocore operator where the sample loss is occurring and contingencies such as collecting a grab sample of surface sediments using a van veen grab or replacing the core catcher should be considered.

There is extensive smearing on the inside of the core barrel

Ensure that the smearing is not sampled and that the sample from the middle of the core barrel is collected for further analysis.

I can't obtain sufficient sample

Collect as much as possible, discuss the analytical requirements with the PM. Additional cores may be required which will require sample homogenisation prior to placement into sample containers.

7.0 Revision History

Revision date	Affected sections	Description of change
May 2, 2016	All	Conversion to AECOM Australia Pty Ltd.

Surface Water Sampling

1.0 Purpose

This procedure describes the methods for collecting direct or representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface. If followed properly, use of this procedure will promote consistency in each of the above areas and ensure regulatory compliance across Australia and New Zealand where best practice guidelines have been developed.

2.0 Scope

The following samplers and sampling techniques result in the collection of representative samples from the majority of surface waters and impoundments encountered.

- Kemmerer bottle
- Van Dorn sampler
- Bacon bomb sampler
- Dip Sampler
- Direct method

3.0 Health and Safety

3.1 Health and Safety Plan and Site Specific Safe Work Method Statements (SWMS) should be prepared prior to field work in accordance with the SWMS Development Procedure and in the Project Specific Health and Safety Plan Template.

3.2 When sampling from water bodies, physical hazards must be identified and adequate precautions must be taken to ensure the safety of the sampling team. The team member collecting the samples should stay away from the edge of the water body, where bank failure may cause loss of balance. When collecting samples near the edge of water bodies, personnel should wear a lifeline or use a buddy system for added safety. All sampling personnel must wear personal flotation devices (life vests). If sampling from a boat, appropriate protective measures must be identified and implemented in accordance with reviewed and approved Health and Safety Plans and Site Specific Safe Work Method Statements (SWMS).

4.0 Terms and Definitions

Morphometry: The measurement of the form characteristics, including area depth, length, width, volume, bottom gradients, of a surface water body.

Impoundments: A body of water formed by the collection or confinement of water, as if in a reservoir.

Boat wake: The visible track of turbulence left by a boat moving through water.

Substrate: Stream substrate (sediment) is the material that rests at the bottom of a stream, including mud (silt and clay), sand, granules, pebbles, cobbles and boulders.

5.0 References

5.1 SWMS Development Procedure S4AN-701-PR1

5.2 Project Specific Health and Safety Plan Template S4AN-702-TP1

6.0 Equipment

Equipment needed for collection of surface water samples may include (depending on the chosen technique):

Table 1 Surface Water Sampling Equipment

Equipment	
Kemmerer bottles	Field data sheets
Van Dorn sampler	Decontamination equipment / supplies
Bacon bomb sampler	Maps / plot plan
Dip sampler	Safety equipment
Line and messengers	GPS
Peristaltic pump	Tape measurer
Tygon tubing	Camera
0.45 micron filters	Logbook
Sample bottles / preservatives	Personal protective equipment (including personal flotation devices, as needed)
Water quality meter including calibration fluids	Ice
Chain of custody records, custody seals	Eskies, packing material
Long water quality cables may be required if stratification is being measured	

7.0 Best Practice Guidelines

A number of guidelines have been developed across the ANZ region outlining best practice methods for surface water sampling. Consideration of these must be made when designing and implementing surface water sampling within the ANZ region. Key documents noted include those detailed in Table 2 below:

Table 2 Best Practice Guideline References

Level	Reference
National / Federal	ANZ Standard 5667.1:1998 Part 1: *Guidance on the design of sampling programmes, sampling techniques and the preservation and handling of samples*
	ANZ Standard 5667.4.1998 Part 4: *Guidance on sampling from lakes, natural and man-made.*
	ANZ Standard 5667.6.1998 Part 6: *Guidance on sampling rivers and streams*
	ANZ Standard 5667.9.1998 Part 9; *Guidance on sampling marine waters*
State – Western Australia	Government of Western Australia Department of Water: *Surface Water Sampling Methods and analysis – Technical Approaches. Standard operating procedures for water sampling – methods and analysis. January 2009.*

It should also be noted that specific guidance documents or advisory notes for surface water sampling may also exist across ANZ and state to state for specific industries. For instance in the Northern Territories (NT) the Department of Mines and Energy have provided an advisory note outlining good practice for sampling of surface waters at mine sites in the NT.

8.0 Procedure

8.1 Planning

The extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed should be outlines in the project-specific sampling plan. Sampling and monitoring equipment should be properly decontaminated prior to initial use, between sampling locations, and following completion of the sampling event. General locations for sampling should be marked or identified on a site map with a geo-reference to landmarks/topography, GPS coordinates or measured from a fixed feature. If required, the proposed locations may be adjusted based on site

access, property boundaries, and obstructions. Final sample locations should be documented using topographic maps/ site plans or a GPS unit to identify and record sample location coordinates.

8.2 Sampling Considerations

In order to collect a representative sample, the hydrology and morphometry of a stream, river, pond, lake or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths. Water quality data should be collected in ponds, lakes and impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, conductivity, oxidation-potential, temperature and turbidity can indicate if strata exist that would affect analytical results. Measurements should be collected at one-meter intervals from the surface to the bottom using the appropriate instrument.

These water quality measurements can assist in the interpretation of analytical data, and the selection of sampling sites and depths when surface water samples are collected. Factors that contribute to the selection of a sampling device used for sampling surface waters in streams, rivers, lakes, ponds, lagoons, and surface impoundments include:

- width, depth, flow and accessibility of the location being sampled; and,
- whether the sample will be collected onshore or offshore.

The appropriate sampling device must be of a proper composition. Selection of samplers constructed of glass, stainless steel, polyvinyl chloride (PVC) or PTFE (Teflon®) should be based upon the suspected contaminants and the analyses to be performed.

8.3 Sample Collection

8.3.1 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples directly into the sample container(s). Health and safety considerations must be addressed when sampling lagoons or other impoundments where specific conditions may exist that warrant the use of additional safety equipment. Using adequate protective clothing, access the sampling station by appropriate means.

For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector. When possible, collect samples in a downstream to upstream direction and avoid disturbing the substrate beneath the water.

For lakes and other impoundments, collect the sample under the water surface (10 to 20 cm) while avoiding surface debris or boat wake.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation. Use a non preserved bottle, rinse it three times with the surface water, collect the sample, then transfer the surface water to the appropriately preserved bottles. Details of suitable preservatives and bottles

8.3.2 Kemmerer Bottles

A Kemmerer bottle may be used in most situations where site access is from a boat or structure, such as a bridge or pier, and where samples at specific depths are required. Sampling procedures are as follows:

a) Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the upper and lower stoppers are pulled away from the body, allowing the surface water to enter tube.
b) Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.
c) When the Kemmerer bottle is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.
d) Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfil analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

8.3.3 Van Dorn Sampler

A Van Dorn sampler is used to collect a surface water sample from a specific sampling depth or from a shallow water body. Since the sampler is suspended horizontally, the depth interval sampled is the diameter of the sampling tube. The sampling procedure is as follows:

a) Use a properly decontaminated Van Dorn sampler. Set the device so that the end stoppers are pulled away from the body allowing surface water to enter the tube.
b) Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.
c) When the Van Dorn is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.
d) Retrieve the sampler and discharge the first 10-20 mL from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfil analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

8.3.4 Bacon Bomb Sampler

A bacon bomb sampler may be used in situations similar to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

a) Lower the bacon bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut. This will allow the sampler to fill.
b) Release the trigger line and retrieve the sampler.
c) Discharge the first 10-20 mL from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfil analytical requirements.

8.3.5 Dip Sampler

A dip sampler is useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

a) Assemble the device following manufacturer's instructions.
b) Collect the sample by dipping the sampler into the water.
c) Transfer the sample to the appropriate sample container(s).

8.4 Sample Preservation, Containers, Handling and Storage

Once samples have been collected, the following procedures should be followed:

- Transfer the sample(s) into suitable, labelled sample containers specific for the analyses to be performed.
- Measure field parameters with a calibrated water quality meter.
- Filter the sample on site if required (for example, as is required for dissolved metals analysis).
- Preserve the sample, if appropriate. Do not overfill bottles if they are pre-preserved.
- Cap the container securely, place in a resealable plastic bag, and cool to 4°C.
- Record all pertinent data in the site logbook and/or on field data sheets.
- Complete the Chain of Custody record.
- Attach custody seals to esky prior to shipment.
- Decontaminate all non-dedicated sampling equipment prior to the collection of additional samples.

9.0 Records

The following records will be maintained:

9.1 sample collection records, including a record of the surface water sampling locations on a site map with a geo-reference to landmarks/topography, GPS coordinates, or measured from a fixed feature;

9.2 field notebook;

9.3 chain-of-custody forms; and,

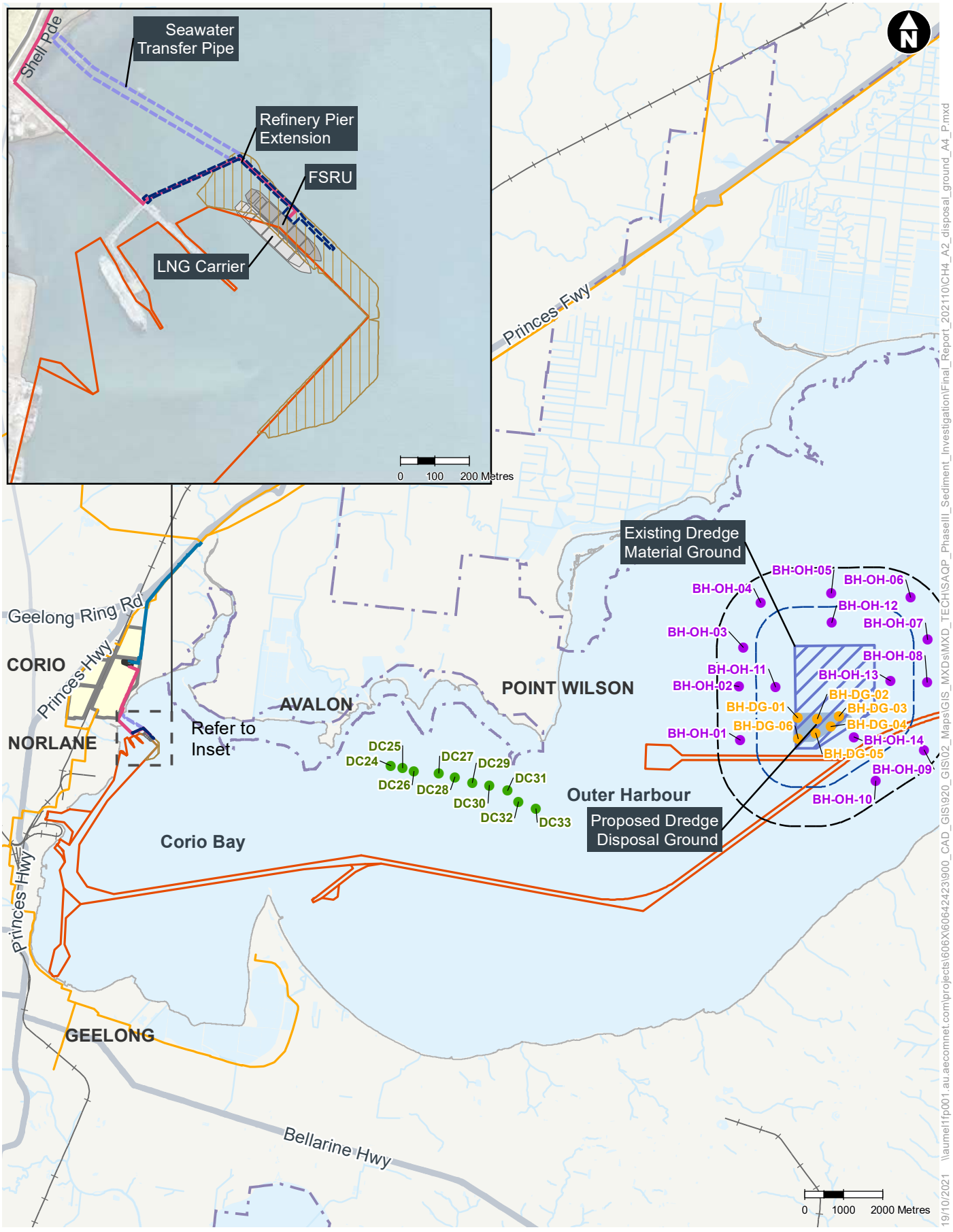
9.4 shipping receipts.

All documentation will be placed in the project files and retained following completion of the project

Appendix B

Figures

AECOM GIS Printed Date: 19/10/2021 \\aumel1fp001.au.aecomnet.com\projects\606X\60644243\900_CAD_GIS\920_GIS\02_Maps\GIS_MXDs\MXD_SINGLEPrjDesc\CH1_S1_Prj_Overview_A4_P_Inset.mxd Imagery Source: Nearmap 2021 (c)


Seawater Transfer Pipe
Shell Pde
Refinery Pier Extension
FSRU
LNG Carrier
0 100 200 Metres
N
Princes Fwy
Existing Dredge Material Ground
BH-OH-05
BH-OH-06
BH-OH-04
BH-OH-12
BH-OH-07
BH-OH-03
BH-OH-08
BH-OH-11
BH-OH-13
BH-OH-02
BH-DG-02
BH-DG-01
BH-DG-03
BH-DG-06
BH-DG-04
BH-OH-01
BH-OH-14
BH-DG-05
BH-OH-09
BH-OH-10
Geelong Ring Rd
CORIO
Princes Hwy
NORLANE
Refer to Inset
AVALON
POINT WILSON
DC25
DC24
DC27
DC29
DC26
DC28
DC31
DC30
DC32
DC33
Outer Harbour
Proposed Dredge Disposal Ground
Corio Bay
Princes Hwy
GEELONG
Bellarine Hwy
0 1000 2000 Metres
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Ambient baseline sediment sample location (conventional COPCs and PFAS, 2021)
Disposal ground sediment sample location (physical characteristics)
Background sediment sample location (PFAS, 2020)
Aboveground Pipeline
Underground Pipeline
Shipping Channel
South West Pipeline
1 km Buffer
2 km Buffer
Dredged Area
Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site
Viva Energy Owned Land
MELBOURNE
GEELONG

AECOM Sediment sample location (conventional COPCs and PFAS, 2021)
Sediment sample location (conventional COPC, 2020)
Sediment sample location (PFAS, 2020)
AECOM Sediment sample location (Landside)
Original Dredged Area boundary
Current Dredged Area Boundary

Removed Dredged Area
Aboveground Pipeline
Seawater Transfer Piping
Refinery Pier Extension
Viva Energy Owned Land

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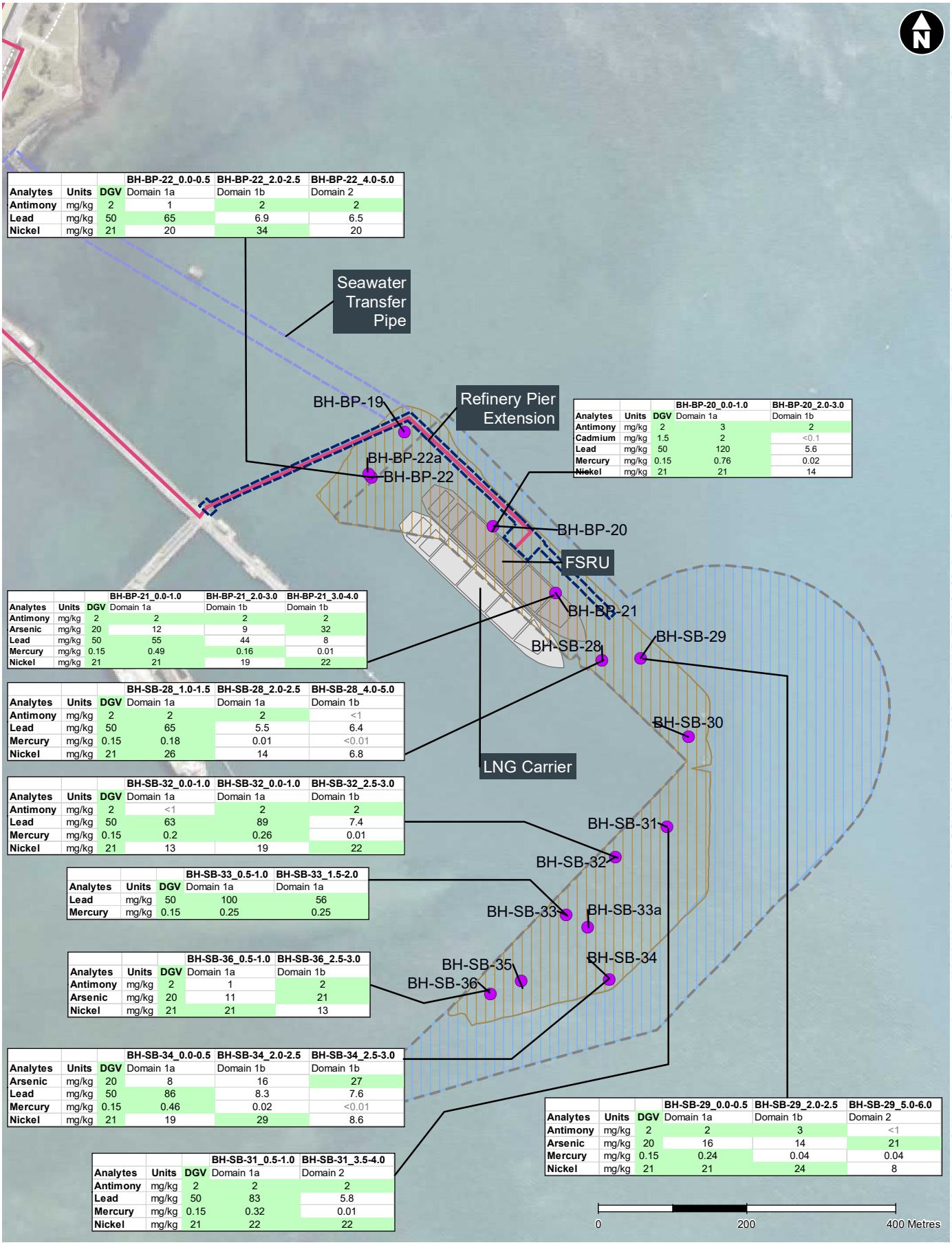

Analytes	Units	DGV	BH-BP-22_0.0-0.5 Domain 1a	BH-BP-22_2.0-2.5 Domain 1b	BH-BP-22_4.0-5.0 Domain 2
Antimony	mg/kg	2	1	2	2
Lead	mg/kg	50	65	6.9	6.5
Nickel	mg/kg	21	20	34	20

Analytes	Units	DGV	BH-BP-20_0.0-1.0 Domain 1a	BH-BP-20_2.0-3.0 Domain 1b
Antimony	mg/kg	2	3	2
Cadmium	mg/kg	1.5	2	<0.1
Lead	mg/kg	50	120	5.6
Mercury	mg/kg	0.15	0.76	0.02
Nickel	mg/kg	21	21	14

Analytes	Units	DGV	BH-BP-21_0.0-1.0 Domain 1a	BH-BP-21_2.0-3.0 Domain 1b	BH-BP-21_3.0-4.0 Domain 1b
Antimony	mg/kg	2	2	2	2
Arsenic	mg/kg	20	12	9	32
Lead	mg/kg	50	55	44	8
Mercury	mg/kg	0.15	0.49	0.16	0.01
Nickel	mg/kg	21	21	19	22

Analytes	Units	DGV	BH-SB-28_1.0-1.5 Domain 1a	BH-SB-28_2.0-2.5 Domain 1a	BH-SB-28_4.0-5.0 Domain 1b
Antimony	mg/kg	2	2	2	<1
Lead	mg/kg	50	65	5.5	6.4
Mercury	mg/kg	0.15	0.18	0.01	<0.01
Nickel	mg/kg	21	26	14	6.8

Analytes	Units	DGV	BH-SB-32_0.0-1.0 Domain 1a	BH-SB-32_0.0-1.0 Domain 1a	BH-SB-32_2.5-3.0 Domain 1b
Antimony	mg/kg	2	<1	2	2
Lead	mg/kg	50	63	89	7.4
Mercury	mg/kg	0.15	0.2	0.26	0.01
Nickel	mg/kg	21	13	19	22

Analytes	Units	DGV	BH-SB-33_0.5-1.0 Domain 1a	BH-SB-33_1.5-2.0 Domain 1a
Lead	mg/kg	50	100	56
Mercury	mg/kg	0.15	0.25	0.25

Analytes	Units	DGV	BH-SB-36_0.5-1.0 Domain 1a	BH-SB-36_2.5-3.0 Domain 1b
Antimony	mg/kg	2	1	2
Arsenic	mg/kg	20	11	21
Nickel	mg/kg	21	21	13

Analytes	Units	DGV	BH-SB-34_0.0-0.5 Domain 1a	BH-SB-34_2.0-2.5 Domain 1b	BH-SB-34_2.5-3.0 Domain 1b
Arsenic	mg/kg	20	8	16	27
Lead	mg/kg	50	86	8.3	7.6
Mercury	mg/kg	0.15	0.46	0.02	<0.01
Nickel	mg/kg	21	19	29	8.6

Analytes	Units	DGV	BH-SB-31_0.5-1.0 Domain 1a	BH-SB-31_3.5-4.0 Domain 2
Antimony	mg/kg	2	2	2
Lead	mg/kg	50	83	5.8
Mercury	mg/kg	0.15	0.32	0.01
Nickel	mg/kg	21	22	22

Analytes	Units	DGV	BH-SB-29_0.0-0.5 Domain 1a	BH-SB-29_2.0-2.5 Domain 1b	BH-SB-29_5.0-6.0 Domain 2
Antimony	mg/kg	2	2	3	<1
Arsenic	mg/kg	20	16	14	21
Mercury	mg/kg	0.15	0.24	0.04	0.04
Nickel	mg/kg	21	21	24	8

AECOM Sediment sample location (conventional COPCs and PFAS, 2021)
Original Dredged Area boundary
Current Dredged Area Boundary
Removed Dredged Area
Aboveground Pipeline
Seawater Transfer Piping
Refinery Pier Extension
Viva Energy Owned Land

DGV: Default Guideline Value

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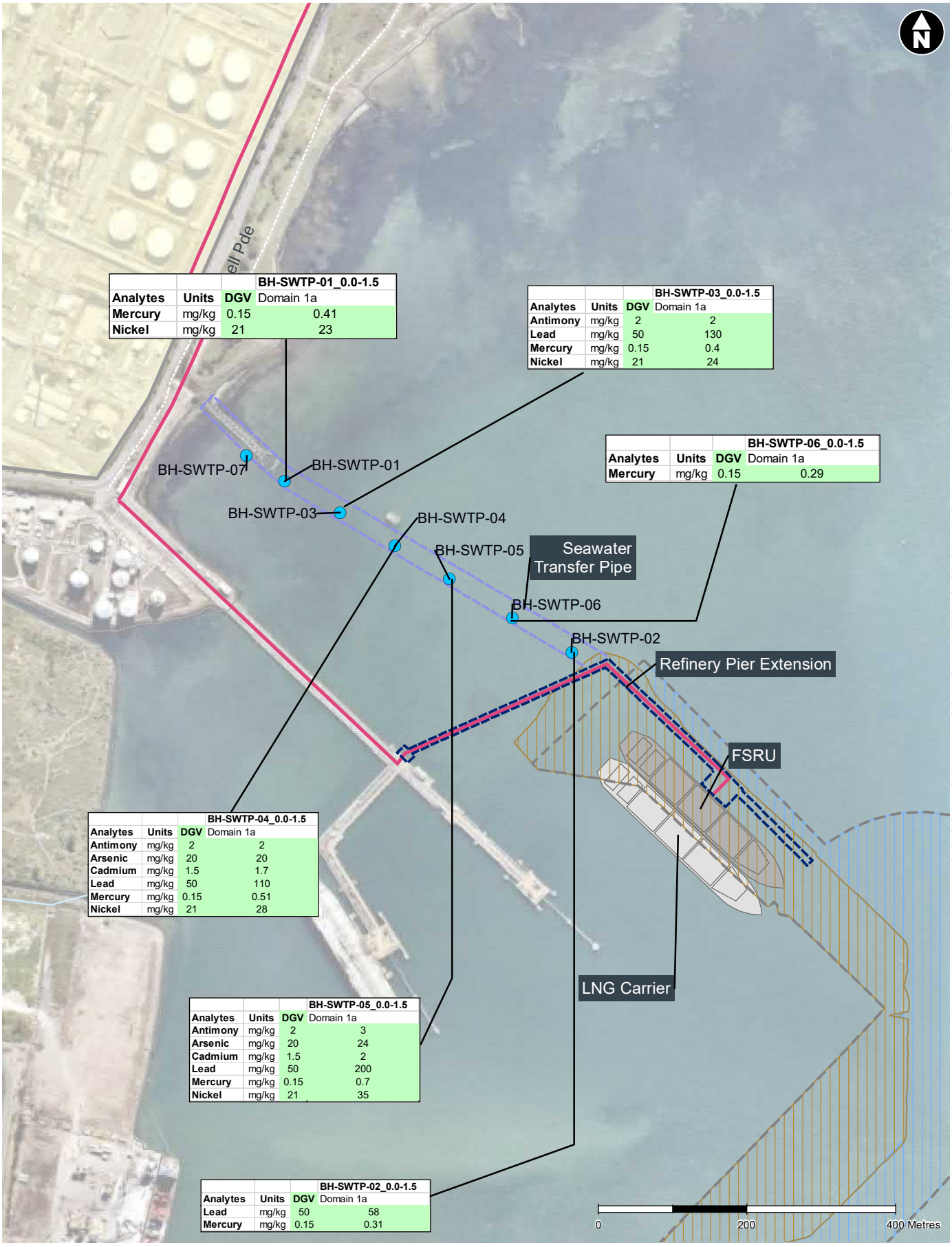
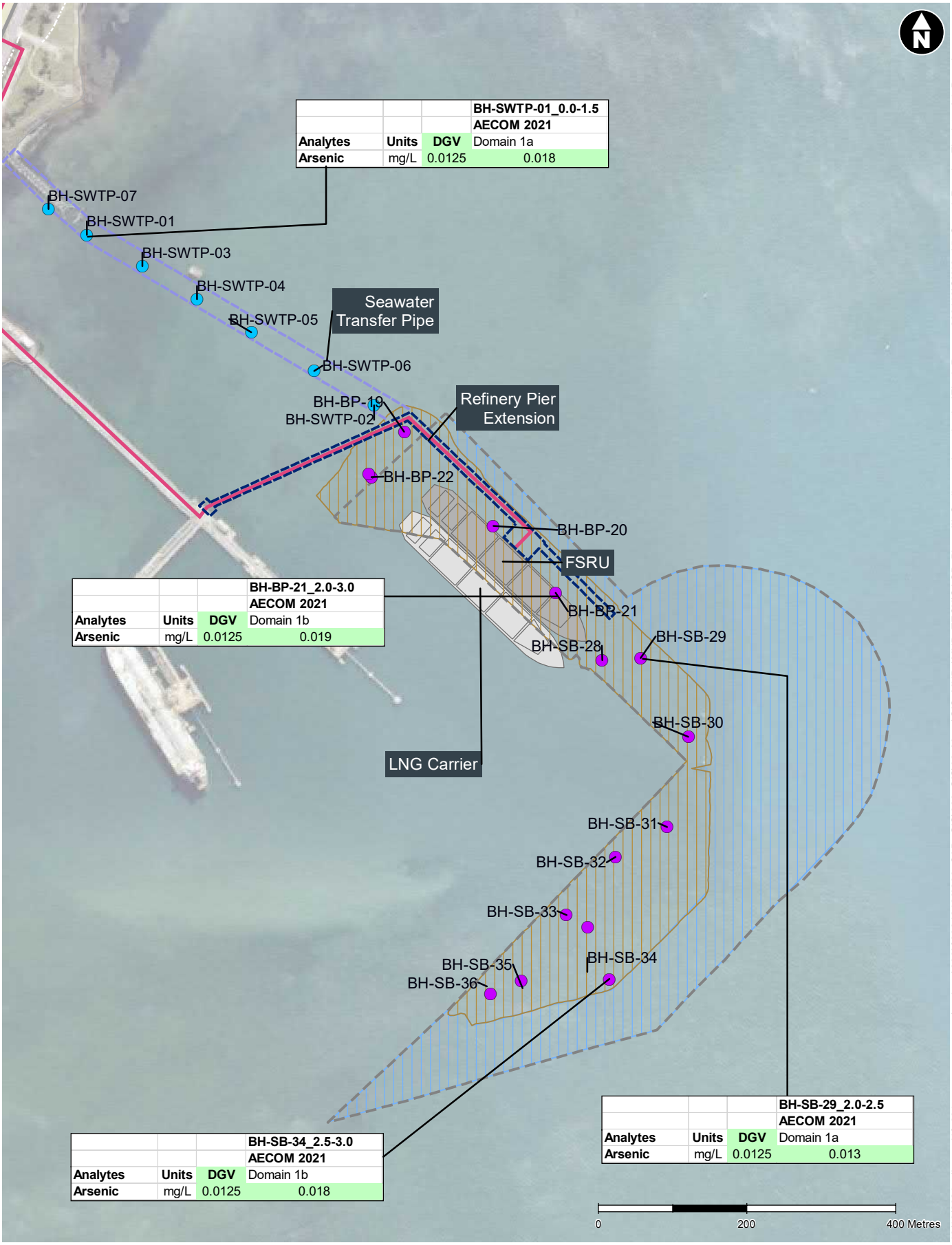

BH-SWTP-01_0.0-1.5
Analytes | Units | DGV | Domain 1a
Mercury | mg/kg | 0.15 | 0.41
Nickel | mg/kg | 21 | 23
BH-SWTP-03_0.0-1.5
Analytes | Units | DGV | Domain 1a
Antimony | mg/kg | 2 | 2
Lead | mg/kg | 50 | 130
Mercury | mg/kg | 0.15 | 0.4
Nickel | mg/kg | 21 | 24
BH-SWTP-06_0.0-1.5
Analytes | Units | DGV | Domain 1a
Mercury | mg/kg | 0.15 | 0.29
BH-SWTP-04_0.0-1.5
Analytes | Units | DGV | Domain 1a
Antimony | mg/kg | 2 | 2
Arsenic | mg/kg | 20 | 20
Cadmium | mg/kg | 1.5 | 1.7
Lead | mg/kg | 50 | 110
Mercury | mg/kg | 0.15 | 0.51
Nickel | mg/kg | 21 | 28
BH-SWTP-05_0.0-1.5
Analytes | Units | DGV | Domain 1a
Antimony | mg/kg | 2 | 3
Arsenic | mg/kg | 20 | 24
Cadmium | mg/kg | 1.5 | 2
Lead | mg/kg | 50 | 200
Mercury | mg/kg | 0.15 | 0.7
Nickel | mg/kg | 21 | 35
BH-SWTP-02_0.0-1.5
Analytes | Units | DGV | Domain 1a
Lead | mg/kg | 50 | 58
Mercury | mg/kg | 0.15 | 0.31
BH-SWTP-07
BH-SWTP-01
BH-SWTP-03
BH-SWTP-04
BH-SWTP-05
BH-SWTP-06
BH-SWTP-02
Seawater Transfer Pipe
Refinery Pier Extension
FSRU
LNG Carrier
0
200
400 Metres
AECOM Sediment sample location (Landside)
Original Dredged Area boundary
Current Dredged Area Boundary
Removed Dredged Area
Aboveground Pipeline
Seawater Transfer Piping
Refinery Pier Extension
Viva Energy Owned Land
DGV: Default Guideline Value
MELBOURNE
GEELONG
19/10/2021 \\aumel1fp001.au.aecomnet.com\projects\606X\60642423\900_CAD_GIS\920_GIS\02_Maps\GIS_MXDs\MXD_TECH\SAQP_PhaseIII_Sediment_Investigation\Final_Report_202110\CH10_A4_SampleResults_SWTP_A4_P.mxd



AECOM Sediment sample location (conventional COPCs and PFAS, 2021)
AECOM Sediment sample location (Landside)
Original Dredged Area boundary
Current Dredged Area Boundary
Removed Dredged Area
Aboveground Pipeline
Seawater Discharge Pipeline
Refinery Pier Extension
Viva Energy Owned Land

DGV: Default Guideline Value

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Appendix C

Tables

Table 1 - Sediment Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

AECOM

								Organotin Compounds																
								Monobutyltin	Dibutyltin as Sn	Tributyltin (as Sn)	Sum (PFHxS + PFOS)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonic acid (PFOS) (1% TOC normalised)	Perfluorodecane sulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)
								µg/kg	µg/kg	µg/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	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
Guideline Values (GVs) - High										**70**														
Default Guideline Values (DGVs)										9							0.06[#2]							
Location Code	**Sampled**	**Depth**	**Field ID**	**Sample**	**Lab Report**	**Area**	**Domain**																	
BH-BP-19	26/08/2021	0.5-1	BH-BP-19_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	<3.3	<2.6	<2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-BP-19	26/08/2021	1.5-2	BH-BP-19_1.5-2.0	Sediment	276673	Loading Site	Domain 1a	<3.3	<2.6	<2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-BP-20	1/09/2021	0-1	BH-BP-20_0.0-1.0	Sediment	277161	Loading Site	Domain 1a	<6.7	<4.1	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-BP-21	1/09/2021	0-1	BH-BP-21_0.0-1.0	Sediment	277161	Loading Site	Domain 1a	<3.7	<3.7	<1	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00018	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-BP-22	8/09/2021	0-0.5	BH-BP-22_0.0-0.5	Sediment	277707	Loading Site	Domain 1a	<1.3	<1.5	<1	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-28	6/09/2021	1-1.5	BH-SB-28_1.0-1.5	Sediment	277486	Loading Site	Domain 1a	<1.7	<1.3	<1	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-28	6/09/2021	2-2.5	BH-SB-28_2.0-2.5	Sediment	277486	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-29	6/09/2021	0-0.5	BH-SB-29_0.0-0.5	Sediment	277486	Loading Site	Domain 1a	<4.8	<3.3	<1	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0004	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-30	27/08/2021	0.5-1	BH-SB-30_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	<3.3	<2.6	<2	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.0005	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-31	27/08/2021	0.5-1	BH-SB-31_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	<3.3	<2.6	<2	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.00017	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-32	30/08/2021	0-1	BH-SB-32_0.0-1.0	Sediment	276959	Loading Site	Domain 1a	<1.7	<1.3	<1	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00018	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-32	30/08/2021	0-1	QC108_210830	Duplicate	276959	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-32	30/08/2021	0-1	QC208_210830	Interlab	EM2117375	Loading Site	Domain 1a	<1	<1	<0.5	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
BH-SB-33	30/08/2021	0.5-1	BH-SB-33_0.5-1.0	Sediment	277569	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-33	30/08/2021	1.5-2	BH-SB-33_1.5-2.0	Sediment	276959	Loading Site	Domain 1a	<2.7	<3	<1	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.00014	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-33	30/08/2021	1.5-2	QC107_210830	Duplicate	276959	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-33	30/08/2021	1.5-2	QC207_210830	Interlab	EM2117375	Loading Site	Domain 1a	<1	<1	<0.5	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
BH-SB-34	7/09/2021	0-0.5	BH-SB-34_0.0-0.5	Sediment	277569	Loading Site	Domain 1a	<1.7	<2.3	<1	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	0.00045	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-35	7/09/2021	1-1.5	BH-SB-35_1.0-1.5	Sediment	277569	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-35	7/09/2021	2-2.5	BH-SB-35_2.0-2.5	Sediment	277569	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-36	8/09/2021	0.5-1	BH-SB-36_0.5-1.0	Sediment	277707	Loading Site	Domain 1a	<3.3	<3.1	<1.2	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00027	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SB-36	8/09/2021	1.5-2	BH-SB-36_1.5-2.0	Sediment	277707	Loading Site	Domain 1a	<1.7	<1.3	<1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-01	7/09/2021	0-1.5	BH-SWTP-01_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<4.5	<2.2	<1	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	0.00031	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-02	7/09/2021	0-1.5	BH-SWTP-02_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<4.9	<2.6	<1	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.00040	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-02	7/09/2021	0-1.5	QC115_210907	Duplicate	277569	Loading Site	Domain 1a	<2.4	<3.2	<1	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	0.00025	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-02	7/09/2021	0-1.5	QC215_210907	Interlab_D	EM2117925	Loading Site	Domain 1a	<1	-	-	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	0.00023	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
BH-SWTP-03	7/09/2021	0-1.5	BH-SWTP-03_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<7.5	<5.7	<1.3	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00023	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-04	7/09/2021	0-1.5	BH-SWTP-04_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<1.9	<1.3	<1	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	0.00021	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-05	7/09/2021	0-1.5	BH-SWTP-05_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<14	<2.9	<1	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00017	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-06	7/09/2021	0-1.5	BH-SWTP-06_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<5.7	<4.5	<1	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.0006	0.00032	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
BH-SWTP-07	7/09/2021	0-1.5	BH-SWTP-07_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	<1.7	<1.3	<1	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.00013	<0.0002	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001

Data Comments

#1 Recovery not available. Please see the PDF report for details
#2: PC99% for sediments and pore water (Simpson et al 2021).
#3: The DGV and GVs for total PAHs include the 18 parent PAHs naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene
NE: Not established

Table 1 - Sediment Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

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Per- and Poly-fluoroalkyl Substances

						Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	Perfluorooctane sulfonamide (FOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	Sum of PFAS
						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						0.0005	0.0005	0.0005	0.0005	0.005	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.001	0.001	0.001	0.005	0.001	0.0001
Guideline Values (GVs) - High																						
Default Guideline Values (DGVs)																						
Location Code	**Sampled**	**Depth**	**Field ID**	**Sample**	**Lab Report**																	
BH-BP-19	26/08/2021	0.5-1	BH-BP-19_0.5-1.0	Sediment	276673	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-BP-19	26/08/2021	1.5-2	BH-BP-19_1.5-2.0	Sediment	276673	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-BP-20	1/09/2021	0-1	BH-BP-20_0.0-1.0	Sediment	277161	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-BP-21	1/09/2021	0-1	BH-BP-21_0.0-1.0	Sediment	277161	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-BP-22	8/09/2021	0-0.5	BH-BP-22_0.0-0.5	Sediment	277707	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0002
BH-SB-28	6/09/2021	1-1.5	BH-SB-28_1.0-1.5	Sediment	277486	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0002
BH-SB-28	6/09/2021	2-2.5	BH-SB-28_2.0-2.5	Sediment	277486	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-29	6/09/2021	0-0.5	BH-SB-29_0.0-0.5	Sediment	277486	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-SB-30	27/08/2021	0.5-1	BH-SB-30_0.5-1.0	Sediment	276673	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0006
BH-SB-31	27/08/2021	0.5-1	BH-SB-31_0.5-1.0	Sediment	276673	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0002
BH-SB-32	30/08/2021	0-1	BH-SB-32_0.0-1.0	Sediment	276959	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-SB-32	30/08/2021	0-1	QC108_210830	Duplicate	276959	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-32	30/08/2021	0-1	QC208_210830	Interlab	EM2117375	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
BH-SB-33	30/08/2021	0.5-1	BH-SB-33_0.5-1.0	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-33	30/08/2021	1.5-2	BH-SB-33_1.5-2.0	Sediment	276959	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0001
BH-SB-33	30/08/2021	1.5-2	QC107_210830	Duplicate	276959	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-33	30/08/2021	1.5-2	QC207_210830	Interlab	EM2117375	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002
BH-SB-34	7/09/2021	0-0.5	BH-SB-34_0.0-0.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0005
BH-SB-35	7/09/2021	1-1.5	BH-SB-35_1.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-35	7/09/2021	2-2.5	BH-SB-35_2.0-2.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SB-36	8/09/2021	0.5-1	BH-SB-36_0.5-1.0	Sediment	277707	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-SB-36	8/09/2021	1.5-2	BH-SB-36_1.5-2.0	Sediment	277707	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	<0.0001
BH-SWTP-01	7/09/2021	0-1.5	BH-SWTP-01_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0005
BH-SWTP-02	7/09/2021	0-1.5	BH-SWTP-02_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0006
BH-SWTP-02	7/09/2021	0-1.5	QC115_210907	Duplicate	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0005
BH-SWTP-02	7/09/2021	0-1.5	QC215_210907	Interlab_D	EM2117925	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0003
BH-SWTP-03	7/09/2021	0-1.5	BH-SWTP-03_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-SWTP-04	7/09/2021	0-1.5	BH-SWTP-04_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0004
BH-SWTP-05	7/09/2021	0-1.5	BH-SWTP-05_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003
BH-SWTP-06	7/09/2021	0-1.5	BH-SWTP-06_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0006
BH-SWTP-07	7/09/2021	0-1.5	BH-SWTP-07_0.0-1.5	Sediment	277569	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.0001	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.005	<0.001	0.0003

Data Comments

#1 Recovery not available. Please see the PDF report for details
#2: PC99% for sediments and pore water (Simpson et al 2021).
#3: The DGV and GVs for total PAHs include the 18 parent PAHs naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene
NE: Not established

Table 1 - Sediment Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

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						Polycyclic Aromatic Hydrocarbons																						
						Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ calc(PQL)	Benzo(a)pyrene TEQ calc (Zero)	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Anthracene	Fluorene	Phenanthrene	Fluoranthene	Benz(a)anthracene	Benzo(k)fluoranthene	Benzo(b&j)fluoranthene	Benzo(b+j) & Benzo(k)fluoranthene	Benzo(a)pyrene	Benzo(e)pyrene	Chrysene	Pyrene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Coronene	Perylene	Sum of PAHs
						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						0.5	0.5	0.5	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.5	0.5	0.01	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.5
Guideline Values (GVs) - High																								NE					**50[#3]**
Default Guideline Values (DGVs)																								NE					10
Location Code	**Sampled**	**Depth**	**Field ID**	**Sample**	**Lab Report**																								
BH-BP-19	26/08/2021	0.5-1	BH-BP-19_0.5-1.0	Sediment	276673	-	-	-	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-BP-19	26/08/2021	1.5-2	BH-BP-19_1.5-2.0	Sediment	276673	-	-	-	<0.005	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-BP-20	1/09/2021	0-1	BH-BP-20_0.0-1.0	Sediment	277161	-	-	-	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	0.02	0.05	0.03	-	-	0.08	0.058	0.031	0.02	0.054	0.03	<0.006	0.03	0.008	0.007	0.324
BH-BP-21	1/09/2021	0-1	BH-BP-21_0.0-1.0	Sediment	277161	-	-	-	0.005	<0.005	<0.005	<0.005	0.009	<0.005	0.03	0.06	0.03	-	-	0.11	0.085	0.059	0.03	0.064	0.055	<0.01	0.053	0.014	0.015	0.485
BH-BP-22	8/09/2021	0-0.5	BH-BP-22_0.0-0.5	Sediment	277707	-	-	-	<0.005	<0.005	<0.005	<0.005	0.02	<0.005	0.072	0.17	0.11	-	-	0.08	0.12	0.074	0.086	0.19	0.067	0.01	0.084	0.016	0.025	0.752
BH-SB-28	6/09/2021	1-1.5	BH-SB-28_1.0-1.5	Sediment	277486	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.007	-	-	0.02	0.02	0.008	0.006	0.01	0.008	<0.005	0.01	<0.005	<0.005	0.082
BH-SB-28	6/09/2021	2-2.5	BH-SB-28_2.0-2.5	Sediment	277486	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-SB-29	6/09/2021	0-0.5	BH-SB-29_0.0-0.5	Sediment	277486	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	0.02	0.01	-	-	0.04	0.03	0.017	0.01	0.02	0.02	<0.005	0.02	<0.005	<0.005	0.157
BH-SB-30	27/08/2021	0.5-1	BH-SB-30_0.5-1.0	Sediment	276673	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.02	0.01	-	-	0.03	0.02	0.012	0.008	0.02	0.01	<0.005	0.02	<0.005	<0.005	0.12
BH-SB-31	27/08/2021	0.5-1	BH-SB-31_0.5-1.0	Sediment	276673	-	-	-	<0.005	<0.005	<0.005	<0.005	0.02	<0.005	0.02	0.04	0.03	-	-	0.07	0.058	0.03	0.02	0.05	0.02	<0.005	0.04	<0.005	<0.005	0.288
BH-SB-32	30/08/2021	0-1	BH-SB-32_0.0-1.0	Sediment	276959	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.02	0.009	-	-	0.02	0.02	0.009	0.008	0.02	0.008	<0.005	0.01	<0.005	<0.005	0.095
BH-SB-32	30/08/2021	0-1	QC108_210830	Duplicate	276959	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.02	0.01	-	-	0.02	0.02	0.01	0.008	0.02	0.01	<0.005	0.01	<0.005	<0.005	0.1
BH-SB-32	30/08/2021	0-1	QC208_210830	Interlab	EM2117375	0.6	1.2	<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
BH-SB-33	30/08/2021	0.5-1	BH-SB-33_0.5-1.0	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	0.02	0.04	0.02	-	-	0.06	0.05	0.026	0.02	0.05	0.02	<0.005	0.03	0.006	0.008	0.098
BH-SB-33	30/08/2021	1.5-2	BH-SB-33_1.5-2.0	Sediment	276959	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.02	0.01	-	-	0.03	0.02	0.01	0.009	0.02	0.01	<0.005	0.01	<0.005	<0.005	0.099
BH-SB-33	30/08/2021	1.5-2	QC107_210830	Duplicate	276959	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.02	0.008	-	-	0.02	0.02	0.009	0.007	0.02	0.008	<0.005	0.01	<0.005	<0.005	0.094
BH-SB-33	30/08/2021	1.5-2	QC207_210830	Interlab	EM2117375	0.6	1.2	<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
BH-SB-34	7/09/2021	0-0.5	BH-SB-34_0.0-0.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.01	0.04	0.02	-	-	0.07	0.05	0.028	0.02	0.04	0.03	<0.005	0.04	0.008	0.007	0.293
BH-SB-35	7/09/2021	1-1.5	BH-SB-35_1.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-SB-35	7/09/2021	2-2.5	BH-SB-35_2.0-2.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-SB-36	8/09/2021	0.5-1	BH-SB-36_0.5-1.0	Sediment	277707	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.02	0.03	0.02	-	-	0.02	0.03	0.018	0.02	0.04	0.02	<0.005	0.02	<0.005	<0.005	0.168
BH-SB-36	8/09/2021	1.5-2	BH-SB-36_1.5-2.0	Sediment	277707	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
BH-SWTP-01	7/09/2021	0-1.5	BH-SWTP-01_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	0.006	-	-	0.01	0.01	0.007	<0.005	0.01	0.007	<0.005	0.008	<0.005	<0.005	0.052
BH-SWTP-02	7/09/2021	0-1.5	BH-SWTP-02_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.02	0.03	0.01	-	-	0.03	0.02	0.011	0.01	0.03	0.01	<0.005	0.01	<0.005	<0.005	0.121
BH-SWTP-02	7/09/2021	0-1.5	QC115 _210907	Duplicate	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.05	0.075	0.03	-	-	0.06	0.05	0.024	0.03	0.067	0.02	<0.005	0.02	<0.005	0.007	0.278
BH-SWTP-02	7/09/2021	0-1.5	QC215_210907	Interlab_D	EM2117925	0.6	1.2	<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
BH-SWTP-03	7/09/2021	0-1.5	BH-SWTP-03_0.0-1.5	Sediment	277569	-	-	-	0.007	0.007	<0.006	<0.006	0.02	0.005	0.053	0.081	0.04	-	-	0.11	0.086	0.045	0.04	0.088	0.053	<0.01	0.056	0.013	0.01	0.501
BH-SWTP-04	7/09/2021	0-1.5	BH-SWTP-04_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	0.02	0.04	0.02	-	-	0.06	0.05	0.024	0.02	0.04	0.03	<0.006	0.03	0.007	0.005	0.266
BH-SWTP-05	7/09/2021	0-1.5	BH-SWTP-05_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.02	0.04	0.02	-	-	0.05	0.04	0.022	0.02	0.04	0.02	<0.005	0.02	<0.005	0.006	0.218
BH-SWTP-06	7/09/2021	0-1.5	BH-SWTP-06_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.01	0.02	0.01	-	-	0.03	0.03	0.013	0.01	0.02	0.02	<0.005	0.02	<0.005	<0.005	0.143
BH-SWTP-07	7/09/2021	0-1.5	BH-SWTP-07_0.0-1.5	Sediment	277569	-	-	-	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	0.03	0.057	0.03	-	-	0.05	0.051	0.026	0.03	0.062	0.02	<0.005	0.03	<0.005	0.009	0.278

Data Comments
#1 Recovery not available. Please see the PDF report for details
#2: PC99% for sediments and pore water (Simpson et al 2021).
#3: The DGV and GVs for total PAHs include the 18 parent PAHs naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene
NE: Not established

Table 1 - Sediment Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

							Metals										Physico-Chemical Parameters				
						Sum of PAHs (1% TOC normalised)	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc	Moisture Content (dried @ 103°C)	Total Organic Carbon	Total Organic Carbon	Density (Soil Particles)	Organic Matter
							mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	mg/kg	g/cm3	%
LOR							1	0.5	0.1	0.5	0.5	0.5	0.01	0.5	0.5	0.5	0.1	0.01	100	0.01	0.1
Guideline Values (GVs) - High							**25**	**70**	**10**	**370**	**270**	**220**	**1**	**52**	**4**	**410**					
Default Guideline Values (DGVs)							2	20	1.5	80	65	50	0.15	21	1	200					
Location Code	**Sampled**	**Depth**	**Field ID**	**Sample**	**Lab Report**																
BH-BP-19	26/08/2021	0.5-1	BH-BP-19_0.5-1.0	Sediment	276673	<0.01	1	12	<0.1	32	6.1	8.5	0.02	16	<0.5	22	55	1.4	14,000	2.569	2.4
BH-BP-19	26/08/2021	1.5-2	BH-BP-19_1.5-2.0	Sediment	276673	<0.01	<1	4	<0.1	10	2	3	<0.01	5.4	<0.5	8	54	1.5	15,000	2.566	2.6
BH-BP-20	1/09/2021	0-1	BH-BP-20_0.0-1.0	Sediment	277161	0.22	3	14	2	36	28	120	0.76	21	<0.5	84	56	1.5	15,000	2.615	2.6
BH-BP-21	1/09/2021	0-1	BH-BP-21_0.0-1.0	Sediment	277161	0.29	2	12	1	38	22	55	0.49	21	<0.5	69	49	1.7	17,000	2.615	2.9
BH-BP-22	8/09/2021	0-0.5	BH-BP-22_0.0-0.5	Sediment	277707	0.36	1	13	1	39	23	65	0.02	20	<0.5	77	40	2.1	21,000	2.501	3.6
BH-SB-28	6/09/2021	1-1.5	BH-SB-28_1.0-1.5	Sediment	277486	0.05	2	11	0.3	53	16	65	0.18	26	<0.5	53	52	1.6	16,000	2.564	2.8
BH-SB-28	6/09/2021	2-2.5	BH-SB-28_2.0-2.5	Sediment	277486	<0.01	2	12	<0.1	27	4	5.5	0.01	14	<0.5	15	36	0.49	4,900	2.623	0.9
BH-SB-29	6/09/2021	0-0.5	BH-SB-29_0.0-0.5	Sediment	277486	0.20	2	16	0.4	40	20	39	0.24	21	<0.5	60	49	0.8	8,000	2.637	1.4
BH-SB-30	27/08/2021	0.5-1	BH-SB-30_0.5-1.0	Sediment	276673	0.1	<1	9.3	0.2	18	8.1	20	0.1	11	<0.5	30	52	1.2	12,000	2.528	2
BH-SB-31	27/08/2021	0.5-1	BH-SB-31_0.5-1.0	Sediment	276673	0.24	2	14	0.8	39	21	83	0.32	22	<0.5	70	55	1.2	12,000	2.59	2
BH-SB-32	30/08/2021	0-1	BH-SB-32_0.0-1.0	Sediment	276959	0.03	<1	9.2	0.4	22	10	63	0.2	13	<0.5	40	53	1.7	17,000	2.596	2.9
BH-SB-32	30/08/2021	0-1	QC108_210830	Duplicate	276959	0.0588235	2	10	0.9	35	15	41	0.23	20	<0.5	49	54	1.7	17,000	2.576	2.9
BH-SB-32	30/08/2021	0-1	QC208_210830	Interlab	EM2117375	<0.5	<5	17	1	55	19	80	0.3	31	<2	88	-	1.12	11,200	-	-
BH-SB-33	30/08/2021	0.5-1	BH-SB-33_0.5-1.0	Sediment	277569	0.08	<1	11	0.5	28	17	100	0.25	16	<0.5	59	56	1.2	12,000	2.599	2
BH-SB-33	30/08/2021	1.5-2	BH-SB-33_1.5-2.0	Sediment	276959	0.14	<1	8.2	0.9	25	14	56	0.25	16	<0.5	51	54	0.72	7200	2.587	1.2
BH-SB-33	30/08/2021	1.5-2	QC107_210830	Duplicate	276959	0.14	1	13	0.3	31	8.2	19	0.06	16	<0.5	30	53	0.69	6900	2.589	1.2
BH-SB-33	30/08/2021	1.5-2	QC207_210830	Interlab	EM2117375	,0.5	<5	18	<1	53	12	39	0.1	27	<2	58	-	0.84	8400	-	-
BH-SB-34	7/09/2021	0-0.5	BH-SB-34_0.0-0.5	Sediment	277569	0.27	<1	8	1.2	32	22	86	0.46	19	<0.5	88	55	1.1	11,000	2.603	1.9
BH-SB-35	7/09/2021	1-1.5	BH-SB-35_1.0-1.5	Sediment	277569	<0.01	<1	12	<0.1	17	3	7.5	0.02	8.8	<0.5	17	49	1.2	12,000	2.622	2
BH-SB-35	7/09/2021	2-2.5	BH-SB-35_2.0-2.5	Sediment	277569	<0.01	<1	5.6	<0.1	20	3	3	0.01	11	<0.5	14	46	0.46	4,600	2.623	0.8
BH-SB-36	8/09/2021	0.5-1	BH-SB-36_0.5-1.0	Sediment	277707	0.15	1	11	0.5	39	13	31	0.02	21	<0.5	46	47	1.1	11,000	2.653	1.8
BH-SB-36	8/09/2021	1.5-2	BH-SB-36_1.5-2.0	Sediment	277707	<0.01	<1	16	<0.1	19	6	9.9	<0.01	20	<0.5	15	33	0.87	8700	2.636	1.5
BH-SWTP-01	7/09/2021	0-1.5	BH-SWTP-01_0.0-1.5	Sediment	277569	0.03	1	17	0.6	42	40	48	0.41	23	<0.5	100	57	1.6	16,000	2.538	2.7
BH-SWTP-02	7/09/2021	0-1.5	BH-SWTP-02_0.0-1.5	Sediment	277569	0.08	<1	15	0.9	29	34	58	0.31	18	<0.5	100	58	1.5	15,000	2.588	2.5
BH-SWTP-02	7/09/2021	0-1.5	QC115_210907	Duplicate	277569	0.14	2	17	2.8	60	45	92	0.56	34	<0.5	140	61	2	20,000	0[#1]	3.4
BH-SWTP-02	7/09/2021	0-1.5	QC215_210907	Interlab_D	EM2117925	<0.5	<5	18	1	52	31	70	0.4	28	<2	112	-	1.29	12,900	2.68	-
BH-SWTP-03	7/09/2021	0-1.5	BH-SWTP-03_0.0-1.5	Sediment	277569	0.39	2	17	1.2	46	49	130	0.4	24	<0.5	110	48	1.3	13,000	2.577	2.2
BH-SWTP-04	7/09/2021	0-1.5	BH-SWTP-04_0.0-1.5	Sediment	277569	0.14	2	20	1.7	52	43	110	0.51	28	<0.5	120	62	1.9	19,000	2.609	3.2
BH-SWTP-05	7/09/2021	0-1.5	BH-SWTP-05_0.0-1.5	Sediment	277569	0.12	3	24	2	67	59	200	0.7	35	<0.5	140	64	1.8	18,000	2.58	3.1
BH-SWTP-06	7/09/2021	0-1.5	BH-SWTP-06_0.0-1.5	Sediment	277569	0.08	<1	8.7	0.5	19	24	44	0.29	12	<0.5	81	55	1.9	19,000	0[#1]	3.2
BH-SWTP-07	7/09/2021	0-1.5	BH-SWTP-07_0.0-1.5	Sediment	277569	0.12	<1	11	0.3	19	21	18	0.1	19	<0.5	56	42	2.4	24,000	0[#1]	4.2

Data Comments

#1 Recovery not available. Please see the PDF report for details
#2: PC99% for sediments and pore water (Simpson et al 2021).
#3: The DGV and GVs for total PAHs include the 18 parent PAHs naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene
NE: Not established

Table 2 - Pore Water, Sea Water and Elutriate Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

AECOM

								Per- and Poly-fluoroalkyl Substances																				
								Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	Perfluorooctane sulfonamide (FOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)
								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	µg/L	µg/L
LOR								0.0002	0.002	0.002	0.002	0.0004	0.0004	0.0002	0.001	0.002	0.002	0.005	0.01	0.05	0.001	0.0004	0.0004	0.002	0.002	0.002	0.01	0.01	0.005	0.05	0.005
ANZG (2018) Marine Water 95% species protection Default Guideline Value (DGV)								6[#7,10] 0.00023[#7,10]																						
Location Code	**Field ID**	**Depth**	**Sampled Date**	**Sample Type**	**Lab Report No.**	**Area**	**Domain**																							
BH-BP-20	BH-BP-20_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	Loading Site	Domain 1a	0.0038	<0.002	<0.002	<0.002	0.001	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-BP-21	BH-BP-21_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	Loading Site	Domain 1a	0.0088	<0.002	<0.002	<0.002	0.001	0.0004	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-BP-21	BH-BP-21_2.0-3.0	2-3	1/09/2021	Elutriate	277161-A	Loading Site	Domain 1b	0.0006	<0.002	<0.002	<0.002	0.0009	<0.0004	0.0006	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-BP-21	BH-BP-21_3.0-4.0	3-4	1/09/2021	Elutriate	277161-A	Loading Site	Domain 1b	0.001	<0.002	<0.002	<0.002	0.0007	<0.0004	0.0006	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-BP-22	BH-BP-22_0.0-0.5	0-0.5	8/09/2021	Elutriate	277707-A	Loading Site	Domain 2	0.004	<0.002	<0.002	<0.002	0.001	<0.0004	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-BP-22	BH-BP-22_2.0-2.5	2-2.5	8/09/2021	Elutriate	277707-A	Loading Site	Domain 2	0.001	<0.002	<0.002	<0.002	0.0009	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-28	BH-SB-28_1.0-1.5	1-1.5	6/09/2021	Elutriate	277486-A	Loading Site	Domain 1a	0.0022	<0.002	<0.002	<0.002	0.001	<0.0004	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-29	BH-SB-29_0.0-0.5	0-0.5	6/09/2021	Elutriate	277486-A	Loading Site	Domain 1a	0.0045	<0.002	<0.002	<0.002	0.001	<0.0004	0.0022	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-29	BH-SB-29_2.0-2.5	2-2.5	6/09/2021	Elutriate	277486-A	Loading Site	Domain 1b	0.001	<0.002	<0.002	<0.002	0.0008	<0.0004	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-29	BH-SB-29_5.0-6.0	5-6	6/09/2021	Elutriate	277486-A	Loading Site	Domain 2	0.001	<0.002	<0.002	<0.002	0.0009	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-31	BH-SB-31_0.5-1.0	0.5-1	27/08/2021	Elutriate	276673-A	Loading Site	Domain 1a	0.0042	<0.002	<0.002	<0.002	0.001	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-31	BH-SB-31_3.5-4.0	3.5-4	27/08/2021	Elutriate	276673-A	Loading Site	Domain 2	0.0022	<0.002	<0.002	<0.002	0.0008	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-32	BH-SB-32_0.0-1.0	0-1	30/08/2021	Elutriate	276959-A	Loading Site	Domain 1a	0.0033	<0.002	<0.002	<0.002	0.001	<0.0004	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-32	BH-SB-32_2.5-3.0	2.5-3	30/08/2021	Elutriate	276959-A	Loading Site	Domain 1a	0.002	<0.002	<0.002	<0.002	0.0008	<0.0004	0.0007	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-32	QC108_210830	2.5-3	30/08/2021	Duplicate	276959-A	Loading Site	Domain 1a	0.0023	<0.002	<0.002	<0.002	0.0009	<0.0004	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-33	BH-SB-33_1.5-2.0	1.5-2	30/08/2021	Elutriate	276959-A	Loading Site	Domain 1a	0.0038	<0.002	<0.002	<0.002	0.002	<0.0004	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-34	BH-SB-34_0.0-0.5	0-0.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.0083	<0.002	<0.002	<0.002	0.001	0.0005	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-34	BH-SB-34_2.0-2.5	2-2.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1b	0.0007	<0.002	<0.002	<0.002	0.0007	<0.0004	0.0006	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-34	BH-SB-34_2.5-3.0	2.5-3	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1b	0.001	<0.002	<0.002	<0.002	0.0007	<0.0004	0.0005	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SB-36	BH-SB-36_2.5-3.0	2.5-3	8/09/2021	Elutriate	277707-A	Loading Site	Domain 1b	0.002	<0.002	<0.002	<0.002	0.0008	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-01	BH-SWTP-01_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.006	<0.002	<0.002	<0.002	0.001	0.0005	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-02	BH-SWTP-02_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.0089	<0.002	<0.002	<0.002	0.001	0.0004	0.002	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-02	QC115 _210907	0.05	7/09/2021	Duplicate	277569-A	Loading Site	Domain 1a	0.0067	<0.002	<0.002	<0.002	0.001	<0.0004	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-03	BH-SWTP-03_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.006	<0.002	<0.002	<0.002	0.0009	0.0004	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-04	BH-SWTP-04_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.004	<0.002	<0.002	<0.002	0.001	<0.0004	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-05	BH-SWTP-05_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.0056	<0.002	<0.002	<0.002	0.001	0.0004	0.001	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
BH-SWTP-06	BH-SWTP-06_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	Loading Site	Domain 1a	0.0099	<0.002	<0.002	<0.002	0.001	0.0006	0.0026	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
PW-SB-28	PW-SB-28_210906	-	6/09/2021	Pore Water	277486-B	Loading Site	-	0.0046	<0.002	<0.02	<0.002	0.003	0.0008	0.0024	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
PW-SB-34	PW-SB-34_210907	-	7/09/2021	Pore Water	277569-B	Loading Site	-	0.0024	<0.002	<0.02	<0.002	0.002	0.0009	0.0022	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
SW-DG-01	SW-DG-01_210819	-	19/08/2021	Sea Water	276460	Disposal Ground	-	0.002	<0.002	<0.002	<0.002	0.0008	<0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
SW-DG-02	SW-DG-02_210819	-	19/08/2021	Sea Water	276460	Disposal Ground	-	0.002	<0.002	<0.002	<0.002	0.0008	0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
SW-DG-03	SW-DG-03_210819	-	19/08/2021	Sea Water	276460	Disposal Ground	-	0.002	<0.002	<0.002	<0.002	0.0008	0.0004	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
SW-DG-03	QC501_210819	-	19/08/2021	Duplicate	276460	Disposal Ground	-	0.002	<0.002	<0.002	<0.002	0.0007	0.0004	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01	<0.05	<0.001	<0.0004	<0.0004	<0.002	<0.002	<0.002	<0.01	<0.01	<0.005	<0.05	<0.005
SW-DG-03	QC601_210819	-	19/08/2021	Interlab	EM2116795	Disposal Ground	-	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05

DGV Comments:
#1:Low reliability
#2:Unknown reliability
#3:Very high reliability
#4:Moderate reliability
#5:Marine low reliability number for antimony
#6:High reliability
#7:99% level of species protection due to potential for bioaccumulation in marine organisms (ANZG, 2018).
#8:High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
#9:CCME 1999 Guidelines for the Protection of Aquatic Life, Marine Interim Guideline for Arsenic
#10: pore water data compared against Simpson et al (2021) DGV, and elutriate and seawater data compared against ANZG (2018) DGV
NE: Not established

Table 2 - Pore Water, Sea Water and Elutriate Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

AECOM

								Polynuclear Aromatic Hydrocarbons																		Metals											
						Sum of PFAS	Sum of US EPA PFAS (PFOS + PFOA)	Benzo(a)pyrene TEQ calc (Zero)	Naphthalene	Acenaphthylene	Acenaphthene	Anthracene	Fluorene	Phenanthrene	Fluoranthene	Benz(a)anthracene	Benzo(k)fluoranthene	Benzo(b&j)fluoranthene	Benzo(b+j) & Benzo(k)fluoranthene	Benzo(a)pyrene	Chrysene	Pyrene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Sum of PAHs	Antimony	Antimony (Filtered)	Arsenic	Arsenic (Filtered)	Cadmium	Cadmium (Filtered)	Chromium	Chromium (Filtered)	Copper	Copper (Filtered)	Lead	Lead (Filtered)
						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	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR						0.0002	0.0002	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1	1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.001	0.001	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001
ANZG (2018) Marine Water 95% species protection Default Guideline Value (DGV)																				0.2[#2]						NE	0.27[#5]	0.009[#5]	0.0125[#9]	0.0125[#9]	0.0007[#7,8]	0.0007[#7,8]	0.027	0.027	0.0013[#3]	0.0013[#3]	0.001[#1]	0.0044[#1]
Location Code	**Field ID**	**Depth**	**Sampled Date**	**Sample Type**	**Lab Report No.**																														
BH-BP-20	BH-BP-20_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	0.0069	0.0046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-BP-21	BH-BP-21_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	0.014	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-BP-21	BH-BP-21_2.0-3.0	2-3	1/09/2021	Elutriate	277161-A	0.0027	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	0.019	-	-	-	-	-	-	<0.001	-
BH-BP-21	BH-BP-21_3.0-4.0	3-4	1/09/2021	Elutriate	277161-A	0.0033	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	0.002	-	-	-	-	-	-	-	-
BH-BP-22	BH-BP-22_0.0-0.5	0-0.5	8/09/2021	Elutriate	277707-A	0.0081	0.0058	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-BP-22	BH-BP-22_2.0-2.5	2-2.5	8/09/2021	Elutriate	277707-A	0.0035	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	-	0.002	-	-	-	-	-	-	-	-
BH-SB-28	BH-SB-28_1.0-1.5	1-1.5	6/09/2021	Elutriate	277486-A	0.0052	0.0031	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.001	-	-	-	-	-	-	0.001	-
BH-SB-29	BH-SB-29_0.0-0.5	0-0.5	6/09/2021	Elutriate	277486-A	0.0099	0.0067	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.003	-	-	-	-	-	-	<0.001	-
BH-SB-29	BH-SB-29_2.0-2.5	2-2.5	6/09/2021	Elutriate	277486-A	0.0038	0.0023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	0.013	-	-	-	-	-	-	-	-
BH-SB-29	BH-SB-29_5.0-6.0	5-6	6/09/2021	Elutriate	277486-A	0.0034	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-	0.007	-	-	-	-	-	-	-	-
BH-SB-31	BH-SB-31_0.5-1.0	0.5-1	27/08/2021	Elutriate	276673-A	0.0072	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-SB-31	BH-SB-31_3.5-4.0	3.5-4	27/08/2021	Elutriate	276673-A	0.0047	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-	<0.001	-	-	-	-	-	-	-	-
BH-SB-32	BH-SB-32_0.0-1.0	0-1	30/08/2021	Elutriate	276959-A	0.0061	0.0042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-SB-32	BH-SB-32_2.5-3.0	2.5-3	30/08/2021	Elutriate	276959-A	0.0041	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-	<0.001	-	-	-	-	-	-	-	-
BH-SB-32	QC108_210830	2.5-3	30/08/2021	Duplicate	276959-A	0.0052	0.0032	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-SB-33	BH-SB-33_1.5-2.0	1.5-2	30/08/2021	Elutriate	276959-A	0.0084	0.0053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	-	<0.001	-	-	-	-	-	-	<0.001	-
BH-SB-34	BH-SB-34_0.0-0.5	0-0.5	7/09/2021	Elutriate	277569-A	0.013	0.0094	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	0.002	-	-	-	-	-	-	0.001	-
BH-SB-34	BH-SB-34_2.0-2.5	2-2.5	7/09/2021	Elutriate	277569-A	0.0027	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	0.006	-	-	-	-	-	-	-	-
BH-SB-34	BH-SB-34_2.5-3.0	2.5-3	7/09/2021	Elutriate	277569-A	0.0031	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.018	-	-	-	-	-	-	-	-
BH-SB-36	BH-SB-36_2.5-3.0	2.5-3	8/09/2021	Elutriate	277707-A	0.0041	0.0026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-	0.004	-	-	-	-	-	-	-	-
BH-SWTP-01	BH-SWTP-01_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	0.012	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.007	-	0.018	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-02	BH-SWTP-02_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	0.014	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	0.001	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-02	QC115 _210907	0.05	7/09/2021	Duplicate	277569-A	0.01	0.0079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	<0.001	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-03	BH-SWTP-03_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	0.01	0.0073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.007	-	<0.001	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-04	BH-SWTP-04_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	0.0073	0.0051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	<0.001	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-05	BH-SWTP-05_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	0.01	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	<0.001	-	<0.0001	-	-	-	-	<0.001	-
BH-SWTP-06	BH-SWTP-06_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	0.017	0.013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	<0.001	-	<0.0001	-	-	-	-	<0.001	-
PW-SB-28	PW-SB-28_210906	-	6/09/2021	Pore Water	277486-B	0.014	0.0069	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	0.006	-	<0.0001	-	-	-	-	<0.001
PW-SB-34	PW-SB-34_210907	-	7/09/2021	Pore Water	277569-B	0.0089	0.0046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	0.003	-	<0.0001	-	-	-	-	<0.001
SW-DG-01	SW-DG-01_210819	-	19/08/2021	Sea Water	276460	0.0043	0.0027	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.002	<0.002	0.003	0.003	<0.002	<0.0002	0.002	<0.002	<0.002	<0.002	<0.002
SW-DG-02	SW-DG-02_210819	-	19/08/2021	Sea Water	276460	0.0048	0.0026	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.002	<0.002	0.003	0.003	<0.002	<0.0002	0.002	<0.002	<0.002	<0.002	<0.002
SW-DG-03	SW-DG-03_210819	-	19/08/2021	Sea Water	276460	0.0048	0.0028	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.002	<0.002	0.003	0.002	<0.002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002
SW-DG-03	QC501_210819	-	19/08/2021	Duplicate	276460	0.0047	0.0027	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.002	<0.002	0.003	0.003	<0.002	<0.0002	<0.002	<0.002	<0.002	<0.002	<0.002
SW-DG-03	QC601_210819	-	19/08/2021	Interlab	EM2116795	<0.01	-	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<0.2	<1	<1	<1	<1	<1	<0.5	<0.002[#1]	<0.002[#1]	0.005	0.004	<0.0002[#1]	<0.0002[#1]	<0.002[#1]	<0.002[#1]	<0.002[#1]	<0.002[#1]	<0.002[#1]

DGV Comments:
#1:Low reliability
#2:Unknown reliability
#3:Very high reliability
#4:Moderate reliability
#5:Marine low reliability number for antimony
#6:High reliability
#7:99% level of species protection due to potential for bioaccumulation in marine organisms (ANZG, 2(
#8:High reliability. DGV may not protect key test species from chronic toxicity (this refers to experimen
#9:CCME 1999 Guidelines for the Protection of Aquatic Life, Marine Interim Guideline for Arsenic
#10: pore water data compared against Simpson et al (2021) DGV, and elutriate and seawater data co
NE: Not established

Table 2 - Pore Water, Sea Water and Elutriate Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

AECOM

													Nutrients	PAH	Speciated Arsenic					pH	
						Manganese (Filtered)	Mercury	Mercury (Filtered)	Nickel	Nickel (Filtered)	Silver	Silver (Filtered)	Zinc	Zinc (Filtered)	Ammonia (as N)	Benzo(a)pyrene TEQ_	Arsenic Acid (As V)	Arsenious Acid (As III)	Arsenobetaine (ASB)	Dimethylarsenic Acid (DMA)	Monomethylarsonic Acid (MMA)	Solids Leachate pH (post rolling)	pH of Leaching Fluid
						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	pH Units	pH Units
LOR						0.0001	0.00005	0.00005	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.0005	1	1	1	1	1	0.1	0.1
ANZG (2018) Marine Water 95% species protection Default Guideline Value (DGV)							0.0001[#3],7	0.0001[#3],[7]	0.07[#6]	0.07[#6]	0.0014[#4]	0.0014[#4]	0.008[#3]	0.008[#3]									
Location Code	**Field ID**	**Depth**	**Sampled Date**	**Sample Type**	**Lab Report No.**																		
BH-BP-20	BH-BP-20_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.4	7.9
BH-BP-21	BH-BP-21_0.0-1.0	0-1	1/09/2021	Elutriate	277161-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-BP-21	BH-BP-21_2.0-3.0	2-3	1/09/2021	Elutriate	277161-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.4	7.9
BH-BP-21	BH-BP-21_3.0-4.0	3-4	1/09/2021	Elutriate	277161-A	-	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-BP-22	BH-BP-22_0.0-0.5	0-0.5	8/09/2021	Elutriate	277707-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-BP-22	BH-BP-22_2.0-2.5	2-2.5	8/09/2021	Elutriate	277707-A	-	-	-	0.004	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SB-28	BH-SB-28_1.0-1.5	1-1.5	6/09/2021	Elutriate	277486-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-SB-29	BH-SB-29_0.0-0.5	0-0.5	6/09/2021	Elutriate	277486-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.1	7.9
BH-SB-29	BH-SB-29_2.0-2.5	2-2.5	6/09/2021	Elutriate	277486-A	-	-	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-SB-29	BH-SB-29_5.0-6.0	5-6	6/09/2021	Elutriate	277486-A	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	7.7	7.9
BH-SB-31	BH-SB-31_0.5-1.0	0.5-1	27/08/2021	Elutriate	276673-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SB-31	BH-SB-31_3.5-4.0	3.5-4	27/08/2021	Elutriate	276673-A	-	-	-	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SB-32	BH-SB-32_0.0-1.0	0-1	30/08/2021	Elutriate	276959-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SB-32	BH-SB-32_2.5-3.0	2.5-3	30/08/2021	Elutriate	276959-A	-	-	-	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-SB-32	QC108_210830	2.5-3	30/08/2021	Duplicate	276959-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SB-33	BH-SB-33_1.5-2.0	1.5-2	30/08/2021	Elutriate	276959-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8	7.9
BH-SB-34	BH-SB-34_0.0-0.5	0-0.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.4	7.9
BH-SB-34	BH-SB-34_2.0-2.5	2-2.5	7/09/2021	Elutriate	277569-A	-	-	-	0.003	-	-	-	-	-	-	-	-	-	-	-	-	8.4	7.9
BH-SB-34	BH-SB-34_2.5-3.0	2.5-3	7/09/2021	Elutriate	277569-A	-	-	-	0.003	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-SB-36	BH-SB-36_2.5-3.0	2.5-3	8/09/2021	Elutriate	277707-A	-	-	-	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.4	7.9
BH-SWTP-01	BH-SWTP-01_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	7.9	7.9
BH-SWTP-02	BH-SWTP-02_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.1	7.9
BH-SWTP-02	QC115 _210907	0.05	7/09/2021	Duplicate	277569-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SWTP-03	BH-SWTP-03_0.0-1.5	0-1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8.2	7.9
BH-SWTP-04	BH-SWTP-04_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	8.3	7.9
BH-SWTP-05	BH-SWTP-05_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	8	7.9
BH-SWTP-06	BH-SWTP-06_0.0-1.5	0.1.5	7/09/2021	Elutriate	277569-A	-	<0.00005	-	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	7.9	7.9
PW-SB-28	PW-SB-28_210906	-	6/09/2021	Pore Water	277486-B	<0.0001	-	<0.00005	-	<0.001	-	-	-	-	6.8	-	2	3	<1	<1	<1	-	-
PW-SB-34	PW-SB-34_210907	-	7/09/2021	Pore Water	277569-B	<0.0001	-	<0.00005	-	<0.001	-	-	-	-	3	-	<1	2	<1	<1	<1	-	-
SW-DG-01	SW-DG-01_210819	-	19/08/2021	Sea Water	276460	-	<0.00005	<0.00005	<0.002	<0.002	<0.0005	<0.0005	0.004	0.003	-	<0.0005	-	-	-	-	-	-	-
SW-DG-02	SW-DG-02_210819	-	19/08/2021	Sea Water	276460	-	<0.00005	<0.00005	<0.002	<0.002	<0.0005	<0.0005	0.003	0.003	-	<0.0005	-	-	-	-	-	-	-
SW-DG-03	SW-DG-03_210819	-	19/08/2021	Sea Water	276460	-	<0.00005	<0.00005	<0.002	<0.002	<0.0005	<0.0005	<0.002	0.002	-	<0.0005	-	-	-	-	-	-	-
SW-DG-03	QC501_210819	-	19/08/2021	Duplicate	276460	-	<0.00005	<0.00005	<0.002	<0.002	<0.0005	<0.0005	<0.002	0.002	-	<0.0005	-	-	-	-	-	-	-
SW-DG-03	QC601_210819	-	19/08/2021	Interlab	EM2116795	-	<0.0001	<0.0001	<0.002[#1]	<0.002[#1]	<0.005[#1]	<0.005[#1]	<0.01[#1]	<0.01[#1]	-	-	-	-	-	-	-	-	-

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Table 3 - Sediment Waste Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

	Unit	LOR	EPA Vic IWRG1828.2 Category B upper limit	EPA Vic IWRG1828.2 Category C upper limit	EPA Vic IWRG1828.2 Category D / Industrial Waste upper limit	EPA Vic IWRG1828.2 Fill material upper limit	**Location Code**	Waste01	Waste02	Waste03
							Sampled Date	6/09/2021	6/09/2021	6/09/2021
							Field ID	Waste01	Waste02	Waste03
							Sample Type	Normal	Normal	Normal
							Lab Report No.	EM2117682	EM2117682	EM2117682
Organotin Compounds										
Monobutyltin	µg/kg	1						<1	<1	-
PAH/Phenols (SIM)										
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5	400[#1]	100[#1]	50[#1]	20[#2]		-	-	<0.5
Per- and Poly-fluoroalkyl Substances										
Sum (PFHxS + PFOS)	mg/kg	0.0002						-	-	0.0005
Perfluorobutane sulfonic acid (PFBS)	mg/kg	0.0002						-	-	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0002						-	-	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	mg/kg	0.0002						-	-	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0002						-	-	<0.0002
Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0002						-	-	0.0005
Perfluorodecane sulfonic acid (PFDS)	mg/kg	0.0002						-	-	<0.0002
Perfluorobutanoic acid (PFBA)	mg/kg	0.001						-	-	<0.001
Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002						-	-	<0.0002
Perfluorohexanoic acid (PFHxA)	mg/kg	0.0002						-	-	<0.0002
Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0002						-	-	<0.0002
Perfluorooctanoic acid (PFOA)	mg/kg	0.0002						-	-	<0.0002
Perfluorononanoic acid (PFNA)	mg/kg	0.0002						-	-	<0.0002
Perfluorodecanoic acid (PFDA)	mg/kg	0.0002						-	-	<0.0002
Perfluoroundecanoic acid (PFUnDA)	mg/kg	0.0002						-	-	<0.0002
Perfluorododecanoic acid (PFDoDA)	mg/kg	0.0002						-	-	<0.0002
Perfluorotridecanoic acid (PFTrDA)	mg/kg	0.0002						-	-	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.0005						-	-	<0.0005
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005						-	-	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	mg/kg	0.0005						-	-	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	mg/kg	0.0005						-	-	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005						-	-	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	mg/kg	0.0002						-	-	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	mg/kg	0.0002						-	-	<0.0002
Perfluorooctane sulfonamide (FOSA)	mg/kg	0.0002						-	-	<0.0002
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005						-	-	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005						-	-	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005						-	-	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	mg/kg	0.0005						-	-	<0.0005
Sum of PFAS	mg/kg	0.0002						-	-	0.0005
Sum of PFAS (WA DER List)	mg/kg	0.0002						-	-	0.0005
Phenols										
Phenols (non-halogenated) EPAVic	mg/kg	1	2200[#1]	560[#1]	560[#1]	60[#3]		-	-	<1
Phenols(halogenated) EPAVic	mg/kg	0.03				1[#4]		-	-	<0.03
VOCs in soil										
Total +ve MAHs	mg/kg	0.2				7[#5]		-	-	<0.2
Total Petroleum Hydrocarbons										
C6-C9 fraction	mg/kg	10	2600	650	325	100		-	-	<10
C10-C14 fraction	mg/kg	50						-	-	<50
C15-C28 fraction	mg/kg	100						-	-	<100
C29-C36 fraction	mg/kg	100						-	-	<100
C10-C36 fraction (sum)	mg/kg	50	40000	10000	5000	1000		-	-	<50
Total Recoverable Hydrocarbons										
C6-C10 fraction	mg/kg	10						-	-	<10
C6-C10 fraction (minus BTEX)(F1)	mg/kg	10						-	-	<10
>C10-C16 (minus Naphthalene)(F2)	mg/kg	50						-	-	<50
>C10-C16 fraction	mg/kg	50						-	-	<50
>C16-C34 fraction	mg/kg	100						-	-	<100
>C34-C40 fraction	mg/kg	100						-	-	<100
>C10-C40 fraction (sum)	mg/kg	50						-	-	<50
Monocyclic Aromatic Hydrocarbons										
Benzene	mg/kg	0.2	16	4	4	1		-	-	<0.2
Toluene	mg/kg	0.5	12800	3200	3200			-	-	<0.5
Ethylbenzene	mg/kg	0.5	4800	1200	1200			-	-	<0.5
m&p-Xylene	mg/kg	0.5						-	-	<0.5
o-Xylene	mg/kg	0.5						-	-	<0.5
Total Xylenes	mg/kg	0.5	9600	2400	2400			-	-	<0.5
Styrene	mg/kg	0.5	480	120	120			-	-	<0.5
Polynuclear Aromatic Hydrocarbons										
Benzo(a)pyrene TEQ calc (Half)	mg/kg	0.5						0.6	0.6	0.6
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5						1.2	1.2	1.2
Benzo(a)pyrene TEQ calc (Zero)	mg/kg	0.5						<0.5	<0.5	<0.5
Naphthalene	mg/kg	0.5						<0.5	<0.5	<0.5
Acenaphthylene	mg/kg	0.5						<0.5	<0.5	<0.5
Acenaphthene	mg/kg	0.5						<0.5	<0.5	<0.5
Anthracene	mg/kg	0.5						<0.5	<0.5	<0.5
Fluorene	mg/kg	0.5						<0.5	<0.5	<0.5
Phenanthrene	mg/kg	0.5						<0.5	<0.5	<0.5
Fluoranthene	mg/kg	0.5						<0.5	<0.5	<0.5
Benz(a)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5
Benzo(k)fluoranthene	mg/kg	0.5						<0.5	<0.5	-
Benzo(b&j)fluoranthene	mg/kg	0.5						<0.5	<0.5	-
Benzo(b+j) & Benzo(k)fluoranthene	mg/kg	1						-	-	<1
Benzo(a)pyrene	mg/kg	0.5	160	40	20	1		<0.5	<0.5	<0.5
Chrysene	mg/kg	0.5						<0.5	<0.5	<0.5
Pyrene	mg/kg	0.5						<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	mg/kg	0.5						<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	mg/kg	0.5						<0.5	<0.5	<0.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.5						<0.5	<0.5	<0.5
Sum of PAHs	mg/kg	0.5	400[#1]	100[#1]	50[#1]	20[#2]		<0.5	<0.5	-
Phenolic Compounds										
3/4-Methylphenol (m/p-cresol)	mg/kg	1						-	-	<1
Phenol	mg/kg	1						-	-	<1
2-Chlorophenol	mg/kg	0.03	4800	1200	1200			-	-	<0.03
2-Methylphenol (o-Cresol)	mg/kg	1						-	-	<1
2-Nitrophenol	mg/kg	1						-	-	<1
2,4-Dichlorophenol	mg/kg	0.03	3200	800	800			-	-	<0.03
2,4-Dimethylphenol	mg/kg	1						-	-	<1
2,6-Dichlorophenol	mg/kg	0.03						-	-	<0.03
4-Chloro-3-methylphenol	mg/kg	0.03						-	-	<0.03
2,4,6-Trichlorophenol	mg/kg	0.05	320	80	80			-	-	<0.05
2,4,5-Trichlorophenol	mg/kg	0.05	64000	16000	16000			-	-	<0.05
2,3,5,6-Tetrachlorophenol	mg/kg	0.03						-	-	<0.03
4,6-Dinitro-2-methylphenol	mg/kg	5						-	-	<5
Pentachlorophenol	mg/kg	0.2						-	-	<0.2
2,3,4,5-&2,3,4,6-Tetrachlorophenol	mg/kg	0.05						-	-	<0.05
2,4-Dinitrophenol	mg/kg	5						-	-	<5
2-Cyclohexyl-4,6-dinitrophenol	mg/kg	5						-	-	<5
4-Nitrophenol	mg/kg	5						-	-	<5
Dinoseb	mg/kg	5						-	-	<5

Table 3 - Sediment Waste Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

	Unit	LOR	EPA Vic IWRG1828.2 Category B upper limit	EPA Vic IWRG1828.2 Category C upper limit	EPA Vic IWRG1828.2 Category D / Industrial Waste upper limit	EPA Vic IWRG1828.2 Fill material upper limit	**Location Code**	Waste01	Waste02	Waste03
							Sampled Date	6/09/2021	6/09/2021	6/09/2021
							Field ID	Waste01	Waste02	Waste03
							Sample Type	Normal	Normal	Normal
							Lab Report No.	EM2117682	EM2117682	EM2117682
Metals										
Antimony	mg/kg	5	300	75	75			<5	<5	-
Arsenic	mg/kg	5	2000	500	500	20		15	23	9
Cadmium	mg/kg	1	400	100	100	3		<1	<1	<1
Chromium	mg/kg	2						46	53	-
Chromium (hexavalent)	mg/kg	0.5	2000	500	500	1		-	-	<0.5
Copper	mg/kg	5	20000	5000	5000	100		10	11	9
Lead	mg/kg	5	6000	1500	1500	300		74	25	12
Mercury	mg/kg	0.1	300	75	75	1		0.2	<0.1	<0.1
Molybdenum	mg/kg	2	4000	1000	1000	40		-	-	<2
Nickel	mg/kg	2	12000	3000	3000	60		23	30	21
Selenium	mg/kg	5	40000	10000	10000	10		-	-	<5
Silver	mg/kg	2	720	180	180	10		<2	<2	<2
Tin	mg/kg	5				50		-	-	<5
Zinc	mg/kg	5	140000	35000	35000	200		51	42	41
Halogenated Aromatic Compounds										
Chlorobenzene	mg/kg	0.02	4800	1200	1200			-	-	<0.02
1,2-Dichlorobenzene	mg/kg	0.02	24000	6000	6000			-	-	<0.02
1,4-Dichlorobenzene	mg/kg	0.02	640	160	160			-	-	<0.02
1,2,4-Trichlorobenzene	mg/kg	0.01						-	-	<0.01
Halogenated Aliphatic Compounds										
Vinyl chloride	mg/kg	0.02	4.8	1.2	1.2			-	-	<0.02
1,1-Dichloroethene	mg/kg	0.01	480	120	120			-	-	<0.01
cis-1,2-Dichloroethene	mg/kg	0.01						-	-	<0.01
trans-1,2-Dichloroethene	mg/kg	0.02						-	-	<0.02
1,1,1-Trichloroethane	mg/kg	0.01	4800	1200	1200			-	-	<0.01
Carbon Tetrachloride	mg/kg	0.01	48	12	12			-	-	<0.01
1,2-Dichloroethane	mg/kg	0.02	48	12	12			-	-	<0.02
Trichloroethene	mg/kg	0.02	80	20	20			-	-	<0.02
1,1,2-Trichloroethane	mg/kg	0.04	190	48	48			-	-	<0.04
Tetrachloroethene	mg/kg	0.02	800	200	200			-	-	<0.02
1,1,1,2-Tetrachloroethane	mg/kg	0.01	1600	400	400			-	-	<0.01
1,1,2,2-Tetrachloroethane	mg/kg	0.02	210	52	52			-	-	<0.02
Dichloromethane	mg/kg	0.4	64	16	16			-	-	<0.4
Hexachlorobutadiene	mg/kg	0.02	11	2.8	2.8			-	-	<0.02
Trihalomethanes										
Chloroform	mg/kg	0.02	960	240	240			-	-	<0.02
Physico-Chemical Parameters										
pH (CaCl2)	pH Units	0.1						-	-	8.6
Moisture Content	%	0.1						41.6	39.7	45.6
Major Ions										
Fluoride	mg/kg	40	40000	10000	10000	450		-	-	320
Polychlorinated Biphenyls										
Polychlorinated Biphenyls	mg/kg	0.1	6	50	2	2		-	-	<0.1
Chlorinated Hydrocarbons										
Chlorinated hydrocarbons (sum)	mg/kg	0.01				1[#6]		-	-	<0.01
Other chlorinated hydrocarbons (sum)	mg/kg	0.01						-	-	<0.01
Organochlorine Pesticides (OC)										
Aldrin	mg/kg	0.03						-	-	<0.03
Dieldrin	mg/kg	0.03						-	-	<0.03
Aldrin + Dieldrin	mg/kg	0.03	4.8	1.2	1.2			-	-	<0.03
a-BHC	mg/kg	0.03						-	-	<0.03
b-BHC	mg/kg	0.03						-	-	<0.03
d-BHC	mg/kg	0.03						-	-	<0.03
g-BHC (Lindane)	mg/kg	0.03						-	-	<0.03
cis-Chlordane	mg/kg	0.03						-	-	<0.03
trans-Chlordane	mg/kg	0.03						-	-	<0.03
Chlordane	mg/kg	0.03	16	4	4			-	-	<0.03
DDD	mg/kg	0.05						-	-	<0.05
DDE	mg/kg	0.05						-	-	<0.05
DDT	mg/kg	0.05						-	-	<0.05
DDT+DDE+DDD	mg/kg	0.05	50	50	50			-	-	<0.05
Endosulfan 1	mg/kg	0.03						-	-	<0.03
Endosulfan 2	mg/kg	0.03						-	-	<0.03
Endosulfan sulfate	mg/kg	0.03						-	-	<0.03
Endrin	mg/kg	0.03						-	-	<0.03
Endrin aldehyde	mg/kg	0.03						-	-	<0.03
Heptachlor	mg/kg	0.03	4.8	1.2	1.2			-	-	<0.03
Heptachlor epoxide	mg/kg	0.03						-	-	<0.03
Hexachlorobenzene (HCB)	mg/kg	0.03						-	-	<0.03
Methoxychlor	mg/kg	0.03						-	-	<0.03
Organochlorine pesticides (sum)	mg/kg	0.03				1[#7]		-	-	<0.03
Other organochlorine pesticides (sum)	mg/kg	0.03	50[#1]	10[#1]	10[#1]			-	-	<0.03
Cyanides										
Cyanide Total	mg/kg	1	10000	2500	2500	50		-	-	<1
Organotins										
Dibutyltin as Sn	µg/kg	1						<3[#1]	<1	-
Tributyltin as SN	mg/kg	0.0005						<0.0005	<0.0005	-

Env Stds Comments
#1:Please refer to IWRG1828.2 Table 2 for a list of sum constituents.□
#2:Please refer to IWRG1828.2 Table 3 Note 4 for a list of sum constituents.□
#3:Please refer to IWRG1828.2 Table 3 Note 2 for a list of sum constituents.□
#4:Please refer to IWRG1828.2 Table 3 Note 1 for a list of sum constituents.□
#5:Please refer to IWRG1828.2 Table 3 Note 3 for a list of sum constituents.□
#6:Please refer to IWRG1828.2 Table 3 Note 5 for a list of sum constituents.□
#7:Please refer to IWRG1828.2 Table 3 Note 6 for a list of sum constituents.

Data Comments
#1 Reported Analyte LOR is higher than Requested Analyte LOR

Table 4 - Particle Size Distribution Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

								Particle Size Distribution								
								Clay (<0.002 mm)	Fine Silt (0.002 -0.02 mm)	Coarse Silt (0.02-0.075 mm)	Very Fine Sand (0.075-0.15 mm)	Fine Sand (0.15-0.3 mm)	Medium Sand (0.3-0.6 mm)	Coarse Sand (0.6-1.18 mm)	Very Coarse Sand (1.18 - 2.36 mm)	Gravel (>2.36 mm)
							Units	%	%	%	%	%	%	%	%	%
							LOR	1	1	1	1	1	1	1	1	1
Location Code	**Sampled Date**	**Depth**	**Field ID**	**Sample Type**	**Lab Report No.**	**Area**	**Domain**									
BH-BP-19	26/08/2021	0.5-1	BH-BP-19_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	24	17	23	19	15	2	<1	<1	<1
BH-BP-19	26/08/2021	1.5-2	BH-BP-19_1.5-2.0	Sediment	276673	Loading Site	Domain 1a	23	15	28	19	15	<1	<1	<1	<1
BH-BP-19	26/08/2021	2.5-3	BH-BP-19_2.5-3.0	Sediment	276673	Loading Site	Domain 1b	46	4	10	23	17	<1	<1	<1	<1
BH-BP-19	26/08/2021	2.5-3	QC104 _210826	Duplicate	276673	Loading Site	Domain 1b	57	6	14	16	5	1	1	1	<1
BH-BP-19	26/08/2021	2.5-3	QC204_210826	Interlab	EM2117075	Loading Site	Domain 1b	74	13		10				3	
BH-BP-20	1/09/2021	0-1	BH-BP-20_0.0-1.0	Sediment	277161	Loading Site	Domain 1a	28	17	29	17	7	1	<1	<1	<1
BH-BP-20	1/09/2021	2-3	BH-BP-20_2.0-3.0	Sediment	277161	Loading Site	Domain 1b	45	7	20	15	5	5	2	<1	<1
BH-BP-20	1/09/2021	4-5	BH-BP-20_4.0-5.0	Sediment	277161	Loading Site	Domain 2	22	1	14	22	27	8	3	1	<1
BH-BP-21	1/09/2021	0-1	BH-BP-21_0.0-1.0	Sediment	277161	Loading Site	Domain 1a	31	10	26	31	2	<1	<1	<1	<1
BH-BP-21	1/09/2021	2-3	BH-BP-21_2.0-3.0	Sediment	277161	Loading Site	Domain 1b	35	15	43	7	<1	<1	<1	<1	<1
BH-BP-21	1/09/2021	3-4	BH-BP-21_3.0-4.0	Sediment	277161	Loading Site	Domain 1b	24	5	21	21	10	6	7	2	<1
BH-BP-22	8/09/2021	0-0.5	BH-BP-22_0.0-0.5	Sediment	277707	Loading Site	Domain 1a	32	14	20	25	5	1	1	<1	<1
BH-BP-22	8/09/2021	2-2.5	BH-BP-22_2.0-2.5	Sediment	277707	Loading Site	Domain 1b	32	7	6	35	10	3	5	<1	<1
BH-BP-22	31/08/2021	4-5	BH-BP-22_4.0-5.0	Sediment	276959	Loading Site	Domain 2	53	8	15	16	7	<1	<1	<1	<1
BH-BP-22	31/08/2021	4-5	QC109_210831	Duplicate	276959	Loading Site	Domain 2	50	5	12	16	7	5	3	1	<1
BH-BP-22	31/08/2021	4-5	QC209_210831	Interlab	EM2117375	Loading Site	Domain 2	49	17		30				4	
BH-SB-28	6/09/2021	1-1.5	BH-SB-28_1.0-1.5	Sediment	277486	Loading Site	Domain 1a	33	20	29	15	3	<1	<1	<1	<1
BH-SB-28	6/09/2021	2-2.5	BH-SB-28_2.0-2.5	Sediment	277486	Loading Site	Domain 1a	24	10	28	20	10	3	2	<1	<1
BH-SB-28	6/09/2021	4-5	BH-SB-28_4.0-5.0	Sediment	277486	Loading Site	Domain 1b	12	4	11	17	7	7	17	8	8
BH-SB-29	6/09/2021	0-0.5	BH-SB-29_0.0-0.5	Sediment	277486	Loading Site	Domain 1a	32	14	33	16	3	1	<1	<1	<1
BH-SB-29	6/09/2021	2-2.5	BH-SB-29_2.0-2.5	Sediment	277486	Loading Site	Domain 1b	26	17	31	20	4	2	<1	<1	<1
BH-SB-29	6/09/2021	5-6	BH-SB-29_5.0-6.0	Sediment	277486	Loading Site	Domain 2	27	5	20	35	8	2	2	1	<1
BH-SB-30	27/08/2021	0.5-1	BH-SB-30_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	24	8	26	26	14	<1	<1	<1	<1
BH-SB-30	27/08/2021	1.5-2	BH-SB-30_1.5-2.0	Sediment	276673	Loading Site	Domain 1b	34	7	13	16	21	5	2	1	<1
BH-SB-30	27/08/2021	4.5-5	BH-SB-30_4.5-5.0	Sediment	276673	Loading Site	Domain 2	26	9	17	45	3	<1	<1	<1	<1
BH-SB-31	27/08/2021	0.5-1	BH-SB-31_0.5-1.0	Sediment	276673	Loading Site	Domain 1a	22	18	17	27	12	2	1	<1	<1
BH-SB-31	27/08/2021	2-2.5	BH-SB-31_2.0-2.5	Sediment	276673	Loading Site	Domain 1b	33	18	23	19	7	<1	<1	<1	<1
BH-SB-31	27/08/2021	3.5-4	BH-SB-31_3.5-4.0	Sediment	276673	Loading Site	Domain 2	43	30	24	3	<1	<1	<1	<1	<1
BH-SB-32	30/08/2021	0-1	BH-SB-32_0.0-1.0	Sediment	276959	Loading Site	Domain 1a	37	19	21	16	7	<1	<1	<1	<1
BH-SB-32	30/08/2021	0-1	QC108_210830	Duplicate	276959	Loading Site	Domain 1a	-	-	-	-	-	-	-	-	-
BH-SB-32	30/08/2021	0-1	QC208_210830	Interlab	EM2117375	Loading Site	Domain 1a	-	-		-				-	
BH-SB-32	30/08/2021	2.5-3	BH-SB-32_2.5-3.0	Sediment	276959	Loading Site	Domain 1b	48	35	14	3	<1	<1	<1	<1	<1
BH-SB-33	30/08/2021	0.5-1	BH-SB-33_0.5-1.0	Sediment	277569	Loading Site	Domain 1a	39	21	24	14	2	<1	<1	<1	<1
BH-SB-33	30/08/2021	1.5-2	BH-SB-33_1.5-2.0	Sediment	276959	Loading Site	Domain 1a	47	12	24	12	5	<1	<1	<1	<1
BH-SB-33	30/08/2021	1.5-2	QC107_210830	Duplicate	276959	Loading Site	Domain 1a	-	-	-	-	-	-	-	-	-
BH-SB-33	30/08/2021	1.5-2	QC207_210830	Interlab	EM2117375	Loading Site	Domain 1a	-	-		-				-	

Table 4 - Particle Size Distribution Analytical Results
Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

								Particle Size Distribution								
								Clay (<0.002 mm)	Fine Silt (0.002 -0.02 mm)	Coarse Silt (0.02-0.075 mm)	Very Fine Sand (0.075-0.15 mm)	Fine Sand (0.15-0.3 mm)	Medium Sand (0.3-0.6 mm)	Coarse Sand (0.6-1.18 mm)	Very Coarse Sand (1.18 - 2.36 mm)	Gravel (>2.36 mm)
							Units	%	%	%	%	%	%	%	%	%
							LOR	1	1	1	1	1	1	1	1	1
Location Code	**Sampled Date**	**Depth**	**Field ID**	**Sample Type**	**Lab Report No.**	**Area**	**Domain**									
BH-SB-33	30/08/2021	3-4	BH-SB-33_3.0-4.0	Sediment	276959	Loading Site	Domain 2	46	13	23	11	3	1	<1	<1	<1
BH-SB-34	7/09/2021	0-0.5	BH-SB-34_0.0-0.5	Sediment	277569	Loading Site	Domain 1a	30	19	25	16	10	<1	<1	<1	<1
BH-SB-34	7/09/2021	2-2.5	BH-SB-34_2.0-2.5	Sediment	277569	Loading Site	Domain 1b	43	11	21	18	6	<1	<1	<1	<1
BH-SB-34	7/09/2021	2.5-3	BH-SB-34_2.5-3.0	Sediment	277569	Loading Site	Domain 1b	42	7	19	20	5	1	4	1	<1
BH-SB-35	7/09/2021	1-1.5	BH-SB-35_1.0-1.5	Sediment	277569	Loading Site	Domain 1a	33	20	24	19	3	<1	1	<1	<1
BH-SB-35	7/09/2021	2-2.5	BH-SB-35_2.0-2.5	Sediment	277569	Loading Site	Domain 1a	52	12	20	11	2	1	1	<1	<1
BH-SB-35	7/09/2021	4-5	BH-SB-35_4.0-5.0	Sediment	277569	Loading Site	Domain 1b	27	38	27	4	3	<1	<1	<1	<1
BH-SB-36	8/09/2021	0.5-1	BH-SB-36_0.5-1.0	Sediment	277707	Loading Site	Domain 1a	44	16	21	15	4	<1	<1	<1	<1
BH-SB-36	8/09/2021	1.5-2	BH-SB-36_1.5-2.0	Sediment	277707	Loading Site	Domain 1a	41	8	17	21	6	1	3	1	<1
BH-SB-36	8/09/2021	2.5-3	BH-SB-36_2.5-3.0	Sediment	277707	Loading Site	Domain 1b	29	7	28	36	<1	<1	<1	<1	<1
BH-SWTP-01	7/09/2021	0-1.5	BH-SWTP-01_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	22	14	15	12	11	9	11	2	<1
BH-SWTP-02	7/09/2021	0-1.5	BH-SWTP-02_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	34	22	29	14	2	<1	<1	<1	<1
BH-SWTP-02	7/09/2021	0-1.5	QC115 _210907	Duplicate	277569	Loading Site	Domain 1a	34	19	24	17	6	<1	<1	<1	<1
BH-SWTP-02	7/09/2021	0-1.5	QC215 _210907	Interlab	EM2117925	Loading Site	Domain 1a	53	42		5				<1	
BH-SWTP-03	7/09/2021	0-1.5	BH-SWTP-03_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	21	17	21	24	12	4	<1	<1	<1
BH-SWTP-04	7/09/2021	0-1.5	BH-SWTP-04_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	32	22	32	10	4	<1	<1	<1	<1
BH-SWTP-05	7/09/2021	0-1.5	BH-SWTP-05_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	27	23	24	16	10	<1	<1	<1	<1
BH-SWTP-06	7/09/2021	0-1.5	BH-SWTP-06_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	31	17	27	20	5	<1	<1	<1	<1
BH-SWTP-07	7/09/2021	0-1.5	BH-SWTP-07_0.0-1.5	Sediment	277569	Loading Site	Domain 1a	7	8	13	21	15	5	10	8	7
BH-DG-01	19/08/2021	0-0.5	BH-DG-01_0.0-0.5	Sediment	276460	Disposal Ground	-	21	13	39	23	3	<1	<1	<1	<1
BH-DG-02	19/08/2021	0-0.5	BH-DG-02_0.0-0.5	Sediment	276460	Disposal Ground	-	25	13	27	26	8	<1	<1	<1	<1
BH-DG-03	19/08/2021	0-0.5	BH-DG-03_0.0-0.5	Sediment	276460	Disposal Ground	-	28	10	25	29	8	<1	<1	<1	<1
BH-DG-04	19/08/2021	0-0.5	BH-DG-04_0.0-0.5	Sediment	276460	Disposal Ground	-	29	14	27	25	5	<1	<1	<1	<1
BH-DG-05	19/08/2021	0-0.5	BH-DG-05_0.0-0.5	Sediment	276460	Disposal Ground	-	31	20	24	15	10	<1	<1	<1	<1
BH-DG-06	19/08/2021	0-0.5	BH-DG-06_0.0-0.5	Sediment	276460	Disposal Ground	-	30	18	21	17	10	3	<1	<1	<1
BH-OH-01	19/08/2021	0-0.5	BH-OH-01_0.0-0.5	Sediment	276460	Ambient	-	23	16	37	23	1	<1	<1	<1	<1
BH-OH-02	19/08/2021	0-0.5	BH-OH-02_0.0-0.5	Sediment	276460	Ambient	-	22	10	46	22	<1	<1	<1	<1	<1
BH-OH-03	19/08/2021	0-0.5	BH-OH-03_0.0-0.5	Sediment	276460	Ambient	-	22	13	51	11	2	<1	<1	<1	<1
BH-OH-04	19/08/2021	0-0.5	BH-OH-04_0.0-0.5	Sediment	276460	Ambient	-	14	9	53	24	<1	<1	<1	<1	<1
BH-OH-05	19/08/2021	0-0.5	BH-OH-05_0.0-0.5	Sediment	276460	Ambient	-	8	4	38	36	13	1	<1	<1	<1
BH-OH-06	19/08/2021	0-0.5	BH-OH-06_0.0-0.5	Sediment	276460	Ambient	-	2	1	9	24	50	11	<1	<1	<1
BH-OH-06	19/08/2021	0-0.5	QC103_210819	Duplicate	276460	Ambient	-	26	18	23	23	10	<1	<1	<1	<1
BH-OH-06	19/08/2021	0-0.5	QC203_210819	Interlab	EM2116795	Ambient	-	42	48		10				<1	
BH-OH-07	19/08/2021	0-0.5	BH-OH-07_0.0-0.5	Sediment	276460	Ambient	-	1	<1	6	25	64	4	<1	<1	<1
BH-OH-08	19/08/2021	0-0.5	BH-OH-08_0.0-0.5	Sediment	276460	Ambient	-	1	<1	5	33	58	3	<1	<1	<1
BH-OH-09	19/08/2021	0-0.5	BH-OH-09_0.0-0.5	Sediment	276460	Ambient	-	<1	1	2	15	64	9	8	<1	<1

Table 4 - Particle Size Distribution Analytical Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

								Particle Size Distribution								
								Clay (<0.002 mm)	Fine Silt (0.002 -0.02 mm)	Coarse Silt (0.02-0.075 mm)	Very Fine Sand (0.075-0.15 mm)	Fine Sand (0.15-0.3 mm)	Medium Sand (0.3-0.6 mm)	Coarse Sand (0.6-1.18 mm)	Very Coarse Sand (1.18 - 2.36 mm)	Gravel (>2.36 mm)
							Units	%	%	%	%	%	%	%	%	%
							LOR	1	1	1	1	1	1	1	1	1
Location Code	Sampled Date	Depth	Field ID	Sample Type	Lab Report No.	Area	Domain									
BH-OH-10	19/08/2021	0-0.5	BH-OH-10_0.0-0.5	Sediment	276460	Ambient	-	5	3	6	25	33	12	6	10	<1
BH-OH-11	19/08/2021	0-0.5	BH-OH-11_0.0-0.5	Sediment	276460	Ambient	-	19	12	33	27	3	5	1	<1	<1
BH-OH-12	19/08/2021	0-0.5	BH-OH-12_0.0-0.5	Sediment	276460	Ambient	-	4	3	7	16	19	18	13	4	<1
BH-OH-13	19/08/2021	0-0.5	BH-OH-13_0.0-0.5	Sediment	276460	Ambient	-	1	<1	6	12	50	13	3	3	<1
BH-OH-13	19/08/2021	0-0.5	QC102_210819	Duplicate	276460	Ambient	-	1	<1	4	13	48	14	13	7	<1
BH-OH-13	19/08/2021	0-0.5	QC202_210819	Interlab	EM2116795	Ambient	-	6	<1		93				1	
BH-OH-14	19/08/2021	0-0.5	BH-OH-14_0.0-0.5	Sediment	276460	Ambient	-	15	6	14	49	16	<1	<1	<1	<1

Appendix D

Bore Logs

SOIL BOREHOLE BH-BP-19

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	PR	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	7.00 m
Coordinates:	5781386.87 mN	Drill Model:	N/A
Date Started:	26-8-21		271106.63 mE
Date Finished:	26-8-21	Permit No:	
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		MLS	Sandy SILT; grey to dark grey, soft, no odour, minor shell fragments	W	S		BH-BP-19_0.5-1.0
				1			Layer of shells				
				2			As above but becoming less soft, increasing consistency, increasing clay content, high plasticity		F		BH-BP-19_1.5-2.0
				3		OHSH	Silty CLAY; grey to dark grey, high plasticity, shells, minor fine to medium grained sand, stiff	W	St		BH-BP-19_2.5-3.0 / QC104 _210826 / QC204_210826
				4							
				5			As above with minor brown mottling, shell fragments				
				6			As above, grey, minor brown mottling, becoming softer, less stiff, fine to medium grained sand		F		
				7			EOH @ 7.0 mbgl				
				8							
				9							

SOIL BOREHOLE BH-BP-20

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Checked By:	VC	Total Depth:	6.00 m
Relative Level:	mRL	Drill Type:	Vibracore
Date Started:	1-9-21	Coordinates:	5781237.03 mN 271232.03 mE
Date Finished:	1-9-21	Permit No:	
		Drill Model:	N/A
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		ML	SILT; brown, high plasticity	W	VS			
						ML	SILT; black, high plasticity	W	VS			BH-BP-20_0.0-1.0
				1		ML	SILT; Green-grey, high plasticity	W	S			
						OHSH	Sandy SILT; grey, high plasticity, high shell content (25%)	W	S			
				2		CLS	Sandy CLAY; grey, high plasticity, fine sand	W	S-F			
						SC	Clayey SAND; Grey, loosely packed	W	S			BH-BP-20_2.0-3.0
				3		CL-ML	Silty CLAY; medium to high plasticity, slightly crumbly	M/W	S			
				4			Interbedded SAND and CLAY lenses; CLAY; mottled grey, orange and dark grey, firm to stiff SAND; lenses range from 2 to 10cm, medium to fine grained, rounded, white, loosely packed	M				BH-BP-20_4.0-5.0
				5								
				6			EOH @ 6.0 mbgl					
				7								
				8								
				9								

SOIL BOREHOLE BH-BP-21

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	6.00 m
Coordinates:	5781164.62 mN 271311.27 mE	Drill Model:	N/A
Date Started:	1-9-21		
Date Finished:	1-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		ML	SILT; brown, high plasticity	W	VS			
						ML	SILT; black, high plasticity	W	VS			BH-BP-21_0.0-1.0
				1								
						ML	SILT; green-grey, high plasticity	W	VS			
				2								BH-BP-21_2.0-3.0
				3		CH	As above but with trace shells	W	S-F			BH-BP-21_3.0-4.0
				4		CH	CLAY; grey-green, high plasticity, becoming pale brown	W	F			
				5		CH	CLAY; pale brown to white, high plasticity	M	St			
						SW	SAND; white and red, coarse, sub rounded	W	L			
				6		CLS	Sandy CLAY; grey, fine sands, high plasticity	M	F			
							EOH @ 6.0 mbgl					
				7								
				8								
				9								

SOIL BOREHOLE BH-BP-22

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	7.00 m
Coordinates:	5781328.27 mN 271063.65 mE	Drill Model:	N/A
Date Started:	31-8-21		
Date Finished:	31-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0			Core Loss					BH-BP-22_0.0-0.5
				1	CORE LOSS							
				2								BH-BP-22_2.0-2.5
				3		CL-ML	Silty CLAY; green-grey, high plasticity, high proportion of shells (30%)	W	VS			
						SW	SAND: grey, fine to medium grained	M	MD			
						CL-CH	CLAY; black, low plasticity, trace silt	D/M	S			
							As above but grey, grainy texture					
				4		CL-CH	CLAY; green-grey, medium plasticity	M	S-F			BH-BP-22_4.0-5.0 / QC109_210831 / QC209_210831
							As above but mottled grey-green, orange					
				5			As above but with shells throughout, 10% high plasticity	M	F			
				6		CH	CLAY; yellow-brown, high plasticity	M	F-St			
				7			EOH @ 7.0 mbgl					
				8								
				9								

SOIL BOREHOLE BH-BP-22a

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	7.00 m
Coordinates:	5781326.24 mN 271060.30 mE	Drill Model:	N/A
Date Started:	8-9-21		
Date Finished:	8-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		ML	SILT; light brown, low plasticity	W	VS		
						ML	SILT; black, low plasticity, fine sands	W	VS		
						ML	SILT; green-grey, low plasticity	W	VS		
							Core loss				
				1	CORE LOSS						
				2		CH	CLAY; grey, high plasticity	W	S		
						CL	CLAY; dark brown, low plasticity	M	F		
						CH	CLAY; green-grey, grey, mottled, high plasticity	M	St		
				3			Target of re-drill reached @ 3.0 mbgl				
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-BP-29

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	6.00 m
Coordinates:	5781107.21 mN	Drill Model:	N/A
Date Started:	6-9-21		271420.27 mE
Date Finished:	6-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		ML	SILT; grey-green, brown mottle, high plasticity	W	VS			BH-SB-29_0.0-0.5
						ML	SILT; black, high plasticity	W	VS			
				1		ML	SILT; green-grey, high plasticity	W	S			
				2								BH-SB-29_2.0-2.5
							Shell layer	W	LP			
						SM	Silty SAND; green-grey, well graded silts, coarse grained sand, shell fragments	W	LP			
				3			Shell layer	W	LP			
				4		CH	CLAY; green, brown, black mottle, high plasticity	M	St			
						SP	SAND; white, poorly graded, coarse grained, sub rounded	W	LP			
				5		CH	CLAY; dark grey, high plasticity	M	St			
						SC	Clayey SAND; fine to medium grained sand	M	LP			
						CH	CLAY; light grey, high plasticity	M	VSt			BH-SB-29_5.0-6.0
				6			EOH @ 6.0 mbgl					
				7								
				8								
				9								

SOIL BOREHOLE BH-DG-01

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781672.00 mN	Drill Model:	N/A
Date Started:	19-8-21		287887.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; green-grey, high plasticity, shell fragments	W			BH-DG-01_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-DG-02

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781650.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288395.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; green-grey, high plasticity, shell fragments	W			BH-DG-02_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-DG-03

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781717.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288957.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; some fine sand, green-grey, high plasticity, shell fragments	W			BH-DG-03_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-DG-04

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781441.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288736.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; with trace of sand, green-grey, high plasticity, biota and shell fragments	W			BH-DG-04_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-DG-05

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781275.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288350.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; with trace of silt, green-grey, high plasticity	W			BH-DG-05_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-DG-06

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781132.00 mN	Drill Model:	N/A
Date Started:	19-8-21		287898.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; with trace of sand, green-grey, high plasticity	W			BH-DG-06_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-01

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781096.00 mN	Drill Model:	N/A
Date Started:	19-8-21		286413.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; green-grey-black, high plasticity, shell fragments	W			BH-OH-01_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-02

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5782470.00 mN	Drill Model:	N/A
Date Started:	19-8-21		286386.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			Silty CLAY; green-grey, high plasticity, biota and shell fragments	W			BH-OH-02_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-03

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5783473.00 mN	Drill Model:	N/A
Date Started:	19-8-21		286492.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			CLAY; green-grey, high plasticity, biota, organic odour	W			BH-OH-03_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-04

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5784627.00 mN	Drill Model:	N/A
Date Started:	19-8-21		286944.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			Sandy CLAY; fine sand, green-grey, high plasticity, shell fragments and organic odour	W			BH-OH-04_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-05

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5784877.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288746.00 mE
Date Finished:	19-8-21	Permit No:	
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			Sandy CLAY; green-grey, low plasticity, minor shell presence, sulfur odour, very sticky	W			BH-OH-05_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-06

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5784760.00 mN	Drill Model:	N/A
Date Started:	19-8-21		290780.00 mE
Date Finished:	19-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; fine sand with a trace of clay, green-grey, some biota, shell fragments and minor organic content	W			BH-OH-06_0.0-0.5 / QC103_210819 / QC203_210819
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-07

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5783680.00 mN 291222.00 mE	Drill Model:	N/A
Date Started:	19-8-21		
Date Finished:	19-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; fine sand with a trace of clay, green-grey, shell fragments, minor biota and organic content. Shell layer 0.2-0.4 mbgl	W			BH-OH-07 _0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-08

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5782580.00 mN	Drill Model:	N/A
Date Started:	19-8-21		291204.00 mE
Date Finished:	19-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; medium sand with a trace of clay, green-grey, shell fragments and minor organic content Shell layer	W			BH-OH-08_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-09

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5780845.00 mN	Drill Model:	N/A
Date Started:	19-8-21		291135.00 mE
Date Finished:	19-8-21	Permit No:	Drill Fluid: N.A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; fine to medium sand with a trace of clay, green-grey, shell fragments and rotten odour	W			BH-OH-09_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-10

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5780043.00 mN	Drill Model:	N/A
Date Started:	19-8-21		289896.00 mE
Date Finished:	19-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			Sandy CLAY; grey-black, high plasticity, shell fragments, biota and organic content	W			BH-OH-10_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-11

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.10 m
Coordinates:	5782458.00 mN	Drill Model:	N/A
Date Started:	19-8-21		287324.00 mE
Drill Fluid:	N/A		
Date Finished:	19-8-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
				0			CLAY; green-grey, high plasticity, shell fragments Limited recovery EOH @ 0.1 mbgl	W				BH-OH-11_0.0-0.5
				1								
				2								
				3								
				4								
				5								
				6								
				7								
				8								
				9								

SOIL BOREHOLE BH-OH-12

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5784111.00 mN	Drill Model:	N/A
Date Started:	19-8-21		288763.00 mE
Date Finished:	19-8-21	Permit No:	
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; fine to medium sand with a trace of clay, green-grey, shell fragments and sulfur odour	W			BH-OH-12_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-13

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5782611.00 mN	Drill Model:	N/A
Date Started:	19-8-21		290266.00 mE
Date Finished:	19-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			SAND; fine to medium sand with a trace of clay, green-grey, biota, shell fragments, organic content and sulfur odour Shellfish in sample	W			BH-OH-13_0.0-0.5 / QC102_210819 / QC202_210819
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-OH-14

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	0.50 m
Coordinates:	5781179.00 mN	Drill Model:	N/A
Date Started:	19-8-21		289331.00 mE
Date Finished:	19-8-21	Permit No:	
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
VC				0			Silty CLAY; green-grey, high plasticity, biota (worm) and shell fragments	W			BH-OH-14_0.0-0.5
							EOH @ 0.5 mbgl				
				1							
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-28

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	5781175.62 mN	Drill Model:	N/A
Date Started:	6-9-21		271362.51 mE
Date Finished:	6-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		ML	SILT; yellow-brown, med plasticity	W	VS		
							As above but green-grey				
							As above but black				
							As above but green-grey				
				1		ML	SILT; green-grey, high plasticity	W	VS		BH-SB-28_1.0-1.5
							As above but with trace fine sand				
				2			Shell layer				
						MLS	Sandy SILT; green-grey, fine to medium grained sand, high plasticity	W	S		BH-SB-28_2.0-2.5
							Shell layer				
						MLS	Sandy SILT; green-grey, fine to coarse grained sand, high plasticity	W	S		
				3		SM	Silty SAND; green-grey, fine to coarse grained, with some shells	W	LP		
				4		CH	CLAY; green-grey, brown mottled, high plasticity	M	F		
						GWS	Gravelly SAND; green-grey to light grey, medium grained sand, medium gravel, rounded				BH-SB-28_4.0-5.0
				5			EOH @ 5.0 mbgl				
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-30

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	PR	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	5780971.14 mN	Drill Model:	N/A
Date Started:	27-8-21		271485.78 mE
Date Finished:	27-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		MLS	Sandy SILT; dark grey to black, fine to medium grained sand, shell fragments, soft, loose	W	S		BH-SB-30_0.5-1.0
				1							
				2		CLS	Sandy CLAY; dark grey, fine to medium grained sand, high plasticity, firm, wet	W	F		BH-SB-30_1.5-2.0
				3		CL-ML	Silty CLAY; light brown-grey, high plasticity, firm, slightly moist	SM	F		
				4							BH-SB-30_4.5-5.0
				5			EOH @ 5.0 mbgl				
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-31

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	PR	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	271463.36 mN 5780857.90 mE	Drill Model:	N/A
Date Started:	27-8-21		
Date Finished:	27-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Sandy SILT; greu to dark grey, fine to medium grained sand, sludge, shell fragments	W	S		BH-SB-31_0.5-1.0
				1							
				2			As above but with increasing clay content, increasing firmness	W	F		BH-SB-31_2.0-2.5
				3			Shell layer Silty CLAY; light brown, grey mottle, medium plasticity, slightly moist, stiff	CL-ML	St		BH-SB-31_3.5-4.0
				4							
				5			EOH @ 5.0 mbgl				
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-32

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	271491.95 mN 5780829.39 mE	Drill Model:	N/A
Date Started:	30-8-21		
Date Finished:	30-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		CL-ML	Silty CLAY; green-grey and black, medium plasticity, non consolidated, trace fine grained sand, trace shells	W	VS			BH-SB-32_0.0-1.0 / QC108_210830 / QC208_210830
				1								
							As above but high plasticity, increased shells	W	S			
				2		CL-CH	CLAY; grey, orange mottle, low to medium plasticity	M	F			
						CH	CLAY; grey, orange mottle, high plasticity	M	St			
						CL-CH	CLAY; pale brown, yellow-brown mottle, low plasticity	D	St			BH-SB-32_2.5-3.0
				3			Core loss					
				4	CORE LOSS							
				5			EOH @ 5.00 mbgl					
				6								
				7								
				8								
				9								

SOIL BOREHOLE BH-SB-33

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	271315.81 mN	Drill Model:	N/A
Date Started:	30-8-21		5780693.93 mE
Date Finished:	30-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0	CORE LOSS		Core loss				BH-SB-33_0.5-1.0
				1			Silty CLAY; green-grey, sticky, trace of fine grained sand, minor shells, black streaks throughout	W	VS		BH-SB-33_1.5-2.0 / QC107_210830 / QC207_210830
				2			CLAY; grey, high plasticity, with some shell fragments	W	VS		
							As above but with high shell content				
				3			Sandy CLAY; green-grey, brown mottle, high plasticity, fine to medium grained sand, organic matter	M	F-S		BH-SB-33_3.0-4.0
				4			CLAY; light grey with light brown lenses, medium plasticity, calcite nodules (<10 mm)	M	F		
				5			EOH @ 5.00 mbgl				
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-33a

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	2.00 m
Coordinates:	271354.94 mN	Drill Model:	N/A
Date Started:	30-8-21		5780715.71 mE
Date Finished:	30-8-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		CL-CH	CLAY; light brown, with silt				
						CL-ML	Silty CLAY; dark grey and grey-brown, with sand				
				1		CL-ML	Clayey SILT; light grey-brown, trace sand, shells As above but becoming grey				
				2			EOH target depth @ 2.00m				
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-34

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	3.50 m
Coordinates:	271384.21 mN	Drill Model:	N/A
Date Started:	7-9-21		5780645.88 mE
Date Finished:	7-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		ML	SILT; brown, green-grey mottle, high plasticity	W	VS			BH-SB-34_0.0-0.5
						ML	SILT; black, medium plasticity, fine grained sand	W	VS			
				1			As above but green-grey					
							As above but with high shell content and light brown					
						MLS	Sandy SILT; green-grey, low to medium plasticity, trace shells	W	VS			
				2		CH	CLAY; green-grey, high plasticity	W	S-F			BH-SB-34_2.0-2.5
												BH-SB-34_2.5-3.0
				3			Shell layer As above but orange-yellow					
							EOH @ 3.50 mbgl - refusal on calcite layer					
				4								
				5								
				6								
				7								
				8								
				9								

SOIL BOREHOLE BH-SB-35

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	5.00 m
Coordinates:	271265.26 mN	Drill Model:	N/A
Date Started:	7-9-21		5780644.69 mE
Date Finished:	7-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0		ML	SILT; light brown, medium to high plasticity As above but black	W	VS		
							Sandy SILT; green-grey, medium plasticity, fine grained sand	W	VS		
				1							BH-SB-35_1.0-1.5
							Shell layer				
				2		MLS	Sandy SILT; dark grey-green, low plasticity, medium grained sand, shells	W	VS		BH-SB-35_2.0-2.5
						CH	CLAY; grey-green, brown mottle, high plasticity	M	S-F		
				3		MLS	Sandy SILT; grey, low plasticity, medium grained sand, trace shells	M	S		
						CH	CLAY; light grey, green, orange, dark brown mottle, high plasticity. Interbedded with Sandy CLAY; light grey, low plasticity, fine to medium-grained sand	M	F		
				4							BH-SB-35_4.0-5.0
						CL-ML	Silty CLAY; light grey, low plasticity	M	S		
						CH	CLAY; light grey, green, orange, dark brown mottle, high plasticity.	M	F		
				5		CH	Interbedded with Sandy CLAY; light grey, low plasticity, fine to medium-grained sand	M	S		
							Silty CLAY: light grey, low plasticity, soft EOH @ 5.00 mbgl				
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SB-36

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:	South Western Drilling	Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	3.20 m
Coordinates:	271223.62 mN	Drill Model:	N/A
Date Started:	8-9-21		5780625.63 mE
Date Finished:	8-9-21	Permit No:	Drill Fluid: N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval	PID (ppm)	Sample ID
Vibracore				0		ML	SILT; light brown, medium plasticity	W	VS			
						ML	SILT; black, medium to low plasticity	W	VS			
						ML	SILT; green-grey, medium plasticity	W	VS			
						MLS	Sandy SILT; grey, low plasticity, fine sands, shells	W	VS			BH-SB-36_0.5-1.0
				1			As above but sand content increasing, medium to fine sands, dark-grey					BH-SB-36_1.5-2.0
				2		CH	CLAY; green-grey, brown mottle, high plasticity	M	F			
						ML	SILT; grey, medium to low plasticity, trace fine grained sand	M	S			
						CALICHE	Calcite layer	W	S			
						CL-CH	CLAY; brown, medium plasticity, trace fine sand	M	St			
				3		CH	CLAY; brown, high plasticity, calcite nodules throughout (5 - 30 mm)					BH-SB-36_2.5-3.0
							EOH @ 3.20 mbgl - refusal on calcrete					
				4								
				5								
				6								
				7								
				8								
				9								

SOIL BOREHOLE BH-SWTP-01

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781648.00 mN 270681.00 mE	Drill Model:	N/A
Date Started:	7-9-21		
Permit No:		Drill Fluid:	N/A
Date Finished:	7-9-21		

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY with sand; grey to dark brown to brown, biota, shell fragments and organic content	W			BH-SWTP-01_0.0-1.5
				1							
							EOH @ 1.5 mbgl				
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-02

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781419.00 mN 271067.00 mE	Drill Model:	N/A
Date Started:	7-9-21		
Permit No:		Drill Fluid:	N/A
Date Finished:	7-9-21		

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY; grey to dark grey to light brown, shell fragments and organic content	W			BH-SWTP-02_0.0-1.5 / QC115 _210907
				1							
				2			EOH @ 1.5 mbgl				
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-03

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781606.00 mN 270756.00 mE	Drill Model:	N/A
Date Started:	7-9-21		
Permit No:		Drill Fluid:	N/A
Date Finished:	7-9-21		

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY; grey to dark grey to brown	W			BH-SWTP-03_0.0-1.5
				1							
							EOH @ 1.5 mbgl				
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-04

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781561.00 mN	Drill Model:	N/A
Date Started:	7-9-21		270829.00 mE
Drill Fluid:	N/A		
Date Finished:	7-9-21	Permit No:	

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY; grey to dark grey to brown, biota, shell fragments and organic content	W			BH-SWTP-04_0.0-1.5
				1							
							EOH @ 1.5 mbgl				
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-05

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781517.00 mN 270903.00 mE	Drill Model:	N/A
Date Started:	7-9-21		
Permit No:		Drill Fluid:	N/A
Date Finished:	7-9-21		

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY; grey to dark grey to light brown, shell fragments and organic content	W			BH-SWTP-05_0.0-1.5
				1							
				2			EOH @ 1.5 mbgl				
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-06

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Relative Level:	mRL	Drill Type:	Vibracore
Checked By:	VC	Total Depth:	1.50 m
Coordinates:	5781465.00 mN 270987.00 mE	Drill Model:	N/A
Date Started:	7-9-21		
Permit No:		Drill Fluid:	N/A
Date Finished:	7-9-21		

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Silty CLAY; grey to dark grey, shell fragments	W			BH-SWTP-06_0.0-1.5
				1							
							EOH @ 1.5 mbgl				
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

SOIL BOREHOLE BH-SWTP-07

Project Name:	VIVA Energy Gas Terminal Project	Client:	VIVA Energy Australia Pty Ltd
Drilling Contractor:		Location:	Loading Site, Refinery Pier, Corio Bay
Project No.:	60642423		
Logged By:	BC	Bore Size:	mm
Checked By:	VC	Total Depth:	1.50 m
Date Started:	7-9-21	Relative Level:	mRL
Date Finished:	7-9-21	Coordinates:	mN mE
		Permit No:	
		Drill Type:	Vibracore
		Drill Model:	N/A
		Drill Fluid:	N/A

Method	Casing	Penetration (S M H R)	Groundwater Data and Comments	Depth (m)	Graphic Log	Classification	LITHOLOGICAL DESCRIPTION (Type, plasticity / particle size, colour, secondary / minor components (e.g., "trace"), additional observations)	Moisture Condition	Consistency Relative Density	Sample Interval PID (ppm)	Sample ID
Vibracore				0			Sandy SILT with clay; grey to dark grey to brown, biota, shell fragments and organic content	W			BH-SWTP-07_0.0-1.5
				1							
							EOH @ 1.5 mbgl				
				2							
				3							
				4							
				5							
				6							
				7							
				8							
				9							

Appendix E

Field Sheets

ANZ

FQM - Sediment Sampling Record

Q4AN(EV)-301-FM1

Project Name:	Viva Energy Gas Terminal Project	**Project Number**	60642423	**PM Name:**	[redacted]	**Sample Date:**	16 Aug-21
Client:	Viva Energy Australia	**Project Location**	Pt Wilson Disposal grounds	**Fieldwork Staff:**	[redacted] Pt Richards	**Page**	1 of 3

General Information			
Sample Method:	Push Tube	**Weather Conditions AM:**	Calm Cool Sunny
Geo Ref. Sys.:	GPS	**Weather Conditions PM:**	Calm Warm Sunny
Comments:			

Tide Information				
Tide	**Time**	**Height**	**Time**	**Height**
High Tide			11:30	0.89
Low Tide	04:45	0.26	16:23	0.60

Sampling Information

Sample Location	Time	Latitude	Longitude	Sample ID	Water Depth	Sample depth (m bgl)	Type, colour/mottling, plasticity/particle size, secondary/minor components	Biota	Shell Presence	Organic Content	Odour	Other Comments (e.g. foreign material, veneers, strata, biota)
BH-OH-08	8:30			BHofOH08	10.3	0.0-0.5	Sand Green-Grey Med sand Trace Clay	No	Yes	Minor	None	Complete Shell Layer
BH-OH-07	9:00			BH-OH-07	10.0	0.0-0.5	Sand Green-Grey F-M Sand Trace Clay	Minor	Yes	Minor	None	Shell layer 0.2-0.4
BH-OH-06	9:15			BH-OH-06	10.0	0.0-0.5	Sand Green-Grey F-M Sand Trace Clay	Some	Yes	Minor	None	—
BH-OH-13	9:30			BH-OH-13	10.0	0.0-0.5	Sand Green-Grey F-M Sand Trace Clay	Yes	Yes	Minor	Sulfur	— Shell/Grit in Sample
BH-OH-05	10:00			BH-OH-05	10.0	0.0-0.5	Sandy Clay Grey-Green Low Plasticity ~~Grit~~	No	Minor	No	Sulfur	V sticky
BH-OH-12	10:15			BH-OH12	10.0	0.0-0.5	Sand Green-Grey F-M Sand Trace Clay	No	Yes	No	Sulfur	—
BH-OH-14	10:30			BH-OH-14	12.6	0.0-0.5	Silty Clay Green Grey High Plasticity	Yes Worm	Yes	No	None	—
BH-OH-09	11:05			BH-OH-09	9.6	0.0-0.5	Sand Green-Grey F-M Sand Trace clay	No	Yes	No	Rotten	-
BH-OH-10	11:25			BH-OH-10	10.1	0.0-0.5	Sandy Clay High Plasts Grey - Black	Yes	Yes	Yes	None.	

Approval and Distribution

Fieldwork Staff Signature	Date	Project Manager Signature	Date
[signature]	19/08/21		

Distribution: Project Central File

ANZ

FQM - Sediment Sampling Record

Q4AN(EV)-301-FM1

Project Name:	Viva Energy Gas Terminal Project	**Project Number**	60642423	**PM Name:**	[redacted]	**Sample Date:**	19 Aug-21
Client:	Viva Energy Australia	**Project Location**	Pt Wilson Disposal Grnd	**Fieldwork Staff:**	[redacted] Pt Richards	**Page**	2 of 3

General Information			
Sample Method:	Push tube	**Weather Conditions AM:**	Calm Cool Sunny
Geo Ref. Sys.:	GPS	**Weather Conditions PM:**	Calm Warm Sunny
Comments:			

Tide Information

Tide	Time	Height	Time	Height
High Tide			11:30	0.89
Low Tide	04:45	0.26	16:23	0.60

Sampling Information

Sample Location	Time	Latitude	Longitude	Sample ID	Water Depth	Sample depth (m bgl)	Type, colour/mottling, plasticity/particle size, secondary/minor components	Biota	Shell Presence	Organic Content	Odour	Other Comments (e.g. foreign material, veneers, strata, biota)
BH-OH-01	11:45			BH-OH-01	10.5	0.0-0.5	Clay Green-Grey Black High Plasticity	No	Yes	No	None	—
BH-OH-02	12:05			BH-OH-02	10.1	0.0-0.5	Silty Clay Green-Grey High Plasticity	Yes	Yes	No	None	—
BH-OH-11	12:15			BH-OH-11	10.7	0.0-0.5	Clay Green-Grey High Plasticity	No	Yes	No	None	Limited Recovery 6 tubes Attempted
BH-OH-03	13:00			BH-OH-03	9.6	0.0-0.5	Clay Green-Grey High Plasticity	Yes	No	No	Organic	Biota see Photos
BH-OH-04	13:40			BH-OH-04	9.1	0.0-0.5	Sandy Clay Green-Grey High Plasticity F Sand	No	Yes	No	Organic	—
BH-DK-01	13:30			BH-DK-01	10.0	0.0-0.5	Clay Green-Grey High Plasticity	No	Yes	No	None	—
BH-DK-02	13:55			BH-DK-02	11.4	0.0-0.5	Clay Green-Grey High Plasticity	No	Yes	No	None	—
BH-DK-03	14:10			BH-DK-03	12.0	0.0-0.5	Clay Green-Grey High Plasticity with Some Fine Sand	No	Yes	No	None	—

Approval and Distribution

Fieldwork Staff Signature	Date	Project Manager Signature	Date
[redacted]	19/08/21		

Distribution: Project Central File

ANZ

FQM - Sediment Sampling Record

Q4AN(EV)-301-FM1

Project Name:	Viva Energy Gas Terminal Project	**Project Number**	60642423	**PM Name:**	[redacted]	**Sample Date:**	14 Aug-21
Client:	Viva Energy Australia	**Project Location**	Pt Wilson Disposal Ground Pt Ricardo	**Fieldwork Staff:**	[redacted]	**Page**	3 of 5

General Information			
Sample Method:		**Weather Conditions AM:**	
Geo Ref. Sys.:		**Weather Conditions PM:**	
Comments:			

Tide Information

Tide	Time	Height	Time	Height
High Tide			11:30	0.89
Low Tide	04:45	0.26	16:23	0.60

Sampling Information

Sample Location	Time	Latitude	Longitude	Sample ID	Water Depth	Sample depth (m bgl)	Type, colour/mottling, plasticity/particle size, secondary/minor components	Biota	Shell Presence	Organic Content	Odour	Other Comments (e.g. foreign material, veneers, strata, biota)
OH-DG-04	14:25			OH-DG-04	11.4	0.0-0.5	Clay Green-Grey High Plasticity trace fine Sand	Yes Worms	Yes	No	None	—
OH-DG-05	14:35			OH-DG-05	11.3	0.0-0.5	Clay Green-Grey High Plasticity trace of Silt	No	No	No	None	—
OH-DG-06	15:05			OH-DG-06	11.6	0.0-0.5	Clay Green-Grey High Plasticity trace fine Sand	No	No	No	None	—

Approval and Distribution

Fieldwork Staff Signature	Date	Project Manager Signature	Date
[redacted]	19/08/21		

Distribution: Project Central File

AECOM

ANZ

FQM - Sediment Sampling Record

Q4AN(EV)-301-FM1

Project Name:	Viva Energy Gas Terminal Project	Project Number:	60642423	PM Name:	[redacted]	Sample Date:	7 Sep ~~Aug~~-21
Client:	Viva Energy Australia	Project Location		Fieldwork Staff:		Page	1 of 1

General Information			
Sample Method:		Weather Conditions AM:	
Geo Ref. Sys.:		Weather Conditions PM:	
Comments:			

Tide Information				
Tide	Time	Height	Time	Height
High Tide				
Low Tide				

Sampling Information

Sample Location	Time	Latitude	Longitude	Sample ID	Water Depth	Sample depth (m bgl)	Type, colour/mottling, plasticity/particle size, secondary/minor components	Biota	Shell Presence	Organic Content	Odour	Other Comments (e.g. foreign material, veneers, strata, biota)
BH-SWTP-06	10:30			0.0-1.5	5	0.0-1.5	Silty CLAY. Grey ~ dark grey.		Y		NO	
BH-SWTP-02	11:00			0.0-1.5	4.7	0.0-1.5	Silty CLAY. Grey/dark grey/light brn.		Y	Y	NO	
BH-SWTP-05	11:30			0.0-1.5	4.9	0.0-1.5	Silty CLAY Grey/dark grey/light brn		Y	Y	NO	
BH SWTP-04	12:00			0.0-1.5	4.4	0.0-1.5	Silty CLAY. Grey/dark grey/brown.	Y	Y	Y	NO	Sea grass
BH-SWTP-03	12:30			0.0-1.5	3.5	0.0-1.5	Silty CLAY. Gr/dark Gr/brn..				NO	
BH-SWTP-01	13:00			0.0-1.5	3.0	0.0-1.5	Silty CLAY ~ sand. Gy/dark gy/brn	Y	Y	Y	NO	Starfish
BH-SWTP-07	13:30			0.0-1.5	2.0	0.0-1.5	Sandy Silt ~ Clay. Gr/dk gy/br	Y	Y	Y	NO	starfish, seagrass

Approval and Distribution

Fieldwork Staff Signature	Date	Project Manager Signature	Date
[signature]	7.9.21		

Distribution: Project Central File

				PFAS	PAH, organotins, metals, TOC			Particle Density, Distribution	For Porewater
BoreID	**Coordinates**	**Sample Depth**	**Sample ID**	250ml Plastic	125ml Glass	250ml Glass	250ml Glass	1kg sed double bagged	5kg sed in bucket
BH-SB-30	271490.422880	0.0-0.5	BH-SB-30_0.0-0.5	X	X	X	X	X	QC10G / QC20G
	5780972.404740	0.5-1.0	BH-SB-30_0.5-1.0	X	X	X	X	X	
		1.0-1.5	BH-SB-30_1.0-1.5	X	X	X	X	X	
		1.5-2.0	BH-SB-30_1.5-2.0	X	X	X	X	X	
		2.0-2.5	BH-SB-30_2.0-2.5	X	X	X	X	X	
		2.5-3.0	BH-SB-30_2.5-3.0	X	X	X	X	X	
		3.5-4.0	BH-SB-30_3.5-4.0	X	X	X	X	X	
		4.5-5.0	BH-SB-30_4.5-5.0	X	X	X	X	X	
BH-SB-29	271425.995276	0.0-0.5	BH-SB-29_0.0-0.5						
	5781078.328090	0.5-1.0	BH-SB-29_0.5-1.0						
		1.0-1.5	BH-SB-29_1.0-1.5						
		1.5-2.0	BH-SB-29_1.5-2.0						
		2.0-2.5	BH-SB-29_2.0-2.5						
		2.5-3.0	BH-SB-29_2.5-3.0						
		3.5-4.0	BH-SB-29_3.5-4.0						
		4.5-5.0	BH-SB-29_4.5-5.0						
		5.5-6.0	BH-SB-29_5.5-6.0						

				PFAS	PAH, organotins, metals, TOC			Particle Density, Distribution	For Porewater
BoreID	**Coordinates**	**Sample Depth**	**Sample ID**	250ml Plastic	125ml Glass	250ml Glass	250ml Glass	1kg sed double bagged	5kg sed in bucket
BH-SB-32	271392.143483	0.0-0.5	BH-SB-32_0.0-0.5						
	5780810.243730	0.5-1.0	BH-SB-32_0.5-1.0						
		1.0-1.5	BH-SB-32_1.0-1.5						
		1.5-2.0	BH-SB-32_1.5-2.0						
		2.0-2.5	BH-SB-32_2.0-2.5						
		2.5-3.0	BH-SB-32_2.5-3.0						
		3.5-4.0	BH-SB-32_3.5-4.0						
		4.5-5.0	BH-SB-32_4.5-5.0						
BH-SB-31	271461.485058	0.0-0.5	BH-SB-31_0.0-0.5	X	X	X	X	X	
	5780850.647480	0.5-1.0	BH-SB-31_0.5-1.0	X	X	X	X	X	QC105 QC205
		1.0-1.5	BH-SB-31_1.0-1.5	X	X	X	X	X	
		1.5-2.0	BH-SB-31_1.5-2.0	X	X	X	X	X	
		2.0-2.5	BH-SB-31_2.0-2.5	X	X	X	X	X	
		2.5-3.0	BH-SB-31_2.5-3.0	X	X	X	X	X	
		3.5-4.0	BH-SB-31_3.5-4.0	X	X	X	X	X	
		4.5-5.0	BH-SB-31_4.5-5.0	X	X	X	X	X	

				PFAS	PAH, organotins, metals, TOC			Particle Density, Distribution	For Porewater
BoreID	**Coordinates**	**Sample Depth**	**Sample ID**	250ml Plastic	125ml Glass	250ml Glass	250ml Glass	1kg sed double bagged	5kg sed in bucket
BH-BP-20	271227.798491	0.0-0.5	BH-BP-20_0.0-0.5						
	5781256.322990	0.5-1.0	BH-BP-20_0.5-1.0						
		1.0-1.5	BH-BP-20_1.0-1.5						
		1.5-2.0	BH-BP-20_1.5-2.0						
		2.0-2.5	BH-BP-20_2.0-2.5						
		2.5-3.0	BH-BP-20_2.5-3.0						
		3.5-4.0	BH-BP-20_3.5-4.0						
		4.5-5.0	BH-BP-20_4.5-5.0						
		5.5-6.0	BH-BP-20_5.5-6.0						
BH-BP-19	271108.225225	0.0-0.5	BH-BP-19_0.0-0.5						
	5781382.994220	0.5-1.0	BH-BP-19_0.5-1.0						
		1.0-1.5	BH-BP-19_1.0-1.5	X	X	X	X	X	
		1.5-2.0	BH-BP-19_1.5-2.0	X	X	X	X	X	
		2.0-2.5	BH-BP-19_2.0-2.5	X	X	X	X	X	
		2.5-3.0	BH-BP-19_2.5-3.0	X	X	X	X	X	QC104/QC204
		3.5-4.0	BH-BP-19_3.5-4.0	X	X	X	X	X	
		4.5-5.0	BH-BP-19_4.5-5.0	X	X	X	X	X	
		5.5-6.0	BH-BP-19_5.5-6.0	X	X	X	X	X	
		6.5-7.0	BH-BP-19_6.5-7.0						

Appendix F

Photo Log

Photographic Log

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 1 **Area:** Loading Site **Bore ID:** BH-BP19 **Sample Interval:** 0.00 – 2.00 m **Description:** 0 – 2.00 m run	
Plate 2 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 0.00 – 2.00 m **Description:** 0 – 2.00 m run close up	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 3 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 2.00 – 3.50 m **Description:** 2.00 – 3.50 m run	
Plate 4 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 2.40 – 2.80 m **Description:** Shell fragments seen at the sandy SILT to silty CLAY interface	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 5 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 2.40 m **Description:** Close up of shell fragments at 2.40 m	
Plate 6 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 3.50 – 4.50 m **Description:** 3.50 – 4.50 m run	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 7 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 4.50 – 5.50 m **Description:** 4.50 – 5.50 m run	
Plate 8 **Area:** Loading Site **Bore ID:** BH-BP-19 **Sample Interval:** 5.50 – 6.50 m **Description:** 5.50 – 6.50 m run	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 9 **Area:** Loading Site **Bore ID:** BH-BP-20 **Sample Interval:** 0.00 – 1.50 m **Description:** 3 runs at location attempted 0.00 – 1.50 m	
Plate 10 **Area:** Loading Site **Bore ID:** BH-BP- **Sample Interval:** 0.00 – 6.00 m **Description:** 0.00 – 1.50 m 0.00 – 1.50 m 0.00 – 3.00 m 1.50 – 4.50 m 4.50 – 6.00 m runs	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 11 **Area:** Loading Site **Bore ID:** BH-BP-21 **Sample Interval:** 0.00 – 6.00 m **Description:** 0.00 – 1.50 m 1.50 – 4.50 m 4.50 – 6.00 m runs	
Plate 12 **Area:** Loading Site **Bore ID:** BH-BP-22a **Sample Interval:** 0.00 – 3.00 m **Description:** 0.00 – 0.50 m 2.00 – 3.00m runs	
Plate 13 **Area:** Loading Site **Bore ID:** BH-BP-22 **Sample Interval:** 3.00 – 3.20 m **Description:** 3.00 – 3.20 m Soft Sediments at the top of the run, into firmer material more consistent with that of limited returns in 0.00 – 3.00 m run. Note large shells potentially inhibiting soft sediments entering core.	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 14 **Area:** Loading Site **Bore ID:** BH-BP-22 **Sample Interval:** 5.75 – 6.25 m **Description:** Change from grey wet sediments with shells into cream to yellow-brown firm clays. Note dry horizon at interface of change.	
Plate 15 **Area:** Loading Site **Bore ID:** BH-BP-22 **Sample Interval:** 6.25 – 6.50 m **Description:** Example of dry nodules throughout yellow-brown clay lithology. Potently calcareous.	

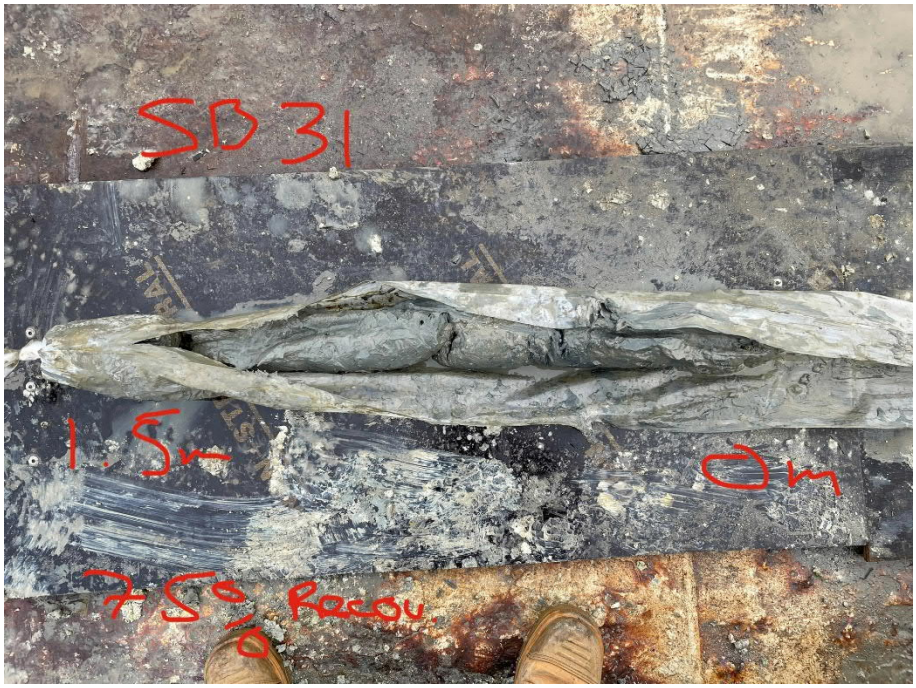
Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 16 **Area:** Loading Site **Bore ID:** BH-BP-22 **Sample Interval:** 3.00 – 7.00 m **Description:** 3.00 – 4.50 m 3.00 – 4.50 m 4.50 – 7.00 m runs	
Plate 17 **Area:** Loading Site **Bore ID:** BH-SB-28 **Sample Interval:** 0.00 – 5.00 m **Description:** 0.00 – 1.50 m 1.50 – 3.00 m 3.00 – 5.00 m runs	
Plate 18 **Area:** Loading Site **Bore ID:** BH- SB-29 **Sample Interval:** 0.00 – 2.00 m **Description:** 0.00 – 2.00 m run	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 19 **Area:** Loading Site **Bore ID:** BH-SB-30 **Sample Interval:** 0.00 – 2.00 m **Description:** 0.00 – 2.00 m run	
Plate 20 **Area:** Loading Site **Bore ID:** BH-SB-30 **Sample Interval:** 2.00 – 5.00 m **Description:** 2.00 – 5.00 m run	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 21 **Area:** Loading Site **Bore ID:** BH-SB-31 **Sample Interval:** 0.00 – 1.50 m **Description:** 0.00 – 1.50 m run	
Plate 22 **Area:** Loading Site **Bore ID:** BH-SB-31 **Sample Interval:** 1.50 – 3.00 m **Description:** 1.50 – 3.00 m run	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 23 **Area:** Loading Site **Bore ID:** BH-SB-31 **Sample Interval:** 3.00 – 5.00 m **Description:** 3.00 – 5.00 m run	
Plate 24 **Area:** Loading Site **Bore ID:** BH-SB-32 **Sample Interval:** 1.50 – 2.00 m **Description:** 1.50 – 2.00 m run showing the transition from soft green grey sediments into firm yellow-brown material at the bottom of the 0.00 – 2.00 m run.	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 25	
Area: Loading Site	
Bore ID: BH-SB-32	
Sample Interval: 0.00 – 2.00 m 0.00 – 2.00 m 2.00 – 3.00 m 2.00 – 3.00 m 2.00 – 3.00 m	
Description: 0.00 – 2.00 m run showed firm Yellow-Brown material from approx 1.9 to 2.0. Top of 2.0 – 5.0 m run did not show the same firm Yellow-Brown material. Assuming collapse was recovered and core loss at the bottom of run.	

Plate 26	
Area: Loading Site	
Bore ID: BH-SB-33	
Sample Interval: 0.00 – 2.00 m	
Description: Minimal returns from 0.00 – 2.00 m run probable drill head blocked by shells not allowing soft sediments to enter core.	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 27 **Area:** Loading Site **Bore ID:** BH-SB-33 **Sample Interval:** 1.50 – 2.00 m 2.00 - 5.00 m **Description:** Minimal returns from 0.00 – 2.00 m run,	
Plate 28 **Area:** Loading Site **Bore ID:** BH-SB-34 **Sample Interval:** 3.00 – 3.50 m **Description:** Calcite nodules and calcite from the drill head when refusal was meet.	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 29 **Area:** Loading Site **Bore ID:** BH-SB-34 **Sample Interval:** 0.00 – 3.50 m **Description:** 0.00 – 3.00 m 2.00 – 3.00 m 3.00 – 3.50 m runs	
Plate 30 **Area:** Loading Site **Bore ID:** BH-SB-35 **Sample Interval:** 0.00 – 1.50 m 3.00 – 4.50 m **Description:** 0.00 – 3.00 m 2.00 – 3.00 m 3.00 – 3.50 m runs	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 31 **Area:** Loading Site **Bore ID:** BH-SB-35 **Sample Interval:** 0.00 – 3.50 m **Description:** 0.00 – 3.00 m 2.00 – 3.00 m 3.00 – 3.50 m runs	
Plate 32 **Area:** Loading Site **Bore ID:** BH-SB-35 **Sample Interval:** 0.00 – 3.50 m **Description:** 0.00 – 3.00 m 2.00 – 3.00 m 3.00 – 3.50 m runs	
Plate 33 **Area:** Loading Site **Bore ID:** BH-SB-36 **Sample Interval:** 0.00 – 3.10 m **Description:** 0.00 – 2.00 m 2.00 – 3.10 m runs	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 34

Area:
Salt Water Transfer Pipe

Bore ID:
BH-SWTP-01 – BH-SWTP-07

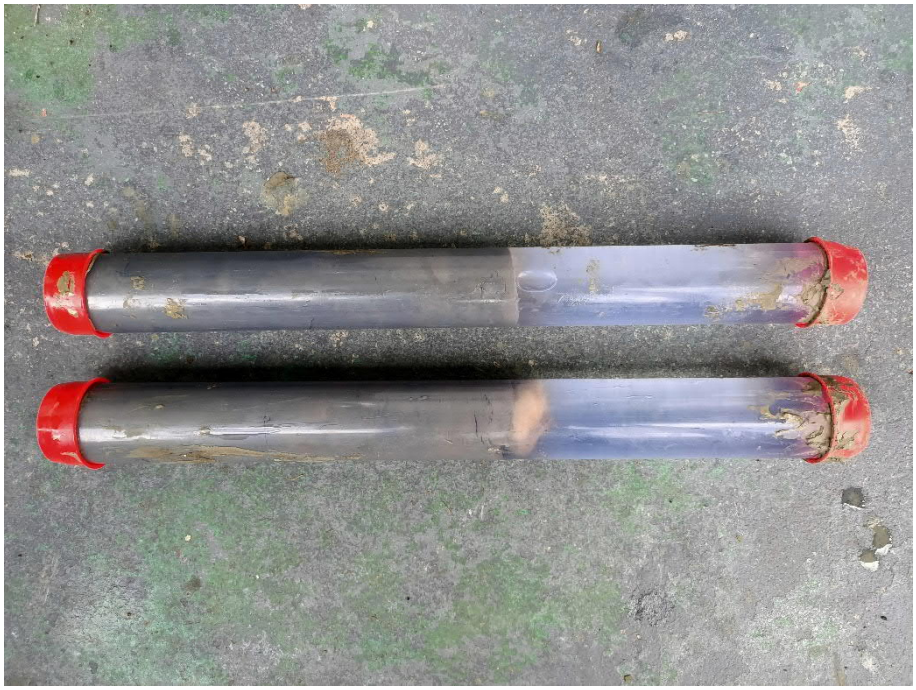
Sample Interval:
0.00 – 1.5 m

Description:
Cores ordered sequentially from BH-SWTP-01 (L) to BH-SWTP-07 (R)

Site Location: Corio Bay, Geelong	Project No: 60642423	Site Name: Viva Energy Gas Terminal Project

Plate 35 **Area:** Ambient baseline **Bore ID:** BH-OH-01 **Sample Interval:** 0.00 – 0.50 m **Description:**	
Plate 36 **Area:** Ambient baseline **Bore ID:** BH-OH-02 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 37 **Area:** Ambient baseline **Bore ID:** BH-OH-03 **Sample Interval:** 0.00 – 0.50 m **Description:** Biota at top of sample	
Plate 38 **Area:** Ambient baseline **Bore ID:** BH-OH-03 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 39 **Area:** Ambient baseline **Bore ID:** BH-OH-04 **Sample Interval:** 0.00 – 0.50 m **Description:**	
Plate 40 **Area:** Ambient baseline **Bore ID:** BH-OH-09 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 41 **Area:** Ambient baseline **Bore ID:** BH-OH-10 **Sample Interval:** 0.00 – 0.50 m **Description:**	
Plate 42 **Area:** Ambient baseline **Bore ID:** BH-OH-11 **Sample Interval:** 0.00 – 0.50 m **Description:** Minimal sample return. Core progressed the full length of sample tube, however minimal recovery.	

Site Location: Corio Bay, Geelong	Project No: 60642423	Site Name: Viva Energy Gas Terminal Project

Plate 43 **Area:** Ambient baseline **Bore ID:** BH-OH-14 **Sample Interval:** 0.00 – 0.50 m **Description:**	
Plate 44 **Area:** Disposal Ground **Bore ID:** BH-DG-01 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Site Location: Corio Bay, Geelong	**Project No:** 60642423	**Site Name:** Viva Energy Gas Terminal Project

Plate 45 **Area:** Disposal Ground **Bore ID:** BH-DG-02 **Sample Interval:** 0.00 – 0.50 m **Description:**	
Plate 46 **Area:** Disposal Ground **Bore ID:** BH-DG-03 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Site Location:	Project No:	Site Name:
Corio Bay, Geelong	60642423	Viva Energy Gas Terminal Project

Plate 47 **Area:** Disposal Ground **Bore ID:** BH-DG-04 **Sample Interval:** 0.00 – 0.50 m **Description:** Core sample note biota (worm) in sample (L).	
Plate 48 **Area:** Disposal Ground **Bore ID:** BH-DG-05 **Sample Interval:** 0.00 – 0.50 m **Description:**	

Appendix G

Laboratory Reports

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As,Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	X	X	X														
277161-13	BH-BP-21_3.0-4.0			Elutriate	X	X	X														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	X	X	X														
277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	X	X	X														
277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	X	X	X														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	X	X	X														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	X	X	X														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	X	X	X														
276959-23	QC109_210831			Elutriate	X	X	X														

☐ x

Relinquished by (Company):	Received by (Company): DLS	*Lab Use Only*	
Print Name:	Print Name: Aileen	Job number: 276673-A	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Due 23/9/21.

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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16-18 Hayden Crt, Myaree, WA 6154
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Melbourne Lab - Envirolab Services
25 Research Drive, Croydon South, VIC 3136
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Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
08 7087 6800 | adelaide@envirolab.com.au

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose:	Standard	Same Day	1 day	2 day	3 day
	☐	☐	☐	☐	☑

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling												Comments: Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X												Use seawater provided with lab job 276460 for elutriate tumbling
276959-1	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X												
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X												
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X												
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X												
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X												
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X												
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X												
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X												
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X												
276959-7	QC108_210830			Elutriate															
☐	x																		

Relinquished by (Company):	Received by (Company): BLS	Lab Use Only	
Print Name:	Print Name: Aileen	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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

CERTIFICATE OF ANALYSIS 276673-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 2 Samples
Date samples received	01/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total			
Our Reference		276673-A-27	276673-A-32
Your Reference	UNITS	BH-SB-31_0.5-1.0_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021
Type of sample		Sediment	Sediment
Date prepared	-	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9
pH of Elutriate after tumbling	pH units	8.2	8.2
Antimony-Total (Elutriate)	µg/L	2	<1
Arsenic-Total (Elutriate)	µg/L	<1	<1
Lead-Total (Elutriate)	µg/L	<1	[NA]
Mercury-Total (Elutriate)	µg/L	<0.05	[NA]
Nickel-Total (Elutriate)	µg/L	2	<1

PFAS in Elutriate Trace Extended			
Our Reference		276673-A-27	276673-A-32
Your Reference	UNITS	BH-SB-31_0.5-1.0_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021
Type of sample		Sediment	Sediment
Date prepared	-	22/09/2021	22/09/2021
Date analysed	-	22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	0.0009
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0042	0.0022
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.001	0.0008
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0008	0.0008
Perfluorononanoic acid	µg/L	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	101	101
Surrogate $^{13}C_2$ *PFOA*	%	99	97
Extracted ISTD $^{13}C_3$ *PFBS*	%	80	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	70	79

PFAS in Elutriate Trace Extended			
Our Reference		276673-A-27	276673-A-32
Your Reference	UNITS	BH-SB-31_0.5-1.0_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021
Type of sample		Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	31	27
Extracted ISTD $^{13}C_3$ *PFPeA*	%	74	77
Extracted ISTD $^{13}C_2$ *PFHxA*	%	85	92
Extracted ISTD $^{13}C_4$ *PFHpA*	%	108	116
Extracted ISTD $^{13}C_4$ *PFOA*	%	96	99
Extracted ISTD $^{13}C_5$ *PFNA*	%	89	96
Extracted ISTD $^{13}C_2$ *PFDA*	%	89	98
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	89	97
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	79	81
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	73	99
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	143	150
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	125	129
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	124	139
Extracted ISTD $^{13}C_8$ *FOSA*	%	64	52
Extracted ISTD d_3 *N MeFOSA*	%	43	50
Extracted ISTD d_5 *N EtFOSA*	%	42	43
Extracted ISTD d_7 *N MeFOSE*	%	62	68
Extracted ISTD d_9 *N EtFOSE*	%	58	65
Extracted ISTD d_3 *N MeFOSAA*	%	97	60
Extracted ISTD d_5 *N EtFOSAA*	%	102	98
Total Positive PFHxS & PFOS	µg/L	0.0055	0.0031
Total Positive PFOS & PFOA	µg/L	0.0050	0.0030
Total Positive PFAS	µg/L	0.0072	0.0047

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/09/2021	27	23/09/2021	23/09/2021		23/09/2021	[NT]
Date analysed	-			23/09/2021	27	23/09/2021	23/09/2021		23/09/2021	[NT]
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	27	2	2	0	106	[NT]
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	27	<1	<1	0	108	[NT]
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	27	<1	<1	0	105	[NT]
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	27	<0.05	<0.05	0	108	[NT]
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	27	2	2	0	101	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	27	22/09/2021	22/09/2021		22/09/2021	[NT]
Date analysed	-			22/09/2021	27	22/09/2021	22/09/2021		22/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	27	<0.0004	<0.0004	0	99	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	27	<0.001	<0.001	0	108	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	27	0.001	0.001	0	104	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	27	<0.001	<0.001	0	99	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.002	27	0.0042	0.0044	5	113	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	83	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	94	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	83	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	27	0.001	0.0009	11	115	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	27	<0.0004	<0.0004	0	86	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	27	0.0008	0.0009	12	105	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	27	<0.001	<0.001	0	116	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	92	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	102	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	27	<0.005	<0.005	0	100	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	27	<0.01	<0.01	0	107	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	27	<0.05	<0.05	0	100	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	27	<0.001	<0.001	0	78	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	27	<0.0004	<0.0004	0	98	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	27	<0.0004	<0.0004	0	108	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	97	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	27	<0.01	<0.01	0	88	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	27	<0.005	<0.005	0	95	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	27	<0.01	<0.01	0	93	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	27	<0.005	<0.005	0	100	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	27	<0.05	<0.05	0	95	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	83	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	27	<0.002	<0.002	0	98	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	27	101	102	1	107	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	27	99	96	3	99	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	72	27	80	80	0	85	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	87	27	93	91	2	94	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	72	27	70	77	10	74	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	34	27	31	29	7	32	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	78	27	74	72	3	77	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	85	27	85	86	1	92	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	107	27	108	106	2	116	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	89	27	96	95	1	94	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	87	27	89	93	4	95	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	88	27	89	93	4	94	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	84	27	89	92	3	95	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	74	27	79	84	6	89	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	77	27	73	71	3	102	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	132	27	143	142	1	141	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	27	125	124	1	111	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	134	27	124	137	10	117	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	61	27	64	67	5	64	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	35	27	43	47	9	45	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	32	27	42	43	2	42	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	51	27	62	66	6	62	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	51	27	58	61	5	60	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	102	27	97	96	1	92	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	27	102	98	4	95	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	276673-A
Date Sample Received	01/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 2 Samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-BP-19_0.0-0.5_210826			✓
BH-BP-19_0.5-1.0_210826			✓
BH-BP-19_1.0-1.5_210826			✓
BH-BP-19_1.5-2.0_210826			✓
BH-BP-19_2.0-2.5_210826			✓
BH-BP-19_2.5-3.0_210826			✓
BH-BP-19_3.5-4.0_210826			✓
BH-BP-19_4.5-5.0_210826			✓
BH-BP-19_5.5-6.0_210826			✓
BH-BP-19_6.5-7.0_210826			✓
PW-BP-19_210826			✓
QC104 _210826			✓
QC306_210826			✓
QC204_210826			✓
BH-SB-30_0.0-0.5_210827			✓
BH-SB-30_0.5-1.0_210827			✓
BH-SB-30_1.0-1.5_210827			✓
BH-SB-30_1.5-2.0_210827			✓
BH-SB-30_2.0-2.5_210827			✓
BH-SB-30_2.5-3.0_210827			✓
BH-SB-30_3.5-4.0_210827			✓
BH-SB-30_4.5-5.0_210827			✓
PW-SB-30_210827			✓
QC106_210827			✓
QC307_210827			✓
BH-SB-31_0.0-0.5_210827			✓
BH-SB-31_0.5-1.0_210827	✓	✓	
BH-SB-31_1.0-1.5_210827			✓
BH-SB-31_1.5-2.0_210827			✓
BH-SB-31_2.0-2.5_210827			✓
BH-SB-31_2.5-3.0_210827			✓
BH-SB-31_3.5-4.0_210827	✓	✓	

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Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-SB-31_4.5-5.0_210827			✓
PW-SB-31_210827			✓
QC105_210827			✓
QC404_210827			✓

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

Additional Info

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

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

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National phone number 1300 424 344

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Brisbane Office - Envirolab Services
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Darwin Office - Envirolab Services
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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No.: 21SY185_Rev1

Date results required:

Or choose:	Standard	Same Day	1 day	2 day	3 day
	☐	☐	☐	☐	☑

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As,Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	x	x	x														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	x	x	x														
277161-13	BH-BP-21_3.0-4.0			Elutriate	x	x	x														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	x	x	x														
277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	x	x	x														
277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	x	x	x														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	x	x	x														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	x	x	x														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	x	x	x														
276959-23	QC109_210831			Elutriate	x	x	x														

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Aileen	Job number: 276959-A	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Due: 23/9/21

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
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Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
PO No. (if applicable):	
Envirolab Quote No. :	21SY185_Rev1
Date results required:	
Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Additional report format:	☑ Esdat ☐ Equis
Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-15	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X														
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X														
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X														
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X														
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X														
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X														
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X														
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X														
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X														
276959-7	QC108_210830			Elutriate																	
☐	x																				

Relinquished by (Company):	Received by (Company):	ELS	*Lab Use Only*
Print Name:	Print Name:	Aileen	Job number: / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time:	20/9/21 AM.	Temperature: / Security seal: Intact / Broken / None
Signature:	Signature:		TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

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CERTIFICATE OF ANALYSIS 276959-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 4 samples
Date samples received	02/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total					
Our Reference		276959-A-1	276959-A-5	276959-A-7	276959-A-9
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.2	8.3	8.2	8.0
Antimony-Total (Elutriate)	µg/L	4	<1	3	4
Arsenic-Total (Elutriate)	µg/L	<1	<1	<1	<1
Lead-Total (Elutriate)	µg/L	<1	[NA]	<1	<1
Mercury-Total (Elutriate)	µg/L	<0.05	[NA]	<0.05	<0.05
Nickel-Total (Elutriate)	µg/L	1	<1	1	1

PFAS in Elutriate Trace Extended					
Our Reference		276959-A-1	276959-A-5	276959-A-7	276959-A-9
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Date analysed	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0009	0.0008	0.001	0.001
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0033	0.002	0.0023	0.0038
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.001	0.0008	0.0009	0.002
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0009	0.0007	0.0009	0.001
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	104	100	98	100
Surrogate $^{13}C_2$ *PFOA*	%	96	96	97	97
Extracted ISTD $^{13}C_3$ *PFBS*	%	81	81	76	72
Extracted ISTD $^{18}O_2$ *PFHxS*	%	92	92	81	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	72	77	74	78

PFAS in Elutriate Trace Extended					
Our Reference		276959-A-1	276959-A-5	276959-A-7	276959-A-9
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	27	30	26	29
Extracted ISTD $^{13}C_3$ *PFPeA*	%	68	79	63	67
Extracted ISTD $^{13}C_2$ *PFHxA*	%	83	89	75	78
Extracted ISTD $^{13}C_4$ *PFHpA*	%	107	110	98	102
Extracted ISTD $^{13}C_4$ *PFOA*	%	96	96	85	88
Extracted ISTD $^{13}C_5$ *PFNA*	%	88	92	83	87
Extracted ISTD $^{13}C_2$ *PFDA*	%	87	95	85	90
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	84	93	80	94
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	77	84	77	92
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	77	93	82	80
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	125	146	113	117
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	112	122	106	105
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	104	122	107	115
Extracted ISTD $^{13}C_8$ *FOSA*	%	62	53	59	72
Extracted ISTD d_3 *N MeFOSA*	%	40	41	34	42
Extracted ISTD d_5 *N EtFOSA*	%	40	40	32	41
Extracted ISTD d_7 *N MeFOSE*	%	60	60	58	72
Extracted ISTD d_9 *N EtFOSE*	%	58	58	57	68
Extracted ISTD d_3 *N MeFOSAA*	%	81	68	78	98
Extracted ISTD d_5 *N EtFOSAA*	%	83	98	79	99
Total Positive PFHxS & PFOS	µg/L	0.0042	0.0026	0.0033	0.0053
Total Positive PFOS & PFOA	µg/L	0.0042	0.0025	0.0032	0.0053
Total Positive PFAS	µg/L	0.0061	0.0041	0.0052	0.0084

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	276959-A-5
Date prepared	-			23/09/2021	1	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Date analysed	-			23/09/2021	1	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	1	4	6	40	106	86
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	1	<1	3	100	108	111
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	1	<1	<1	0	105	[NT]
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	108	[NT]
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	1	1	3	100	101	84

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	276959-A-5
Date prepared	-			22/09/2021	1	22/09/2021	22/09/2021		22/09/2021	22/09/2021
Date analysed	-			22/09/2021	1	22/09/2021	22/09/2021		22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	99	93
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	108	102
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	1	0.0009	0.0009	0	104	98
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	99	97
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.002	1	0.0033	0.002	49	113	99
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	83	85
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	94	90
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	83	84
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	1	0.001	0.0009	11	115	115
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	86	91
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	1	0.0009	0.0008	12	105	100
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	116	120
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	92	90
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	102	99
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	100	97
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	107	101
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	100	101
4:2 FTS	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	78	82
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	98	96
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	108	105
10:2 FTS	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	97	80
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	88	88
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	95	100
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	93	96
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	100	105
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	95	99
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	83	83
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	98	101
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	1	104	90	14	107	99
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	1	96	100	4	99	98

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	276959-A-5
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	72	1	81	77	5	85	78
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	87	1	92	90	2	94	90
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	72	1	72	79	9	74	73
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	34	1	27	27	0	32	28
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	78	1	68	67	1	77	75
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	85	1	83	83	0	92	86
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	107	1	107	104	3	116	106
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	89	1	96	91	5	94	90
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	87	1	88	93	6	95	85
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	88	1	87	90	3	94	88
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	84	1	84	89	6	95	84
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	74	1	77	81	5	89	79
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	77	1	77	82	6	102	89
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	132	1	125	115	8	141	148
Extracted ISTD$^{13}C_2$ 6:2FTS	%		Org-029	114	1	112	105	6	111	114
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	134	1	104	114	9	117	119
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	61	1	62	64	3	64	53
Extracted ISTD d_3 N MeFOSA	%		Org-029	35	1	40	44	10	45	42
Extracted ISTD d_5 N EtFOSA	%		Org-029	32	1	40	41	2	42	40
Extracted ISTD d_7 N MeFOSE	%		Org-029	51	1	60	65	8	62	62

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	276959-A-5
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	51	1	58	61	5	60	61
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	102	1	81	84	4	92	72
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	1	83	89	7	95	94

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	276959-A
Date Sample Received	02/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 4 samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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

Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-SB-32_0.0-1.0_210830	✓	✓	
BH-SB-32_1.0-1.5_210830			✓
BH-SB-32_1.7-2.0_210830			✓
BH-SB-32_2.0-2.5_210830			✓
BH-SB-32_2.5-3.0_210830	✓	✓	
PW-SB-32_210830			✓
QC108_210830	✓	✓	
QC406_210830			✓
BH-SB-33_1.5-2.0_210830	✓	✓	
BH-SB-33_2.0-2.5_210830			✓
BH-SB-33_2.5-3.0_210830			✓
BH-SB-33_3.0-4.0_210830			✓
BH-SB-33_4.0-5.0_210830			✓
PW-SB-33_210830			✓
QC107_210830			✓
QC308_210830			✓
QC309_210831			✓
BH-BP-22_3.0-4.0_210831			✓
BH-BP-22_4.0-5.0_210831			✓
BH-BP-22_5.0-6.0_210831			✓
BH-BP-22_6.0-7.0_210831			✓
PW-BP-22_210831			✓
QC109_210831	✓	✓	
BH-SB-32_0.0-1.0_210830 - [TRIPLICATE]			✓

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

Additional Info

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

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

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

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

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
PO No. (if applicable):	
Envirolab Quote No. :	21SY185_Rev1
Date results required:	
Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Additional report format:	☑ Esdat ☐ Equis
Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	X	X	X														
277161-13	BH-BP-21_3.0-4.0			Elutriate	X	X	X														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	X	X	X														
277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	X	X	X														
277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	X	X	X														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	X	X	X														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	X	X	X														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	X	X	X														
276959-23	QC109_210831			Elutriate	X	X	X														

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Aileen	Job number: 277161-A	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

DJe 23/9/21

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-1	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X														
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X														
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X														
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X														
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X														
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X														
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X														
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X														
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X														
276959-7	QC108_210830			Elutriate																	

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Alison	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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CERTIFICATE OF ANALYSIS 277161-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 4 Samples
Date samples received	03/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total					
Our Reference		277161-A-1	277161-A-10	277161-A-12	277161-A-13
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.4	8.2	8.4	8.3
Antimony-Total (Elutriate)	µg/L	3	2	11	2
Arsenic-Total (Elutriate)	µg/L	<1	<1	19	2
Lead-Total (Elutriate)	µg/L	<1	<1	<1	[NA]
Mercury-Total (Elutriate)	µg/L	<0.05	<0.05	<0.05	[NA]
Nickel-Total (Elutriate)	µg/L	2	1	2	1

PFAS in Elutriate Trace Extended					
Our Reference		277161-A-1	277161-A-10	277161-A-12	277161-A-13
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Date analysed	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	0.002	0.0006	0.0008
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0038	0.0088	0.0006	0.001
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.001	0.001	0.0009	0.0007
Perfluoroheptanoic acid	µg/L	<0.0004	0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0008	0.002	0.0006	0.0006
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	100	97	100
Surrogate $^{13}C_2$ *PFOA*	%	97	97	97	101
Extracted ISTD $^{13}C_3$ *PFBS*	%	75	74	74	82
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89	88	86	88
Extracted ISTD $^{13}C_4$ *PFOS*	%	76	75	78	77

PFAS in Elutriate Trace Extended					
Our Reference		277161-A-1	277161-A-10	277161-A-12	277161-A-13
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	28	28	#	27
Extracted ISTD $^{13}C_3$ *PFPeA*	%	63	65	50	68
Extracted ISTD $^{13}C_2$ *PFHxA*	%	81	76	65	86
Extracted ISTD $^{13}C_4$ *PFHpA*	%	100	99	96	107
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	88	85	93
Extracted ISTD $^{13}C_5$ *PFNA*	%	89	88	88	94
Extracted ISTD $^{13}C_2$ *PFDA*	%	88	88	88	96
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	92	96	94	95
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	85	88	86	90
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	81	80	82	97
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	152	132	112	146
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	122	107	99	115
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	124	117	109	125
Extracted ISTD $^{13}C_8$ *FOSA*	%	57	62	65	64
Extracted ISTD d_3 *N MeFOSA*	%	28	42	44	44
Extracted ISTD d_5 *N EtFOSA*	%	26	42	43	44
Extracted ISTD d_7 *N MeFOSE*	%	54	60	69	69
Extracted ISTD d_9 *N EtFOSE*	%	51	58	65	64
Extracted ISTD d_3 *N MeFOSAA*	%	101	96	80	94
Extracted ISTD d_5 *N EtFOSAA*	%	102	104	92	111
Total Positive PFHxS & PFOS	µg/L	0.0051	0.010	0.001	0.002
Total Positive PFOS & PFOA	µg/L	0.0046	0.010	0.001	0.002
Total Positive PFAS	µg/L	0.0069	0.014	0.0027	0.0033

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Date analysed	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	108	[NT]
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.002	[NT]	[NT]	[NT]	[NT]	113	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	115	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	116	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	100	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	78	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	108	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	88	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	95	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	93	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	95	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	107	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	85	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	87	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	34	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	107	[NT]	[NT]	[NT]	[NT]	116	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	87	[NT]	[NT]	[NT]	[NT]	95	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	95	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	74	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	77	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	132	[NT]	[NT]	[NT]	[NT]	141	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	[NT]	[NT]	[NT]	[NT]	111	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	134	[NT]	[NT]	[NT]	[NT]	117	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	61	[NT]	[NT]	[NT]	[NT]	64	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	35	[NT]	[NT]	[NT]	[NT]	45	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	32	[NT]	[NT]	[NT]	[NT]	42	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	51	[NT]	[NT]	[NT]	[NT]	62	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	51	[NT]	[NT]	[NT]	[NT]	60	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277161-A
Date Sample Received	03/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 4 Samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-BP-20_0.0-1.0_210901	✓	✓	
BH-BP-20_1.0-1.5_210901			✓
BH-BP-20_1.5-2.0_210901			✓
BH-BP-20_2.0-3.0_210901			✓
BH-BP-20_3.0-4.0_210901			✓
BH-BP-20_4.0-5.0_210901			✓
BH-BP-20_5.0-6.0_210901			✓
PW-BP-20_210901			✓
QC110_210901			✓
BH-BP-21_0.0-1.0	✓	✓	
BH-BP-21_1.0-1.5			✓
BH-BP-21_2.0-3.0	✓	✓	
BH-BP-21_3.0-4.0	✓	✓	
BH-BP-21_4.0-5.0			✓
BH-BP-21_5.0-6.0			✓
PW-BP-21_210901			✓
QC111_210901			✓
QC310_210901			✓
QC408_210901			✓

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

Additional Info

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

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As,Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	X	X	X														
277161-13	BH-BP-21_3.0-4.0			Elutriate	X	X	X														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	X	X	X														
277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	X	X	X														
277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	X	X	X														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	X	X	X														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	X	X	X														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	X	X	X														
276959-23	QC109_210831			Elutriate	X	X	X														

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Arleen	Job number: 277486-A	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

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02 9910 6200 | sydney@envirolab.com.au

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

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
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Brisbane Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-1	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X														
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X														
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X														
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X														
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X														
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X														
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X														
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X														
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X														
276959-7	QC108_210830			Elutriate																	

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Aileen	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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CERTIFICATE OF ANALYSIS 277486-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 4 Samples
Date samples received	08/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total					
Our Reference		277486-A-3	277486-A-10	277486-A-14	277486-A-18
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.3	8.1	8.3	7.7
Antimony-Total (Elutriate)	µg/L	3	3	8	<1
Arsenic-Total (Elutriate)	µg/L	1	3	13	7
Lead-Total (Elutriate)	µg/L	1	<1	[NA]	[NA]
Mercury-Total (Elutriate)	µg/L	<0.05	<0.05	[NA]	[NA]
Nickel-Total (Elutriate)	µg/L	1	2	2	5

PFAS in Elutriate Trace Extended					
Our Reference		277486-A-3	277486-A-10	277486-A-14	277486-A-18
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	0.002	0.0008	0.0008
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0022	0.0045	0.001	0.001
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.001	0.001	0.0008	0.0009
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0009	0.0022	0.0009	0.0008
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	97	93	94	91
Surrogate $^{13}C_2$ *PFOA*	%	97	101	102	99
Extracted ISTD $^{13}C_3$ *PFBS*	%	81	80	81	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	88	93	82
Extracted ISTD $^{13}C_4$ *PFOS*	%	76	75	80	71

PFAS in Elutriate Trace Extended					
Our Reference		277486-A-3	277486-A-10	277486-A-14	277486-A-18
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	21	27	22	#
Extracted ISTD $^{13}C_3$ *PFPeA*	%	56	68	61	46
Extracted ISTD $^{13}C_2$ *PFHxA*	%	72	79	76	59
Extracted ISTD $^{13}C_4$ *PFHpA*	%	100	108	104	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	90	89	90	78
Extracted ISTD $^{13}C_5$ *PFNA*	%	89	86	91	77
Extracted ISTD $^{13}C_2$ *PFDA*	%	93	86	95	84
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	98	92	100	88
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	93	78	92	83
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	81	68	75	84
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	92	106	104	96
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	140	123	126	106
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	146	134	147	120
Extracted ISTD $^{13}C_8$ *FOSA*	%	59	60	63	48
Extracted ISTD d_3 *N MeFOSA*	%	26	33	47	35
Extracted ISTD d_5 *N EtFOSA*	%	24	31	46	34
Extracted ISTD d_7 *N MeFOSE*	%	53	60	71	51
Extracted ISTD d_9 *N EtFOSE*	%	50	53	63	48
Extracted ISTD d_3 *N MeFOSAA*	%	118	92	90	83
Extracted ISTD d_5 *N EtFOSAA*	%	116	92	101	82
Total Positive PFHxS & PFOS	µg/L	0.0032	0.0064	0.0022	0.002
Total Positive PFOS & PFOA	µg/L	0.0031	0.0067	0.0023	0.002
Total Positive PFAS	µg/L	0.0052	0.0099	0.0038	0.0034

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	277486-A-10
Date prepared	-			23/09/2021	3	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Date analysed	-			23/09/2021	3	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	3	3	4	29	106	86
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	3	1	4	120	108	111
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	3	1	<1	0	105	72
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	3	<0.05	<0.05	0	108	100
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	3	1	<1	0	101	83

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	277486-A-10
Date prepared	-			23/09/2021	3	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Date analysed	-			23/09/2021	3	23/09/2021	23/09/2021		23/09/2021	23/09/2021
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	105	100
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	106	111
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	3	0.001	0.0009	11	96	96
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	101	107
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.0023	3	0.0022	0.002	10	115	104
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	85	86
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	103	98
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	90	89
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	3	0.001	0.001	0	123	119
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	98	92
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	3	0.0009	0.001	11	112	104
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	120	121
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	95	93
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	103	103
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	100	100
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	104	95
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	3	<0.05	<0.05	0	104	104
4:2 FTS	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	82	83
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	111	100
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	101	105
10:2 FTS	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	84	88
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	92	87
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	105	98
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	96	96
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	108	109
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	3	<0.05	<0.05	0	106	105
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	89	86
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	106	101
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	96	3	97	106	9	101	96
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	100	3	97	101	4	99	102

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	277486-A-10
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	76	3	81	79	2	74	75
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	83	3	85	90	6	91	82
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	70	3	76	71	7	76	71
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	33	3	21	20	5	31	23
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	79	3	56	53	6	75	59
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	88	3	72	69	4	84	71
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	106	3	100	98	2	104	96
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	91	3	90	88	2	89	84
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	88	3	89	88	1	91	83
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	86	3	93	90	3	91	83
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	85	3	98	93	5	89	87
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	74	3	93	83	11	81	71
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	73	3	81	80	1	74	61
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	113	3	92	98	6	87	75
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	128	3	140	127	10	106	109
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	147	3	146	141	3	127	124
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	62	3	59	63	7	65	60
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	32	3	26	29	11	47	45
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	30	3	24	29	19	46	40
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	46	3	53	56	6	58	62

QUALITY CONTROL: PFAS in Elutriate Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	277486-A-10
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	43	3	50	53	6	53	54
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	110	3	118	101	16	80	85
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	3	116	95	20	80	87

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA, MeFOSE and EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277486-A
Date Sample Received	08/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 4 Samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	11
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-SB-28_0.0-0.5_210906			✓
BH-SB-28_0.5-1.0_210906			✓
BH-SB-28_1.0-1.5_210906	✓	✓	
BH-SB-28_1.5-2.0_210906			✓
BH-SB-28_2.0-2.5_210906			✓
BH-SB-28_2.5-3.0_210906			✓
BH-SB-28_4.0-5.0_210906			✓
PW-SB-28_210906			✓
QC112_210906			✓
BH-SB-29_0.0-0.5_210906	✓	✓	
BH-SB-29_0.5-1.0_210906			✓
BH-SB-29_1.0-1.5_210906			✓
BH-SB-29_1.5-2.0_210906			✓
BH-SB-29_2.0-2.5_210906	✓	✓	
BH-SB-29_2.5-3.0_210906			✓
BH-SB-29_3.0-4.0_210906			✓
BH-SB-29_4.0-5.0_210906			✓
BH-SB-29_5.0-6.0_210906	✓	✓	
PW-SB-29_210906			✓
QC113 _210906			✓
QC311 _210906			✓
QC312_210906			✓
QC410_210906			✓

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

Additional Info

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

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

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Adelaide Office - Envirolab Services
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Brisbane Office - Envirolab Services
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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
PO No. (if applicable):	
Envirolab Quote No. :	21SY185_Rev1
Date results required:	
Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Additional report format:	☑ Esdat ☐ Equis
Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As,Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumpbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	X	X	X														
277161-13	BH-BP-21_3.0-4.0			Elutriate	X	X	X														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	X	X	X														
* 277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	X	X	X														
* 277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	X	X	X														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	X	X	X														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	X	X	X														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	X	X	X														
276959-23	QC109_210831			Elutriate	X	X	X														

☐ x

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Arleon	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

CHAIN OF CUSTODY FORM - Client

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Melbourne Lab - Envirolab Services
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Adelaide Office - Envirolab Services
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Brisbane Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-1	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X														
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X														
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X														
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X														
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X														
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X														
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X														
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X														
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X														
276959-7	QC108_210830			Elutriate																	
☐	x																				

Relinquished by (Company):	Received by (Company): ELS	*Lab Use Only*	
Print Name:	Print Name: Aleen	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 2019/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
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Melbourne Lab - Envirolab Services
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Brisbane Office - Envirolab Services
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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	Standard ☐ / Same Day ☐ / 1 day ☐ / 2 day ☐ / 3 day ☑
Address:		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Phone:	Mob: [redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Results to:	[redacted]	Lab Comments:	
Email Invoice to:	[redacted]		

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Cd, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling	Comments
[redacted]	BH-SWTP-01_0.0-1.5_210907			Elutriate	x	x	x	Provide as much information about the sample as you can
[redacted]	BH-SWTP-02_0.0-1.5_210907			Elutriate	x	x	x	
[redacted]	BH-SWTP-03_0.0-1.5_210907			Elutriate	x	x	x	
[redacted]	BH-SWTP-04_0.0-1.5_210907			Elutriate	x	x	x	
[redacted]	BH-SWTP-05_0.0-1.5_210907			Elutriate	x	x	x	
[redacted]	BH-SWTP-06_0.0-1.5_210907			Elutriate	x	x	x	
[redacted]	QC115 _210907			Elutriate	x	x	x	Use seawater provided with lab job 276460 for elutriate tumbling

☐ x

Relinquished by (Company):		Received by (Company):	Ateen
Print Name:		Print Name:	ELS
Date & Time:		Date & Time:	20/9/21
Signature:		Signature:	

Lab Use Only

Job number:	Cooling: Ice / Ice pack / None
Temperature:	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Envirolab Services Pty Ltd
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CERTIFICATE OF ANALYSIS 277569-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 10 Samples
Date samples received	09/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total						
Our Reference		277569-A-4	277569-A-8	277569-A-9	277569-A-23	277569-A-24
Your Reference	UNITS	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.4	8.4	8.3	7.9	8.1
Antimony-Total (Elutriate)	µg/L	6	5	3	7	3
Arsenic-Total (Elutriate)	µg/L	2	6	18	18	1
Cadmium-Total (Elutriate)	µg/L	[NA]	[NA]	[NA]	<0.1	<0.1
Lead-Total (Elutriate)	µg/L	1	[NA]	[NA]	<1	<1
Mercury-Total (Elutriate)	µg/L	<0.05	[NA]	[NA]	<0.05	<0.05
Nickel-Total (Elutriate)	µg/L	2	3	3	2	1

Elutriate analysis - total						
Our Reference		277569-A-25	277569-A-26	277569-A-27	277569-A-28	277569-A-30
Your Reference	UNITS	BH-SWTP-03_0.0-1.5_210907	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.2	8.3	8.0	7.9	8.2
Antimony-Total (Elutriate)	µg/L	7	9	3	2	3
Arsenic-Total (Elutriate)	µg/L	<1	<1	<1	<1	<1
Cadmium-Total (Elutriate)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Lead-Total (Elutriate)	µg/L	<1	<1	<1	<1	<1
Mercury-Total (Elutriate)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Total (Elutriate)	µg/L	2	<1	2	<1	2

PFAS in Elutriate Trace Extended						
Our Reference		277569-A-4	277569-A-8	277569-A-9	277569-A-23	277569-A-24
Your Reference	UNITS	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Date analysed	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	0.001	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.002	0.0006	0.0008	0.002	0.002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0083	0.0007	0.001	0.0060	0.0089
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.001	0.0007	0.0007	0.001	0.001
Perfluoroheptanoic acid	µg/L	0.0005	<0.0004	<0.0004	0.0005	0.0004
Perfluorooctanoic acid PFOA	µg/L	0.001	0.0006	0.0005	0.002	0.002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	92	101	101	102	98
Surrogate $^{13}C_2$ *PFOA*	%	95	95	94	96	98
Extracted ISTD $^{13}C_3$ *PFBS*	%	70	79	89	73	79
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	92	98	84	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	72	76	86	70	74

PFAS in Elutriate Trace Extended						
Our Reference		277569-A-4	277569-A-8	277569-A-9	277569-A-23	277569-A-24
Your Reference	UNITS	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_4$ *PFBA*	%	28	26	26	23	29
Extracted ISTD $^{13}C_3$ *PFPeA*	%	64	65	74	52	72
Extracted ISTD $^{13}C_2$ *PFHxA*	%	79	83	92	61	85
Extracted ISTD $^{13}C_4$ *PFHpA*	%	96	108	118	84	109
Extracted ISTD $^{13}C_4$ *PFOA*	%	86	94	104	78	93
Extracted ISTD $^{13}C_5$ *PFNA*	%	80	89	98	82	89
Extracted ISTD $^{13}C_2$ *PFDA*	%	81	93	102	80	91
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	84	96	104	77	91
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	75	89	99	62	84
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	59	81	85	54	72
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	117	116	160	94	142
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	98	100	130	80	121
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	100	109	137	101	129
Extracted ISTD $^{13}C_8$ *FOSA*	%	63	67	74	58	70
Extracted ISTD d_3 *N MeFOSA*	%	44	41	54	34	47
Extracted ISTD d_5 *N EtFOSA*	%	41	42	50	30	49
Extracted ISTD d_7 *N MeFOSE*	%	66	72	80	59	71
Extracted ISTD d_9 *N EtFOSE*	%	61	66	72	50	66
Extracted ISTD d_3 *N MeFOSAA*	%	83	80	113	67	95
Extracted ISTD d_5 *N EtFOSAA*	%	88	88	117	68	101
Total Positive PFHxS & PFOS	µg/L	0.0099	0.001	0.002	0.0078	0.010
Total Positive PFOS & PFOA	µg/L	0.0094	0.001	0.002	0.0075	0.011
Total Positive PFAS	µg/L	0.013	0.0027	0.0031	0.012	0.014

PFAS in Elutriate Trace Extended						
Our Reference		277569-A-25	277569-A-26	277569-A-27	277569-A-28	277569-A-30
Your Reference	UNITS	BH-SWTP-03_0.0-1.5_210907	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Date analysed	-	22/09/2021	22/09/2021	22/09/2021	22/09/2021	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	0.001	0.001	0.0023	0.001
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0060	0.0040	0.0056	0.0099	0.0067
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0009	0.001	0.001	0.001	0.001
Perfluoroheptanoic acid	µg/L	0.0004	<0.0004	0.0004	0.0006	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.001	0.001	0.001	0.0026	0.001
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	97	103	97	106	101
Surrogate $^{13}C_2$ *PFOA*	%	97	98	96	97	100
Extracted ISTD $^{13}C_3$ *PFBS*	%	74	72	78	74	72
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	79	87	89	82
Extracted ISTD $^{13}C_4$ *PFOS*	%	73	65	73	74	66
Extracted ISTD $^{13}C_4$ *PFBA*	%	31	31	30	27	30

PFAS in Elutriate Trace Extended						
Our Reference		277569-A-25	277569-A-26	277569-A-27	277569-A-28	277569-A-30
Your Reference	UNITS	BH-SWTP-03_0.0-1.5_210907	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_3$ *PFPeA*	%	72	73	72	65	68
Extracted ISTD $^{13}C_2$ *PFHxA*	%	84	82	85	81	79
Extracted ISTD $^{13}C_4$ *PFHpA*	%	101	97	100	98	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	88	82	88	90	85
Extracted ISTD $^{13}C_5$ *PFNA*	%	83	77	83	87	79
Extracted ISTD $^{13}C_2$ *PFDA*	%	82	81	83	91	77
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	84	83	82	88	77
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	77	75	70	76	73
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	66	64	60	58	58
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	139	131	130	119	124
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	109	104	109	107	105
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	111	102	105	115	105
Extracted ISTD $^{13}C_8$ *FOSA*	%	63	63	61	60	56
Extracted ISTD d_3 *N MeFOSA*	%	35	38	40	36	28
Extracted ISTD d_5 *N EtFOSA*	%	34	37	37	33	28
Extracted ISTD d_7 *N MeFOSE*	%	60	59	59	56	50
Extracted ISTD d_9 *N EtFOSE*	%	51	56	55	52	45
Extracted ISTD d_3 *N MeFOSAA*	%	90	95	82	88	79
Extracted ISTD d_5 *N EtFOSAA*	%	88	95	80	86	79
Total Positive PFHxS & PFOS	µg/L	0.0074	0.0052	0.0071	0.012	0.0082
Total Positive PFOS & PFOA	µg/L	0.0073	0.0051	0.0070	0.013	0.0079
Total Positive PFAS	µg/L	0.010	0.0073	0.010	0.017	0.010

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Date analysed	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Cadmium-Total (Elutriate)	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	108	[NT]
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.002	[NT]	[NT]	[NT]	[NT]	113	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	115	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	116	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	100	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	78	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	108	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	88	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	95	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	93	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	95	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	107	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	85	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	87	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	34	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	107	[NT]	[NT]	[NT]	[NT]	116	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	87	[NT]	[NT]	[NT]	[NT]	95	[NT]
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	95	[NT]
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	74	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	77	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	132	[NT]	[NT]	[NT]	[NT]	141	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	114	[NT]	[NT]	[NT]	[NT]	111	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	134	[NT]	[NT]	[NT]	[NT]	117	[NT]
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	61	[NT]	[NT]	[NT]	[NT]	64	[NT]
Extracted ISTD d_3 N MeFOSA	%		Org-029	35	[NT]	[NT]	[NT]	[NT]	45	[NT]
Extracted ISTD d_5 N EtFOSA	%		Org-029	32	[NT]	[NT]	[NT]	[NT]	42	[NT]
Extracted ISTD d_7 N MeFOSE	%		Org-029	51	[NT]	[NT]	[NT]	[NT]	62	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	51	[NT]	[NT]	[NT]	[NT]	60	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277569-A
Date Sample Received	09/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 10 Samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	15
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-SB-33_0.0-0.5_2108			✓
BH-SB-33_0.5-1.0_2108			✓
BH-SB-33_1.0-1.5_2108			✓
BH-SB-34_0.0-0.5_210907	✓	✓	
BH-SB-34_0.5-1.0_210907			✓
BH-SB-34_1.0-1.5_210907			✓
BH-SB-34_1.5-2.0_210907			✓
BH-SB-34_2.0-2.5_210907	✓	✓	
BH-SB-34_2.5-3.0_210907	✓	✓	
BH-SB-34_3.0-4.5_210907			✓
PW-SB-34_210907			✓
QC114_210907			✓
BH-SB-35_0.0-0.5_210907			✓
BH-SB-35_0.5-1.0_210907			✓
BH-SB-35_1.0-1.5_210907			✓
BH-SB-35_1.5-2.0_210907			✓
BH-SB-35_2.0-2.5_210907			✓
BH-SB-35_2.5-3.0_210907			✓
BH-SB-35_3.0-4.0_210907			✓
BH-SB-35_4.0-5.0_210907			✓
PW-SB-35_210907			✓
QC117_210907			✓
BH-SWTP-01_0.0-1.5_210907	✓	✓	
BH-SWTP-02_0.0-1.5_210907	✓	✓	
BH-SWTP-03_0.0-1.5_210907	✓	✓	
BH-SWTP-04_0.0-1.5_210907	✓	✓	
BH-SWTP-05_0.0-1.5_210907	✓	✓	
BH-SWTP-06_0.0-1.5_210907	✓	✓	
BH-SWTP-07_0.0-1.5_210907			✓
QC115 _210907	✓	✓	
QC116 _210907			✓
QC313_210907			✓

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Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
QC314_210907			✓
QC412_210907			✓
QC217_210906			✓

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

Additional Info

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

CHAIN OF CUSTODY FORM - Client

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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose:	Standard	Same Day	1 day	2 day	3 day
	☐	☐	☐	☐	☑

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Ni,)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling														Provide as much information about the sample as you can
276673-32	BH-SB-31_3.5-4.0_210827			Elutriate	X	X	X														Use seawater provided with lab job 276460 for elutriate tumbling
276959-5	BH-SB-32_2.5-3.0_210830			Elutriate	X	X	X														
277161-13	BH-BP-21_3.0-4.0			Elutriate	X	X	X														
277486-18	BH-SB-29_5.0-6.0_210906			Elutriate	X	X	X														
277569-8	BH-SB-34_2.0-2.5_210907			Elutriate	X	X	X														
277569-9	BH-SB-34_2.5-3.0_210907			Elutriate	X	X	X														
277707-6	BH-SB-36_2.5-3.0_210908			Elutriate	X	X	X														
277707-8	BH-BP-22_2.0-2.5_210908			Elutriate	X	X	X														
277486-14	BH-SB-29_2.0-2.5_210906			Elutriate	X	X	X														
276959-23	QC109_210831			Elutriate	X	X	X														

☐ x

Relinquished by (Company):	Received by (Company): ELS	Lab Use Only	
Print Name:	Print Name: Aileen	Job number: 277707-A	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

DUE: 23/9/21

CHAIN OF CUSTODY FORM - Client

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Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	Standard ☐ / Same Day ☐ / 1 day ☐ / 2 day ☐ / 3 day ☑
Address:		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Phone:	Mob: [redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Results to:	[redacted]	Lab Comments:	
Email Invoice to:	[redacted]		

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total Metals and metalloids: (Sb, As, Pb, Hg, Ni)	PFAS - Extended Suite (28 analytes)	Elutriate tumbling													Provide as much information about the sample as you can
276673-27	BH-SB-31_0.5-1.0_210827			Elutriate	X	X	X													Use seawater provided with lab job 276460 for elutriate tumbling
276959-1	BH-SB-32_0.0-1.0_210830			Elutriate	X	X	X													
276959-9	BH-SB-33_1.5-2.0_210830			Elutriate	X	X	X													
277161-1	BH-BP-20_0.0-1.0_210901			Elutriate	X	X	X													
277161-10	BH-BP-21_0.0-1.0			Elutriate	X	X	X													
277161-12	BH-BP-21_2.0-3.0			Elutriate	X	X	X													
277486-3	BH-SB-28_1.0-1.5_210906			Elutriate	X	X	X													
277486-10	BH-SB-29_0.0-0.5_210906			Elutriate	X	X	X													
277569-4	BH-SB-34_0.0-0.5_210907			Elutriate	X	X	X													
277707-7	BH-BP-22_0.0-0.5_210908			Elutriate	X	X	X													
276959-7	QC108_210830			Elutriate																

☐ x

Relinquished by (Company):	Received by (Company): FLS	Lab Use Only	
Print Name:	Print Name: Alpha	Job number:	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 20/9/21	Temperature:	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 277707-A

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 3 Samples
Date samples received	10/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Elutriate analysis - total				
Our Reference		277707-A-6	277707-A-7	277707-A-8
Your Reference	UNITS	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil
Date prepared	-	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021
pH of Elutriate	pH units	7.9	7.9	7.9
pH of Elutriate after tumbling	pH units	8.4	8.2	8.2
Antimony-Total (Elutriate)	µg/L	<1	4	1
Arsenic-Total (Elutriate)	µg/L	4	<1	2
Lead-Total (Elutriate)	µg/L	[NA]	<1	[NA]
Mercury-Total (Elutriate)	µg/L	[NA]	<0.05	[NA]
Nickel-Total (Elutriate)	µg/L	<1	2	4

PFAS in Elutriate Trace Extended				
Our Reference		277707-A-6	277707-A-7	277707-A-8
Your Reference	UNITS	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil
Date prepared	-	23/09/2021	23/09/2021	23/09/2021
Date analysed	-	23/09/2021	23/09/2021	23/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0007	0.001	0.0008
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.002	0.0040	0.001
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0008	0.001	0.0009
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0008	0.002	0.0008
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	100	94
Surrogate $^{13}C_2$ *PFOA*	%	103	97	100
Extracted ISTD $^{13}C_3$ *PFBS*	%	84	84	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%	97	92	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	78	76	81

PFAS in Elutriate Trace Extended				
Our Reference		277707-A-6	277707-A-7	277707-A-8
Your Reference	UNITS	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil
Extracted ISTD $^{13}C_4$ *PFBA*	%	29	29	32
Extracted ISTD $^{13}C_3$ *PFPeA*	%	79	71	82
Extracted ISTD $^{13}C_2$ *PFHxA*	%	92	87	94
Extracted ISTD $^{13}C_4$ *PFHpA*	%	118	111	119
Extracted ISTD $^{13}C_4$ *PFOA*	%	99	97	102
Extracted ISTD $^{13}C_5$ *PFNA*	%	97	97	99
Extracted ISTD $^{13}C_2$ *PFDA*	%	96	98	99
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	88	107	96
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	77	91	83
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	91	81	79
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	115	100	114
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	136	127	129
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	146	153	139
Extracted ISTD $^{13}C_8$ *FOSA*	%	49	64	60
Extracted ISTD d_3 *N MeFOSA*	%	43	31	47
Extracted ISTD d_5 *N EtFOSA*	%	41	30	47
Extracted ISTD d_7 *N MeFOSE*	%	55	59	62
Extracted ISTD d_9 *N EtFOSE*	%	57	52	56
Extracted ISTD d_3 *N MeFOSAA*	%	80	115	95
Extracted ISTD d_5 *N EtFOSAA*	%	96	113	100
Total Positive PFHxS & PFOS	µg/L	0.0024	0.0051	0.002
Total Positive PFOS & PFOA	µg/L	0.0026	0.0058	0.002
Total Positive PFAS	µg/L	0.0041	0.0081	0.0035

Method ID	Methodology Summary
Elutriate	A sediment is extracted 1:4 with site water and tumbled for 1 hour. The sample is then centrifuged and or filtered and analysed. Please see report comments for more information.
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: Elutriate analysis - total					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Date analysed	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Antimony-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Arsenic-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Lead-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Mercury-Total (Elutriate)	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	108	[NT]
Nickel-Total (Elutriate)	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Date analysed	-			23/09/2021	[NT]	[NT]	[NT]	[NT]	23/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	0.0023	[NT]	[NT]	[NT]	[NT]	115	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	85	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	123	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	0.001	[NT]	[NT]	[NT]	[NT]	112	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	120	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	82	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	111	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	101	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	84	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	92	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	105	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	96	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	108	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	106	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	89	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	106	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	76	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	83	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	70	[NT]	[NT]	[NT]	[NT]	76	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	33	[NT]	[NT]	[NT]	[NT]	31	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	79	[NT]	[NT]	[NT]	[NT]	75	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	84	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	104	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	86	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	74	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	73	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	113	[NT]	[NT]	[NT]	[NT]	87	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	128	[NT]	[NT]	[NT]	[NT]	106	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	147	[NT]	[NT]	[NT]	[NT]	127	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	62	[NT]	[NT]	[NT]	[NT]	65	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	32	[NT]	[NT]	[NT]	[NT]	47	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	30	[NT]	[NT]	[NT]	[NT]	46	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	46	[NT]	[NT]	[NT]	[NT]	58	[NT]

QUALITY CONTROL: PFAS in Elutriate Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	43	[NT]	[NT]	[NT]	[NT]	53	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	110	[NT]	[NT]	[NT]	[NT]	80	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	80	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFBA, MeFOSA, EtFOSA, MeFOSE and EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Client supplied seawater used for reported blank and LCS.
Laboratory water blank all <PQL.

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www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277707-A
Date Sample Received	10/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 3 Samples
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	10
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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

Sample ID	Elutriate analysis - total	PFAS in Elutriate Trace Extended	On Hold
BH-SB-36_0.0-0.5_210908			✓
BH-SB-36_0.5-1.0_210908			✓
BH-SB-36_1.0-1.5_210908			✓
BH-SB-36_1.5-2.0_210908			✓
BH-SB-36_2.0-2.5_210908			✓
BH-SB-36_2.5-3.0_210908	✓	✓	
BH-BP-22_0.0-0.5_210908	✓	✓	
BH-BP-22_2.0-2.5_210908	✓	✓	
BH-BP-22_2.5-3.0_210908			✓
PW-SB-36_210908			✓
QC315 _210908			✓
QC414 _210908			✓

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

Additional Info

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

From: [redacted]olab.com.au>
Sent: [redacted] 9 PM
To: [redacted]
Cc: [redacted]
Subject: [EXTERNAL] RE: 21SY185_Rev1: elutriate and COCs

[redacted],
No luck. One sample had small little pockets of ~1mL amongst it. Others had some damp sediment under the clay, but not wet enough to extract. One I had hope for had sediment on top, but underneath was dry clumps of clay with lots of air pockets.

Kind Regards,

[redacted] | **Operations Manager | Envirolab Services**

Great Science. Great Service.

12 Ashley Street Chatswood NSW 2067
[redacted]
[redacted] **W** www.envirolab.com.au

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Samples will be analysed per our T&C's.

From: [redacted]
Sent: Tuesday, 21 September 2021 5:27 PM
To: [redacted]
[redacted]
Subject: RE: 21SY185_Rev1: elutriate and COCs

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi [redacted]

Thanks for the call. Please let me know how you go tomorrow with seeing if any water has settled out to the bottom.

Thanks,
[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

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From: [redacted]
Sent: Tuesday, 21 September 2021 4:53 PM
To: [redacted]
[redacted]
Subject: [EXTERNAL] RE: 21SY185_Rev1: elutriate and COCs

[redacted]
The guys have been working on those pore water samples today. They've managed to get one done, and are halfway through the second sample. They have however hit a snag. The remaining 5 samples are very dry, and I doubt we will be able to extract any water from them.
Please see attached photo. (I do have more of the other samples, but they are very large in size – I can send if required).
The only 2 we can therefore do are 277486-8 (PW-SB-28_210906) and 277569-11 (PW-SB-34_210907).

We should therefore be able to get the results of those two to you by COB Thursday.
Please feel free to call if you would like to discuss further.

Kind Regards,

[redacted] | **Operations Manager | Envirolab Services**

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12 Ashley Street Chatswood NSW 2067
[redacted] | **W** www.envirolab.com.au

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Please consider the environment before printing this email.

Samples will be analysed per our T&C's.

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This e-mail message has been scanned for Viruses

From: [redacted]
Sent: Monday, 20 September 2021 3:26 PM
To: [redacted]
[redacted]
Subject: RE: 21SY185_Rev1: elutriate and COCs

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi [redacted]

David and I chatted and he sorted out my question (thanks!)

Please find attached the COC for elutriate and porewater analysis. All are marked for 3-day TAT.
[redacted] know that the 3-day TAT for porewater will be dependent on how quickly water can be extracted.

Thanks,
[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

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From: [redacted]
Sent: Monday, 20 September 2021 10:50 AM
To: [redacted]
Subject: 21SY185_Rev1: query about elutriate

Hi [redacted],

We're just about ready to schedule the elutriate and porewater analysis, but will you please clarify if 2L of seawater is required for each elutriate sample regardless of how many analytical suites are requested?

At this point, only certain metals and the PFAS suite will be requested. 20L of seawater were submitted, is it correct that a maximum of 10 elutriate samples can be requested?

Thanks,
[redacted]

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Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
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CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No.:	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)		Depth	Date Sampled	Type of Sample	Dissolved metals (Sb, As, Cd, Pb, Hg, Ni),	Chelex metals (Sb, As, Cd, Pb, Hg, Ni),	Arsenic - Speciated	PFAS - Extended Suite (28 Analytes) - Trace level	Ammonia (NH3) as N	Pore water extraction											Provide as much information about the sample as you can
276673-34	PW-SB-31_210827			Porewater	X	X	X	X	X	X											
276959-6	PW-SB-32_210830			Porewater	X	X	X	X	X	X											
277161-16	PW-BP-21_210901			Porewater	X	X	X	X	X	X											
277161-8	PW-BP-20_210901			Porewater	X	X	X	X	X	X											
277486-19 [redacted]	PW-SB-29_210906			Porewater	X	X	X	X	X	X											
277486-8 [redacted]	PW-SB-28_210906			Porewater	X	X	X	X	X	X											
277569-11	PW-SB-34_210907			Porewater	X	X	X	X	X	X											

☐ x

Relinquished by (Company):	Received by (Company):	ELS	Lab Use Only
Print Name:	Print Name:	Aileen	Job number: 277486-B / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time:	20/9/21	Temperature: / Security seal: Intact / Broken / None
Signature:	Signature:		TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

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

CERTIFICATE OF ANALYSIS 277486-B

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 2 Sample
Date samples received	08/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

HM in pore water - dissolved		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Antimony-Dissolved	µg/L	2
Arsenic-Dissolved	µg/L	6
Cadmium-Dissolved	µg/L	<0.1
Lead-Dissolved	µg/L	<1
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	2

Speciated Arsenic in pore water		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Arsenobetaine (ASB)	µg/L	<1
Arsenious Acid, As (III)	µg/L	3
Dimethylarsenic Acid (DMA)	µg/L	<1
Monomethylarsonic Acid (MMA)	µg/L	<1
Arsenic Acid, As (V)	µg/L	2

Metals 0.45µm Filtered Before Chelex		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Before Chelex	µg/L	<0.1
Nickel Before Chelex	µg/L	2
Lead Before Chelex	µg/L	<1
Mercury Before Chelex	µg/L	<0.1

Metals 0.45µm Filtered After Chelex		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium After Chelex	µg/L	<0.1
Nickel After Chelex	µg/L	1
Lead After Chelex	µg/L	<1
Mercury After Chelex	µg/L	<0.1

Metals 0.45µm Filtered Chelex Retained		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Chelex Retained	µg/L	[NT]
Nickel Chelex Retained	µg/L	<1
Lead Chelex Retained	µg/L	[NT]
Mercury Chelex Retained	µg/L	[NT]

Metals 0.45µm Filtered Chelex Retained %		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Chelex Retained	%	[NT]
Nickel Chelex Retained	%	15
Lead Chelex Retained	%	[NT]
Mercury Chelex Retained	%	[NT]

PFAS in Pore Water Trace Extended		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Perfluorobutanesulfonic acid	µg/L	0.001
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0046
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.02
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	0.003
Perfluoroheptanoic acid	µg/L	0.0008
Perfluorooctanoic acid PFOA	µg/L	0.0024
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	102
Surrogate $^{13}C_2$ *PFOA*	%	104
Extracted ISTD $^{13}C_3$ *PFBS*	%	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	82
Extracted ISTD $^{13}C_4$ *PFOS*	%	66
Extracted ISTD $^{13}C_4$ *PFBA*	%	#

PFAS in Pore Water Trace Extended		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Extracted ISTD $^{13}C_3$ *PFPeA*	%	34
Extracted ISTD $^{13}C_2$ *PFHxA*	%	46
Extracted ISTD $^{13}C_4$ *PFHpA*	%	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	70
Extracted ISTD $^{13}C_5$ *PFNA*	%	81
Extracted ISTD $^{13}C_2$ *PFDA*	%	79
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	80
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	72
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	71
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	136
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	126
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	134
Extracted ISTD $^{13}C_8$ *FOSA*	%	55
Extracted ISTD d_3 *N MeFOSA*	%	23
Extracted ISTD d_5 *N EtFOSA*	%	22
Extracted ISTD d_7 *N MeFOSE*	%	50
Extracted ISTD d_9 *N EtFOSE*	%	47
Extracted ISTD d_3 *N MeFOSAA*	%	87
Extracted ISTD d_5 *N EtFOSAA*	%	94
Total Positive PFHxS & PFOS	µg/L	0.0065
Total Positive PFOS & PFOA	µg/L	0.0069
Total Positive PFAS	µg/L	0.014

Miscellaneous Inorganics		
Our Reference		277486-B-8
Your Reference	UNITS	PW-SB-28_210906
Date Sampled		6/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Ammonia as N in pore water	mg/L	6.8

Method ID	Methodology Summary
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-021/022	Determination of various metals from an unpreserved sample by ICP-MS and CV-AAS following filtration and passing through a Chelex 100 resin column.
Metals-022	Determination of various metals by ICP-MS.
Metals-031	Analysis of Speciated forms of Arsenic using LC separation followed by ICP-MS analysis.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: HM in pore water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: Speciated Arsenic in pore water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Arsenobetaine (ASB)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Arsenious Acid, As (III)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Dimethylarsenic Acid (DMA)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Monomethylarsonic Acid (MMA)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Arsenic Acid, As (V)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Before Chelex					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium Before Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Nickel Before Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Lead Before Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	73	[NT]
Mercury Before Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered After Chelex					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium After Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	18	[NT]
Nickel After Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	14	[NT]
Lead After Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	3	[NT]
Mercury After Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	0	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Chelex Retained					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Chelex Retained %					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium Chelex Retained	%	1	Metals-021/022	[NT]	[NT]	[NT]	[NT]	[NT]	82	[NT]
Nickel Chelex Retained	%	1	Metals-021/022	[NT]	[NT]	[NT]	[NT]	[NT]	86	[NT]
Lead Chelex Retained	%	1	Metals-021/022	[NT]	[NT]	[NT]	[NT]	[NT]	95	[NT]
Mercury Chelex Retained	%	1	Metals-021/022	[NT]	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	109	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	112	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	107	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	96	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	110	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	99	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	101	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	104	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	77	[NT]	[NT]	[NT]	[NT]	76	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	80	[NT]	[NT]	[NT]	[NT]	80	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	73	[NT]	[NT]	[NT]	[NT]	70	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	87	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	84	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	93	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	87	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	83	[NT]	[NT]	[NT]	[NT]	79	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	82	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	86	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	82	[NT]	[NT]	[NT]	[NT]	80	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	63	[NT]	[NT]	[NT]	[NT]	65	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	129	[NT]	[NT]	[NT]	[NT]	131	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	105	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	116	[NT]	[NT]	[NT]	[NT]	111	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	64	[NT]	[NT]	[NT]	[NT]	57	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	30	[NT]	[NT]	[NT]	[NT]	34	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	28	[NT]	[NT]	[NT]	[NT]	33	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	50	[NT]	[NT]	[NT]	[NT]	51	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	47	[NT]	[NT]	[NT]	[NT]	50	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	86	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Ammonia as N in pore water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	[NT]	[NT]	112	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s). PFBA PQL raised.

MeFOSA, EtFOSA, MeFOSE, EtFOSE Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277486-B
Date Sample Received	08/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 2 Sample
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	11
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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12 Ashley St Chatswood NSW 2067
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Sample ID	HM in pore water - dissolved	HM in pore water - dissolved (Chelex)	Speciated Arsenic in pore water	PFAS in Pore Water Trace Extended	Ammonia as N in pore water	On Hold
BH-SB-28_0.0-0.5_210906						✓
BH-SB-28_0.5-1.0_210906						✓
BH-SB-28_1.0-1.5_210906						✓
BH-SB-28_1.5-2.0_210906						✓
BH-SB-28_2.0-2.5_210906						✓
BH-SB-28_2.5-3.0_210906						✓
BH-SB-28_4.0-5.0_210906						✓
PW-SB-28_210906	✓	✓	✓	✓	✓	
QC112_210906						✓
BH-SB-29_0.0-0.5_210906						✓
BH-SB-29_0.5-1.0_210906						✓
BH-SB-29_1.0-1.5_210906						✓
BH-SB-29_1.5-2.0_210906						✓
BH-SB-29_2.0-2.5_210906						✓
BH-SB-29_2.5-3.0_210906						✓
BH-SB-29_3.0-4.0_210906						✓
BH-SB-29_4.0-5.0_210906						✓
BH-SB-29_5.0-6.0_210906						✓
PW-SB-29_210906	✓	✓	✓	✓	✓	
QC113 _210906						✓
QC311 _210906						✓
QC312_210906						✓
QC410_210906						✓

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

Additional Info

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

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

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

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

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:	[redacted]	Envirolab Quote No.:	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Sample information					Tests Required							Comments
Envirolab Sample ID (Lab use only)		Depth	Date Sampled	Type of Sample	Dissolved metals (Sb, As, Cd, Pb, Hg, Ni),	Chelex metals (Sb, As, Cd, Pb, Hg, Ni),	Arsenic - Speciated	PFAS - Extended Suite (28 Analytes) - Trace level	Ammonia (NH3) as N	Pore water extraction		Provide as much information about the sample as you can
276673-34	PW-SB-31_210827			Porewater	X	X	X	X	X	X		
276959-6	PW-SB-32_210830			Porewater	X	X	X	X	X	X		
277161-16	PW-BP-21_210901			Porewater	X	X	X	X	X	X		
277161-8	PW-BP-20_210901			Porewater	X	X	X	X	X	X		
277486-19	PW-SB-29_210906			Porewater	X	X	X	X	X	X		
277486-8	PW-SB-28_210906			Porewater	X	X	X	X	X	X		
✱ 277569-11	PW-SB-34_210907			Porewater	X	X	X	X	X	X		

☐ x

Relinquished by (Company):		Received by (Company):	ELS
Print Name:		Print Name:	Aleen
Date & Time:		Date & Time:	20/9/21
Signature:		Signature:	AR

Lab Use Only	
Job number: 277569-B	Cooling: Ice / Ice pack / None
Temperature:	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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CERTIFICATE OF ANALYSIS 277569-B

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	Additional Testing on 1 Sample
Date samples received	09/09/2021
Date completed instructions received	20/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	23/09/2021
Date of Issue	23/09/2021

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

Results Approved By
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

HM in pore water - dissolved		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Antimony-Dissolved	µg/L	2
Arsenic-Dissolved	µg/L	3
Cadmium-Dissolved	µg/L	<0.1
Lead-Dissolved	µg/L	<1
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	2

Metals 0.45µm Filtered Before Chelex		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Before Chelex	µg/L	<0.1
Nickel Before Chelex	µg/L	1
Lead Before Chelex	µg/L	<1
Mercury Before Chelex	µg/L	<0.1

Metals 0.45µm Filtered After Chelex		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium After Chelex	µg/L	<0.1
Nickel After Chelex	µg/L	1
Lead After Chelex	µg/L	<1
Mercury After Chelex	µg/L	<0.1

Metals 0.45µm Filtered Chelex Retained		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Chelex Retained	µg/L	[NT]
Nickel Chelex Retained	µg/L	<1
Lead Chelex Retained	µg/L	[NT]
Mercury Chelex Retained	µg/L	[NT]

Metals 0.45µm Filtered Chelex Retained %		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Cadmium Chelex Retained	%	[NT]
Nickel Chelex Retained	%	30
Lead Chelex Retained	%	[NT]
Mercury Chelex Retained	%	[NT]

Speciated Arsenic in pore water		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Arsenobetaine (ASB)	µg/L	<1
Arsenious Acid, As (III)	µg/L	2
Dimethylarsenic Acid (DMA)	µg/L	<1
Monomethylarsonic Acid (MMA)	µg/L	<1
Arsenic Acid, As (V)	µg/L	<1

PFAS in Pore Water Trace Extended		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0024
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.02
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	0.002
Perfluoroheptanoic acid	µg/L	0.0009
Perfluorooctanoic acid PFOA	µg/L	0.0022
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	104
Surrogate $^{13}C_2$ *PFOA*	%	105
Extracted ISTD $^{13}C_3$ *PFBS*	%	79
Extracted ISTD $^{18}O_2$ *PFHxS*	%	82
Extracted ISTD $^{13}C_4$ *PFOS*	%	68
Extracted ISTD $^{13}C_4$ *PFBA*	%	#

PFAS in Pore Water Trace Extended		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Extracted ISTD $^{13}C_3$ *PFPeA*	%	48
Extracted ISTD $^{13}C_2$ *PFHxA*	%	58
Extracted ISTD $^{13}C_4$ *PFHpA*	%	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	79
Extracted ISTD $^{13}C_5$ *PFNA*	%	83
Extracted ISTD $^{13}C_2$ *PFDA*	%	84
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	83
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	70
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	75
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	132
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	112
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	128
Extracted ISTD $^{13}C_8$ *FOSA*	%	57
Extracted ISTD d_3 *N MeFOSA*	%	28
Extracted ISTD d_5 *N EtFOSA*	%	26
Extracted ISTD d_7 *N MeFOSE*	%	50
Extracted ISTD d_9 *N EtFOSE*	%	46
Extracted ISTD d_3 *N MeFOSAA*	%	87
Extracted ISTD d_5 *N EtFOSAA*	%	90
Total Positive PFHxS & PFOS	µg/L	0.0034
Total Positive PFOS & PFOA	µg/L	0.0046
Total Positive PFAS	µg/L	0.0089

Miscellaneous Inorganics		
Our Reference		277569-B-11
Your Reference	UNITS	PW-SB-34_210907
Date Sampled		07/09/2021
Type of sample		Porewater
Date prepared	-	22/09/2021
Date analysed	-	22/09/2021
Ammonia as N in pore water	mg/L	3.0

Method ID	Methodology Summary
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-021/022	Determination of various metals from an unpreserved sample by ICP-MS and CV-AAS following filtration and passing through a Chelex 100 resin column.
Metals-022	Determination of various metals by ICP-MS.
Metals-031	Analysis of Speciated forms of Arsenic using LC separation followed by ICP-MS analysis.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: HM in pore water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Before Chelex					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium Before Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Nickel Before Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Lead Before Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	73	[NT]
Mercury Before Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered After Chelex					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium After Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	18	[NT]
Nickel After Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	14	[NT]
Lead After Chelex	µg/L	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	3	[NT]
Mercury After Chelex	µg/L	0.1	Metals-021/022	<0.1	[NT]	[NT]	[NT]	[NT]	0	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Chelex Retained						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]

QUALITY CONTROL: Metals 0.45µm Filtered Chelex Retained %					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Cadmium Chelex Retained	%	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Nickel Chelex Retained	%	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Lead Chelex Retained	%	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Mercury Chelex Retained	%	1	Metals-021/022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Speciated Arsenic in pore water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Arsenobetaine (ASB)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Arsenious Acid, As (III)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Dimethylarsenic Acid (DMA)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Monomethylarsonic Acid (MMA)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Arsenic Acid, As (V)	µg/L	1	Metals-031	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	109	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	112	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	107	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	96	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	110	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	99	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	101	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	104	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	77	[NT]	[NT]	[NT]	[NT]	76	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	80	[NT]	[NT]	[NT]	[NT]	80	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	73	[NT]	[NT]	[NT]	[NT]	70	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	87	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	84	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	93	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	87	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	83	[NT]	[NT]	[NT]	[NT]	79	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	82	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	86	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	82	[NT]	[NT]	[NT]	[NT]	80	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	63	[NT]	[NT]	[NT]	[NT]	65	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	129	[NT]	[NT]	[NT]	[NT]	131	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	105	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	116	[NT]	[NT]	[NT]	[NT]	111	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	64	[NT]	[NT]	[NT]	[NT]	57	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	30	[NT]	[NT]	[NT]	[NT]	34	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	28	[NT]	[NT]	[NT]	[NT]	33	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	50	[NT]	[NT]	[NT]	[NT]	51	[NT]

QUALITY CONTROL: PFAS in Pore Water Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	47	[NT]	[NT]	[NT]	[NT]	50	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	86	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Date analysed	-			22/09/2021	[NT]	[NT]	[NT]	[NT]	22/09/2021	[NT]
Ammonia as N in pore water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	[NT]	[NT]	118	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s). PFBA PQL raised.

MeFOSA, EtFOSA, MeFOSE, EtFOSE Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277569-B
Date Sample Received	09/09/2021
Date Instructions Received	20/09/2021
Date Results Expected to be Reported	23/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 1 Sample
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	15
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]st
P[redacted]
[redacted]1
[redacted]

Analysis Underway, details on the following page:

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Sample ID	HM in pore water - dissolved	HM in pore water - dissolved (Chelex)	Speciated Arsenic in pore water	PFAS in Pore Water Trace Extended	Ammonia as N in pore water	On Hold
BH-SB-33_0.0-0.5_2108						✓
BH-SB-33_0.5-1.0_2108						✓
BH-SB-33_1.0-1.5_2108						✓
BH-SB-34_0.0-0.5_210907						✓
BH-SB-34_0.5-1.0_210907						✓
BH-SB-34_1.0-1.5_210907						✓
BH-SB-34_1.5-2.0_210907						✓
BH-SB-34_2.0-2.5_210907						✓
BH-SB-34_2.5-3.0_210907						✓
BH-SB-34_3.0-4.5_210907						✓
PW-SB-34_210907	✓	✓	✓	✓	✓	
QC114_210907						✓
BH-SB-35_0.0-0.5_210907						✓
BH-SB-35_0.5-1.0_210907						✓
BH-SB-35_1.0-1.5_210907						✓
BH-SB-35_1.5-2.0_210907						✓
BH-SB-35_2.0-2.5_210907						✓
BH-SB-35_2.5-3.0_210907						✓
BH-SB-35_3.0-4.0_210907						✓
BH-SB-35_4.0-5.0_210907						✓
PW-SB-35_210907						✓
QC117_210907						✓
BH-SWTP-01_0.0-1.5_210907						✓
BH-SWTP-02_0.0-1.5_210907						✓
BH-SWTP-03_0.0-1.5_210907						✓
BH-SWTP-04_0.0-1.5_210907						✓
BH-SWTP-05_0.0-1.5_210907						✓
BH-SWTP-06_0.0-1.5_210907						✓
BH-SWTP-07_0.0-1.5_210907						✓
QC115 _210907						✓
QC116 _210907						✓
QC313_210907						✓

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www.envirolab.com.au

Sample ID	HM in pore water - dissolved	HM in pore water - dissolved (Chelex)	Speciated Arsenic in pore water	PFAS in Pore Water Trace Extended	Ammonia as N in pore water	On Hold
QC314_210907						✓
QC412_210907						✓
QC217_210906						✓

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

Additional Info

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

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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable): 60642423 / 2.08

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information | **Tests Required** | **Comments**

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density								FREEZE and HOLD	Provide as much information about the sample as you can
1	BH-DG-01_0.0-0.5_210819			Sediment					x	x	x									
2	BH-DG-02_0.0-0.5_210819			Sediment					x	x	x									
3	BH-DG-03_0.0-0.5_210819			Sediment					x	x	x									
4	BH-DG-04_0.0-0.5_210819			Sediment					x	x	x									
5	BH-DG-05_0.0-0.5_210819			Sediment					x	x	x									
6	BH-DG-06_0.0-0.5_210819			Sediment					x	x	x									
7	QC103_210819			Sediment					x	x	x									

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	AECOM
Print Name:	A. MICHAEL
Date & Time:	24/03/2021
Signature:	

Received by (Company):	ELS - SYD
Print Name:	V. VEGA
Date & Time:	25/8/21 @ 1000
Signature:	

Lab Use Only

Job number:	WJ276506 276460
Temperature:	12 °C
Cooling:	Ice / Ice pack / None
Security seal:	Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable): 60642423 / 2.08

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information | **Tests Required** | **Comments**

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
1 8	BH-OH-01_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
2 9	BH-OH-02_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
3 10	BH-OH-03_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
4 11	BH-OH-04_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
W 5 12	BH-OH-05_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
6 13	BH-OH-06_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
7 14	BH-OH-07 _0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
8 15	BH-OH-08_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
9 16	BH-OH-09_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
10 17	BH-OH-10_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										
4 18	BH-OH-11_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X										MISSING

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	AECOM	Received by (Company):	Eis - SYD
Print Name:	A. MICHAEL	Print Name:	V. VEGA
Date & Time:	24/08/2021 2pm	Date & Time:	25/8/21 @ 1000
Signature:		Signature:	

Lab Use Only

Job number: W 276505 276460	Cooling: Ice / Ice pack / None
Temperature: 12°C	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable): 60642423 / 2.08

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density								FREEZE and HOLD	Provide as much information about the sample as you can
19	BH-OH-12_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X									
20	BH-OH-13_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X									
21	BH-OH-14_0.0-0.5_210819			Sediment	X	X	X	X	X	X	X									
22	QC102_210819			Sediment	X	X	X	X	X	X	X									

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	AECOM	Received by (Company):	ELS · SYD
Print Name:	A. Mitchell	Print Name:	V. VEGA
Date & Time:	24/08/21 1pm	Date & Time:	25/8/21 @ 1000
Signature:		Signature:	

Lab Use Only

Job number: ~~270505~~ 270460 Cooling: Ice / Ice pack / None

Temperature: 12°C Security seal: Intact / Broken / None

TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
PO No. (if applicable):	60642423 / 2.08
Envirolab Quote No.:	21SY185_Rev1
Date results required:	Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Additional report format:	✓Esdat ☐ Equis
Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)													Provide as much information about the sample as you can
23	SW-DG-01_210819			Seawater	x	x	x	x													Total and dissolved metals. Preserved bottle contents were field filtered
24	SW-DG-02_210819			Seawater	x	x	x	x													
25	SW-DG-03_210819			Seawater	x	x	x	x													
26	QC501_210819			Seawater	x	x	x	x													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ELS - STD
Print Name:	ARWA MICHAEL	Print Name:	V. VEGA
Date & Time:	24/08/2021	Date & Time:	25/8/21 10:40
Signature:		Signature:	

Lab Use Only	
Job number:	Cooling: Ice / Ice pack / None
Temperature: 10	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable): 60642423 / 2.08

Envirolab Quote No.: 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)												Provide as much information about the sample as you can
27	QC300_210819			Water	X	X	X	X												
28	QC301_210819			Water	X	X	X	X												
29	QC302_210819			Water	X	X	X	X												
30	QC303_210819			Water	X	X	X	X												
31	QC304_210819			Water	X	X	X	X												
32	QC305_210819			Water	X	X	X	X												
33	QC400_210819			Water				X												

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	AECOM	Received by (Company):	ECS-SYD
Print Name:	ANNA MICHAEL	Print Name:	J. VEGA
Date & Time:	24/08/2021 2PM	Date & Time:	25/8/21 @ 1000
Signature:	[signature]	Signature:	[signature]

Lab Use Only

Job number: 27 6460	Cooling: Ice / Ice pack / None
Temperature: 12	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

5 Alvan Street
Mount Lawley, WA 6050
+61 8 9225 5810
ABN 65 133 060 787

Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street, Chatswood, NSW 2067
Contact name: [redacted]
Job number: 21_1390
Revision No.: 1
Date received: 26/08/2021
Date analysed: 14/09/2021
Date reported: 16/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments: **This report supersedes 21_1390_01 to 21_1390_41 Absolute density report following ASTM D5550 NATA Revision 0 issued on 15/09/2021 due to request to split by client job numbers and change to one sample name.**

Sample preparation

The sample supplied by the client was a fine, damp, slurry with occasional large particulate throughout. Each sample was washed twice with RO water to remove any salts present and oven dried at 45 °C prior to analysis.

Analysis

The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

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Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
276460-1	21_1390_01	2.631 ± 0.001
276460-2	21_1390_02	2.606 ± 0.001
276460-3	21_1390_03	2.604 ± 0.001
276460-4	21_1390_04	2.660 ±0.001
276460-5	21_1390_05	2.593 ± 0.002
276460-6	21_1390_06	2.618 ± 0.002
276460-7	21_1390_07	2.435 ± 0.001
276460-8	21_1390_08	2.612 ± 0.001
276460-9	21_1390_09	2.602 ± 0.001
276460-10	21_1390_10	2.618 ± 0.001
276460-11	21_1390_11	2.649 ± 0.001
276460-12	21_1390_12	2.656 ± 0.001
276460-13	21_1390_13	2.675 ± 0.001
276460-14	21_1390_14	2.685 ± 0.001
276460-15	21_1390_15	2.678 ± 0.001
276460-16	21_1390_16	2.668 ± 0.002
276460-17	21_1390_17	2.630 ± 0.001
276460-19	21_1390_19	2.652 ± 0.001
276460-20	21_1390_20	2.669 ± 0.001
276460-21	21_1390_21	2.646 ± 0.001
276460-22	21_1390_22	2.656 ± 0.000
276460-18	21_1390_41	2.607 ± 0.000

The results are representative only of the sample/s provided.

Analyst: [redacted]
B.Sc.(Multidisciplinary)

Reported: [redacted] B.Sc.(Archaeology)

Authorised: [redacted], B.Sc.(Nanotechnology)

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 276460

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	22 Sediment, 4 Seawater, 8 Water
Date samples received	25/08/2021
Date completed instructions received	25/08/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	08/09/2021
Date of Issue	17/09/2021

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Results Approved By
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Jeremy Faircloth, Operations Manager, Sydney
Josh Williams, LC Supervisor
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date extracted	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	<5	<5	<5
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	<5	<5	<5	<5	<5
Pyrene	µg/kg	<5	<5	<5	<5	<5
Benz(a)anthracene	µg/kg	<5	<5	<5	<5	<5
Chrysene	µg/kg	<5	<5	<5	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	<10	<10	<10
Benzo(e)pyrene	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	µg/kg	<5	<5	<5	<5	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	<5	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	<5	<5	<5	<5	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	89	86	92	98	90

PAH NAGD level in soil						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date extracted	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	<5	<5	<5
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	<5	<5	<5	<5	<5
Pyrene	µg/kg	<5	<5	<5	<5	<5
Benz(a)anthracene	µg/kg	<5	<5	<5	<5	<5
Chrysene	µg/kg	<5	<5	<5	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	<10	<10	<10
Benzo(e)pyrene	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	µg/kg	<5	<5	<5	<5	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	<5	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	<5	<5	<5	<5	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	108	106	91	89	93

PAH NAGD level in soil						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date extracted	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	<5	<5	<5
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	<5	<5	<5	<5	<5
Pyrene	µg/kg	<5	<5	<5	<5	<5
Benz(a)anthracene	µg/kg	<5	<5	<5	<5	<5
Chrysene	µg/kg	<5	<5	<5	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	<10	<10	<10
Benzo(e)pyrene	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	µg/kg	<5	<5	<5	<5	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	<5	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	<5	<5	<5	<5	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	97	85	111	94	113

Organotin Compunds in Soil						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	26/08/2021	26/08/2021	26/08/2021	26/08/2021	26/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Monobutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tributyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	98	100	98	95	100

Organotin Compunds in Soil						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	26/08/2021	26/08/2021	26/08/2021	26/08/2021	26/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Monobutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tributyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	100	100	100	100	98

Organotin Compunds in Soil						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	26/08/2021	26/08/2021	26/08/2021	26/08/2021	26/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Monobutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibutyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tributyltin as Sn	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Triphenyltin	%	99	100	100	100	100

PFAS in Soils Extended						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.6	0.4	0.3	0.2	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	101	97	100	102	101
Surrogate $^{13}C_2$ *PFOA*	%	96	93	106	94	105
Extracted ISTD $^{13}C_3$ *PFBS*	%	78	77	80	80	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89	88	96	93	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	90	94	95	93

PFAS in Soils Extended						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	86	85	91	90	90
Extracted ISTD $^{13}C_3$ *PFPeA*	%	81	79	82	89	88
Extracted ISTD $^{13}C_2$ *PFHxA*	%	84	84	92	95	89
Extracted ISTD $^{13}C_4$ *PFHpA*	%	87	84	96	89	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	90	91	91	99	88
Extracted ISTD $^{13}C_5$ *PFNA*	%	93	93	100	100	96
Extracted ISTD $^{13}C_2$ *PFDA*	%	84	76	96	91	95
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	81	74	91	94	78
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	104	108	104	111	101
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	96	96	101	105	101
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	78	75	77	83	80
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	91	87	94	97	93
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	100	88	95	98	93
Extracted ISTD $^{13}C_8$ *FOSA*	%	88	87	95	95	93
Extracted ISTD d_3 *N MeFOSA*	%	82	80	88	89	86
Extracted ISTD d_5 *N EtFOSA*	%	86	83	93	93	90
Extracted ISTD d_7 *N MeFOSE*	%	86	83	87	98	91
Extracted ISTD d_9 *N EtFOSE*	%	86	85	86	90	96
Extracted ISTD d_3 *N MeFOSAA*	%	94	93	91	97	91
Extracted ISTD d_5 *N EtFOSAA*	%	94	88	93	96	92
Total Positive PFHxS & PFOS	µg/kg	0.6	0.4	0.3	0.2	<0.1
Total Positive PFOS & PFOA	µg/kg	0.6	0.4	0.3	0.2	<0.1
Total Positive PFAS	µg/kg	0.6	0.4	0.3	0.2	<0.1

PFAS in Soils Extended						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	<0.1	0.1	<0.1	0.3
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	101	99	105	104	99
Surrogate $^{13}C_2$ *PFOA*	%	96	93	94	93	100
Extracted ISTD $^{13}C_3$ *PFBS*	%	84	85	81	81	76
Extracted ISTD $^{18}O_2$ *PFHxS*	%	99	98	99	95	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	96	93	94	97	92
Extracted ISTD $^{13}C_4$ *PFBA*	%	91	91	93	94	86

PFAS in Soils Extended						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	88	92	89	92	79
Extracted ISTD $^{13}C_2$ *PFHxA*	%	95	94	93	93	86
Extracted ISTD $^{13}C_4$ *PFHpA*	%	90	97	94	96	85
Extracted ISTD $^{13}C_4$ *PFOA*	%	97	98	99	100	92
Extracted ISTD $^{13}C_5$ *PFNA*	%	100	104	96	102	96
Extracted ISTD $^{13}C_2$ *PFDA*	%	99	92	103	86	82
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	92	90	85	98	76
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	106	105	110	109	98
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	113	105	105	110	100
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	83	85	86	83	82
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	91	94	98	99	90
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	97	96	95	105	95
Extracted ISTD $^{13}C_8$ *FOSA*	%	95	96	96	97	89
Extracted ISTD d_3 *N MeFOSA*	%	89	88	91	92	83
Extracted ISTD d_5 *N EtFOSA*	%	91	94	94	92	86
Extracted ISTD d_7 *N MeFOSE*	%	90	88	98	99	88
Extracted ISTD d_9 *N EtFOSE*	%	94	91	94	87	86
Extracted ISTD d_3 *N MeFOSAA*	%	101	98	100	102	99
Extracted ISTD d_5 *N EtFOSAA*	%	97	99	102	98	93
Total Positive PFHxS & PFOS	µg/kg	0.1	<0.1	0.1	<0.1	0.3
Total Positive PFOS & PFOA	µg/kg	0.1	<0.1	0.1	<0.1	0.3
Total Positive PFAS	µg/kg	0.1	<0.1	0.1	<0.1	0.3

PFAS in Soils Extended						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.7	0.3	<0.1	0.6	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	103	100	100	100	103
Surrogate $^{13}C_2$ *PFOA*	%	100	106	99	96	101
Extracted ISTD $^{13}C_3$ *PFBS*	%	75	76	85	73	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	75	89	100	92	99
Extracted ISTD $^{13}C_4$ *PFOS*	%	76	88	95	88	94
Extracted ISTD $^{13}C_4$ *PFBA*	%	88	81	93	83	94

PFAS in Soils Extended						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	73	79	91	83	88
Extracted ISTD $^{13}C_2$ *PFHxA*	%	95	81	92	83	94
Extracted ISTD $^{13}C_4$ *PFHpA*	%	74	83	97	87	92
Extracted ISTD $^{13}C_4$ *PFOA*	%	109	86	94	92	99
Extracted ISTD $^{13}C_5$ *PFNA*	%	91	89	103	86	98
Extracted ISTD $^{13}C_2$ *PFDA*	%	89	90	94	84	103
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	79	81	89	82	100
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	100	97	116	97	101
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	142	95	111	94	110
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	77	73	84	74	84
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	109	83	95	89	95
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	89	91	89	84	92
Extracted ISTD $^{13}C_8$ *FOSA*	%	86	88	95	85	94
Extracted ISTD d_3 *N MeFOSA*	%	70	81	92	81	87
Extracted ISTD d_5 *N EtFOSA*	%	73	81	91	80	92
Extracted ISTD d_7 *N MeFOSE*	%	63	85	88	81	91
Extracted ISTD d_9 *N EtFOSE*	%	74	90	95	84	94
Extracted ISTD d_3 *N MeFOSAA*	%	71	88	103	84	99
Extracted ISTD d_5 *N EtFOSAA*	%	67	90	95	89	100
Total Positive PFHxS & PFOS	µg/kg	0.7	0.3	<0.1	0.6	<0.1
Total Positive PFOS & PFOA	µg/kg	0.7	0.3	<0.1	0.6	<0.1
Total Positive PFAS	µg/kg	0.7	0.3	<0.1	0.6	<0.1

Miscellaneous Inorg - soil						
Our Reference		276460-1	276460-2	276460-3	276460-4	276460-5
Your Reference	UNITS	BH-DG-01_0.0-0.5_210819	BH-DG-02_0.0-0.5_210819	BH-DG-03_0.0-0.5_210819	BH-DG-04_0.0-0.5_210819	BH-DG-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/06/2021	02/06/2021	02/06/2021	02/06/2021	02/06/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Total Organic Carbon (Combustion)	mg/kg	6,300	6,600	7,100	7,000	8,200
Organic Matter (Combustion)	%	1.1	1.1	1.2	1.2	1.4
Density in Soils/Solids	g/cc	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		276460-6	276460-7	276460-8	276460-9	276460-10
Your Reference	UNITS	BH-DG-06_0.0-0.5_210819	QC103_210819	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/06/2021	02/06/2021	02/06/2021	02/06/2021	02/06/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Total Organic Carbon (Combustion)	mg/kg	7,900	7,900	5,900	5,500	6,100
Organic Matter (Combustion)	%	1.4	1.4	1	0.9	1.1
Density in Soils/Solids	g/cc	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		276460-11	276460-12	276460-13	276460-14	276460-15
Your Reference	UNITS	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/06/2021	02/06/2021	02/06/2021	02/06/2021	02/06/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Total Organic Carbon (Combustion)	mg/kg	5,000	3,100	2,000	1,300	1,200
Organic Matter (Combustion)	%	0.9	0.5	0.3	0.2	0.2
Density in Soils/Solids	g/cc	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		276460-16	276460-17	276460-18	276460-19	276460-20
Your Reference	UNITS	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/06/2021	02/06/2021	02/06/2021	02/06/2021	02/06/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Total Organic Carbon (Combustion)	mg/kg	1,700	3,700	6,400	3,700	1,500
Organic Matter (Combustion)	%	0.3	0.6	1.1	0.6	0.3
Density in Soils/Solids	g/cc	#	#	#	#	#

Miscellaneous Inorg - soil			
Our Reference		276460-21	276460-22
Your Reference	UNITS	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021
Type of sample		Sediment	Sediment
Date prepared	-	02/06/2021	02/06/2021
Date analysed	-	06/09/2021	06/09/2021
Total Organic Carbon (Combustion)	mg/kg	6,100	1,500
Organic Matter (Combustion)	%	1	0.3
Density in Soils/Solids	g/cc	#	#

Particle Size Distribution in Soils						
Our Reference		276460-1	276460-2	276460-3	276460-4	276460-5
Your Reference	UNITS	BH-DG-01_0.0-0.5_210819	BH-DG-02_0.0-0.5_210819	BH-DG-03_0.0-0.5_210819	BH-DG-04_0.0-0.5_210819	BH-DG-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	<1	<1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	<1	<1
Medium Sand 0.3-0.425mm	%	<1	<1	<1	<1	<1
Fine Sand 0.15-0.3mm	%	3	8	8	5	10
Very Fine Sand 0.075-0.15mm	%	23	26	29	25	15
Coarse Silt 0.020-0.075mm	%	39	27	25	27	24
Fine Silt 0.002-0.020mm	%	13	13	10	14	20
Clay <0.002mm	%	21	25	28	29	31

Particle Size Distribution in Soils						
Our Reference		276460-6	276460-7	276460-8	276460-9	276460-10
Your Reference	UNITS	BH-DG-06_0.0-0.5_210819	QC103_210819	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	<1	<1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	<1	<1
Medium Sand 0.3-0.425mm	%	3	<1	<1	<1	<1
Fine Sand 0.15-0.3mm	%	10	10	1	<1	2
Very Fine Sand 0.075-0.15mm	%	17	23	23	22	11
Coarse Silt 0.020-0.075mm	%	21	23	37	46	51
Fine Silt 0.002-0.020mm	%	18	18	16	10	13
Clay <0.002mm	%	30	26	23	22	22

Particle Size Distribution in Soils						
Our Reference		276460-11	276460-12	276460-13	276460-14	276460-15
Your Reference	UNITS	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	<1	<1
Medium Sand 0.425-0.6mm	%	<1	<1	4	<1	<1
Medium Sand 0.3-0.425mm	%	<1	1	11	4	3
Fine Sand 0.15-0.3mm	%	<1	13	50	64	58
Very Fine Sand 0.075-0.15mm	%	24	36	24	25	33
Coarse Silt 0.020-0.075mm	%	53	38	9	6	5
Fine Silt 0.002-0.020mm	%	9	4	1	<1	<1
Clay <0.002mm	%	14	8	2	1	1

Particle Size Distribution in Soils						
Our Reference		276460-16	276460-17	276460-18	276460-19	276460-20
Your Reference	UNITS	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	4	3
Coarse Sand 0.6-1.18mm	%	<1	10	<1	13	3
Medium Sand 0.425-0.6mm	%	8	6	1	18	12
Medium Sand 0.3-0.425mm	%	9	12	5	16	13
Fine Sand 0.15-0.3mm	%	64	33	3	19	50
Very Fine Sand 0.075-0.15mm	%	15	25	27	16	12
Coarse Silt 0.020-0.075mm	%	2	6	33	7	6
Fine Silt 0.002-0.020mm	%	1	3	12	3	<1
Clay <0.002mm	%	<1	5	19	4	1

Particle Size Distribution in Soils			
Our Reference		276460-21	276460-22
Your Reference	UNITS	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021
Type of sample		Sediment	Sediment
Date prepared	-	31/08/2021	31/08/2021
Date analysed	-	01/09/2021	01/09/2021
Cobbles >75mm	%	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	7
Medium Sand 0.425-0.6mm	%	<1	13
Medium Sand 0.3-0.425mm	%	<1	14
Fine Sand 0.15-0.3mm	%	16	48
Very Fine Sand 0.075-0.15mm	%	49	13
Coarse Silt 0.020-0.075mm	%	14	4
Fine Silt 0.002-0.020mm	%	6	<1
Clay <0.002mm	%	15	1

Acid Extractractable metals in soil						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony - low level	mg/kg	<1	<1	<1	<1	<1
Arsenic - low level	mg/kg	3	5.0	3	1	2
Cadmium - low level	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper - low level	mg/kg	5.2	7.4	6.2	3	3
Chromium - low level	mg/kg	17	22	16	8.0	10
Lead - low level	mg/kg	6.6	8.4	6.8	4	4
Mercury - low level	mg/kg	0.04	0.05	0.05	0.02	0.02
Nickel - low level	mg/kg	8.5	11	8.0	4	5
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	22	27	23	13	15

Acid Extractractable metals in soil						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony - low level	mg/kg	<1	<1	<1	<1	<1
Arsenic - low level	mg/kg	4	4	3	3	4
Cadmium - low level	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper - low level	mg/kg	2	2	1	1	4
Chromium - low level	mg/kg	6.1	7.2	5.1	5.5	9.1
Lead - low level	mg/kg	3	3	2	2	4
Mercury - low level	mg/kg	0.01	0.01	<0.01	<0.01	0.02
Nickel - low level	mg/kg	3	3	2	3	5
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	8.1	8.4	6.0	8.0	13

Acid Extractractable metals in soil						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony - low level	mg/kg	<1	<1	<1	<1	<1
Arsenic - low level	mg/kg	5	5.5	4	3	3
Cadmium - low level	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Copper - low level	mg/kg	9.3	3	1	6.4	0.9
Chromium - low level	mg/kg	27	10	5	13	4
Lead - low level	mg/kg	9.5	4	2	7.6	2
Mercury - low level	mg/kg	0.04	0.02	<0.01	0.03	<0.01
Nickel - low level	mg/kg	14	5	2	8.2	2
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	32	12	5.3	22	5.0

Moisture						
Our Reference		276460-8	276460-9	276460-10	276460-11	276460-12
Your Reference	UNITS	BH-OH-01_0.0-0.5_210819	BH-OH-02_0.0-0.5_210819	BH-OH-03_0.0-0.5_210819	BH-OH-04_0.0-0.5_210819	BH-OH-05_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Moisture	%	43	39	36	32	27

Moisture						
Our Reference		276460-13	276460-14	276460-15	276460-16	276460-17
Your Reference	UNITS	BH-OH-06_0.0-0.5_210819	BH-OH-07 _0.0-0.5_210819	BH-OH-08_0.0-0.5_210819	BH-OH-09_0.0-0.5_210819	BH-OH-10_0.0-0.5_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Moisture	%	20	21	18	19	30

Moisture						
Our Reference		276460-18	276460-19	276460-20	276460-21	276460-22
Your Reference	UNITS	BH-OH-11_0.0-0.5_210819	BH-OH-12_0.0-0.5_210819	BH-OH-13_0.0-0.5_210819	BH-OH-14_0.0-0.5_210819	QC102_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Moisture	%	44	25	19	44	19

PAHs in Water - Low Level						
Our Reference	UNITS	276460-23	276460-24	276460-25	276460-26	276460-27
Your Reference		SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819	QC300_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater	Water
Date extracted	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	88	94	92	86	81

PAHs in Water - Low Level						
Our Reference		276460-28	276460-29	276460-30	276460-31	276460-32
Your Reference	UNITS	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Date analysed	-	31/08/2021	31/08/2021	31/08/2021	31/08/2021	31/08/2021
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	92	90	94	90	88

Organotin Compunds in Water						
Our Reference		276460-23	276460-24	276460-25	276460-26	276460-27
Your Reference	UNITS	SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819	QC300_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater	Water
Date prepared	-	26/08/2021	26/08/2021	26/08/2021	26/08/2021	26/08/2021
Date analysed	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Monobutyltin as Sn	µg/L	0.04	0.04	0.04	0.02	0.02
Dibutyltin as Sn	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Tributyltin as Sn	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate Triphenyltin	%	96	97	100	100	94

Organotin Compunds in Water						
Our Reference		276460-28	276460-29	276460-30	276460-31	276460-32
Your Reference	UNITS	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	26/08/2021	26/08/2021	26/08/2021	26/08/2021	26/08/2021
Date analysed	-	30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Monobutyltin as Sn	µg/L	0.02	0.04	<0.005	0.04	<0.005
Dibutyltin as Sn	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Tributyltin as Sn	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate Triphenyltin	%	95	95	95	96	96

PFAS in Waters Trace Extended						
Our Reference		276460-23	276460-24	276460-25	276460-26	276460-27
Your Reference	UNITS	SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819	QC300_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater	Water
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0008	0.0009	0.0008	0.0009	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.002	0.002	0.002	0.002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0008	0.0008	0.0008	0.0007	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	0.0004	0.0004	0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0008	0.0008	0.0009	0.0008	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	97	101	103	97	103
Surrogate $^{13}C_2$ *PFOA*	%	92	90	90	91	91
Extracted ISTD $^{13}C_3$ *PFBS*	%	77	80	81	83	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	80	85	88	88
Extracted ISTD $^{13}C_4$ *PFOS*	%	78	80	76	84	80
Extracted ISTD $^{13}C_4$ *PFBA*	%	34	35	33	35	82

PFAS in Waters Trace Extended						
Our Reference		276460-23	276460-24	276460-25	276460-26	276460-27
Your Reference	UNITS	SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819	QC300_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	55	55	55	56	73
Extracted ISTD $^{13}C_2$ *PFHxA*	%	87	85	86	92	95
Extracted ISTD $^{13}C_4$ *PFHpA*	%	85	87	87	91	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	89	92	99	99
Extracted ISTD $^{13}C_5$ *PFNA*	%	79	78	80	84	89
Extracted ISTD $^{13}C_2$ *PFDA*	%	84	85	82	90	92
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	87	91	87	96	80
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	96	98	95	105	72
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	75	78	66	83	66
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	93	94	95	95	95
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	84	81	82	87	91
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	80	76	73	79	86
Extracted ISTD $^{13}C_8$ *FOSA*	%	76	76	80	84	77
Extracted ISTD d_3 *N MeFOSA*	%	41	40	46	42	28
Extracted ISTD d_5 *N EtFOSA*	%	40	42	46	44	40
Extracted ISTD d_7 *N MeFOSE*	%	68	66	77	74	62
Extracted ISTD d_9 *N EtFOSE*	%	70	75	79	78	76
Extracted ISTD d_3 *N MeFOSAA*	%	126	124	127	137	83
Extracted ISTD d_5 *N EtFOSAA*	%	138	130	125	140	142
Total Positive PFHxS & PFOS	µg/L	0.0027	0.0028	0.0026	0.0028	<0.0002
Total Positive PFOS & PFOA	µg/L	0.0027	0.0026	0.0028	0.0027	<0.0002
Total Positive PFAS	µg/L	0.0043	0.0048	0.0048	0.0047	<0.0002

PFAS in Waters Trace Extended						
Our Reference		276460-28	276460-29	276460-30	276460-31	276460-32
Your Reference	UNITS	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	0.0006	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	0.0005	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	97	99	102	104
Surrogate $^{13}C_2$ *PFOA*	%	91	92	91	91	88
Extracted ISTD $^{13}C_3$ *PFBS*	%	84	88	88	89	81
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	85	86	88	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	85	82	83	84	74
Extracted ISTD $^{13}C_4$ *PFBA*	%	86	82	87	82	83

PFAS in Waters Trace Extended						
Our Reference		276460-28	276460-29	276460-30	276460-31	276460-32
Your Reference	UNITS	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	78	73	78	74	72
Extracted ISTD $^{13}C_2$ *PFHxA*	%	97	96	98	96	91
Extracted ISTD $^{13}C_4$ *PFHpA*	%	89	89	90	90	88
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	89	98	100	97
Extracted ISTD $^{13}C_5$ *PFNA*	%	82	60	88	88	82
Extracted ISTD $^{13}C_2$ *PFDA*	%	92	89	93	93	87
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	91	72	97	91	86
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	102	67	110	85	99
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	83	50	53	64	66
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	92	92	95	87	80
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	93	77	101	87	94
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	92	89	94	92	82
Extracted ISTD $^{13}C_8$ *FOSA*	%	80	36	88	77	77
Extracted ISTD d_3 *N MeFOSA*	%	38	27	43	28	41
Extracted ISTD d_5 *N EtFOSA*	%	43	44	43	42	44
Extracted ISTD d_7 *N MeFOSE*	%	73	41	83	54	68
Extracted ISTD d_9 *N EtFOSE*	%	80	86	81	81	70
Extracted ISTD d_3 *N MeFOSAA*	%	113	38	139	87	110
Extracted ISTD d_5 *N EtFOSAA*	%	168	113	171	150	131
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002	0.001	<0.0002	<0.0002

PFAS in Waters Trace Extended		
Our Reference		276460-33
Your Reference	UNITS	QC400_210819
Date Sampled		19/08/2021
Type of sample		Water
Date prepared	-	03/09/2021
Date analysed	-	03/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.002
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	103
Surrogate $^{13}C_2$ *PFOA*	%	93
Extracted ISTD $^{13}C_3$ *PFBS*	%	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85
Extracted ISTD $^{13}C_4$ *PFOS*	%	76
Extracted ISTD $^{13}C_4$ *PFBA*	%	88

PFAS in Waters Trace Extended		
Our Reference		276460-33
Your Reference	UNITS	QC400_210819
Date Sampled		19/08/2021
Type of sample		Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	80
Extracted ISTD $^{13}C_2$ *PFHxA*	%	101
Extracted ISTD $^{13}C_4$ *PFHpA*	%	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	98
Extracted ISTD $^{13}C_5$ *PFNA*	%	84
Extracted ISTD $^{13}C_2$ *PFDA*	%	87
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	92
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	104
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	57
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	94
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	97
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	91
Extracted ISTD $^{13}C_8$ *FOSA*	%	82
Extracted ISTD d_3 *N MeFOSA*	%	45
Extracted ISTD d_5 *N EtFOSA*	%	42
Extracted ISTD d_7 *N MeFOSE*	%	76
Extracted ISTD d_9 *N EtFOSE*	%	76
Extracted ISTD d_3 *N MeFOSAA*	%	119
Extracted ISTD d_5 *N EtFOSAA*	%	130
Total Positive PFHxS & PFOS	µg/L	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002
Total Positive PFAS	µg/L	<0.0002

All metals in water-dissolved					
Our Reference		276460-23	276460-24	276460-25	276460-26
Your Reference	UNITS	SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony-Dissolved	µg/L	<2	<2	<2	<2
Arsenic-Dissolved	µg/L	3	3	2	3
Chromium-Dissolved	µg/L	<2	<2	<2	<2
Copper-Dissolved	µg/L	<2	<2	<2	<2
Lead-Dissolved	µg/L	<2	<2	<2	<2
Nickel-Dissolved	µg/L	<2	<2	<2	<2
Silver-Dissolved	µg/L	<2	<2	<2	<2
Zinc-Dissolved	µg/L	3	3	2	2
Cadmium-Dissolved	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05

All metals in water - total						
Our Reference		276460-23	276460-24	276460-25	276460-26	276460-27
Your Reference	UNITS	SW-DG-01_210819	SW-DG-02_210819	SW-DG-03_210819	QC501_210819	QC300_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Seawater	Seawater	Seawater	Seawater	Water
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony-Total	µg/L	<2	<2	<2	<2	<1
Arsenic-Total	µg/L	3	3	3	3	<1
Chromium-Total	µg/L	2	2	<2	<2	<1
Copper-Total	µg/L	<2	<2	<2	<2	<1
Lead-Total	µg/L	<2	<2	<2	<2	<1
Nickel-Total	µg/L	<2	<2	<2	<2	<1
Silver-Total	µg/L	<2	<2	<2	<2	<1
Zinc-Total	µg/L	4	3	<2	<2	<1
Cadmium-Total	µg/L	<2	<2	<2	<2	<0.1
Mercury-Total	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05

All metals in water - total						
Our Reference		276460-28	276460-29	276460-30	276460-31	276460-32
Your Reference	UNITS	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819
Date Sampled		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Date analysed	-	27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Antimony-Total	µg/L	<1	<1	<1	<1	<1
Arsenic-Total	µg/L	<1	<1	<1	<1	<1
Chromium-Total	µg/L	<1	<1	<1	2	<1
Copper-Total	µg/L	<1	<1	<1	<1	<1
Lead-Total	µg/L	<1	<1	<1	20	<1
Nickel-Total	µg/L	<1	<1	<1	<1	<1
Silver-Total	µg/L	<1	<1	<1	<1	<1
Zinc-Total	µg/L	2	<1	<1	22	<1
Cadmium-Total	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury-Total	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276460-8
Date extracted	-			27/08/2021	17	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Date extracted	-			30/08/2021	17	30/08/2021	30/08/2021		30/08/2021	30/08/2021
Naphthalene	µg/kg	5	Ext-054	<5	17	<5	<5	0	83	110
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	17	<5	<5	0	82	112
Phenanthrene	µg/kg	5	Ext-054	<5	17	<5	<5	0	73	111
Anthracene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	17	<5	<5	0	76	103
Pyrene	µg/kg	5	Ext-054	<5	17	<5	<5	0	79	105
Benz(a)anthracene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	17	<5	<5	0	86	103
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	17	<10	<10	0	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	17	<5	<5	0	81	124
Perylene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	17	<5	<5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	97	17	93	130	33	78	102

QUALITY CONTROL: Organotin Compounds in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276460-8
Date prepared	-			26/08/2021	17	26/08/2021	26/08/2021		26/08/2021	26/08/2021
Date analysed	-			27/08/2021	17	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	17	<0.5	<0.5	0	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	17	<0.5	<0.5	0	80	77
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	17	<0.5	<0.5	0	89	85
Surrogate Triphenyltin	%		Ext-054	110	17	98	100	2	97	96

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276460-9
Date prepared	-			01/09/2021	8	27/08/2021	27/08/2021		01/09/2021	27/08/2021
Date analysed	-			01/09/2021	8	27/08/2021	27/08/2021		01/09/2021	27/08/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	100	102
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	74	96
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	99	99
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	122	88
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	8	0.6	0.5	18	110	93
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	131	101
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	103	101
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	96	94
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	105	91
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	99	102
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	102	100
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	112	91
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	8	<0.5	<0.5	0	94	103
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	8	<0.5	<0.5	0	112	104
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	8	<0.5	<0.5	0	97	104
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	8	<0.5	<0.5	0	117	105
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	8	<5	<5	0	86	106
4:2 FTS	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	108	110
6:2 FTS	µg/kg	0.1	Org-029	<0.1	8	<0.1	<0.1	0	92	98
8:2 FTS	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	103	102
10:2 FTS	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	122	112
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	8	<1	<1	0	90	107
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	8	<1	<1	0	102	100
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	8	<1	<1	0	102	95
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	8	<1	<1	0	106	108
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	8	<5	<5	0	103	106
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	118	98
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	8	<0.2	<0.2	0	101	103
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	110	8	101	99	2	105	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	102	8	96	96	0	103	96

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276460-9
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	58	8	78	78	0	67	75
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	67	8	89	93	4	63	90
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	59	8	88	90	2	53	88
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	59	8	86	85	1	60	83
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	93	8	81	78	4	54	85
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	51	8	84	88	5	95	86
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	102	8	87	81	7	98	84
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	61	8	90	87	3	107	88
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	109	8	93	88	6	111	95
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	106	8	84	84	0	52	82
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	97	8	81	89	9	91	79
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	118	8	104	110	6	51	92
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	65	8	96	91	5	62	94
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	57	8	78	71	9	97	76
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	62	8	91	91	0	53	90
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	60	8	100	92	8	55	87
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	52	8	88	88	0	57	85
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	101	8	82	82	0	103	84
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	105	8	86	85	1	107	85
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	100	8	86	87	1	101	87

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276460-9
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	98	8	86	86	0	104	83
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	50	8	94	85	10	119	86
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	122	8	94	90	4	124	86

QUALITY CONTROL: PFAS in Soils Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	27/08/2021	27/08/2021		[NT]	[NT]
Date analysed	-			[NT]	19	27/08/2021	27/08/2021		[NT]	[NT]
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	19	0.3	0.3	0	[NT]	[NT]
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Perfluorobutanoic acid	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Perfluoropentanoic acid	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Perfluorohexanoic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluorononanoic acid	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Perfluorodecanoic acid	µg/kg	0.5	Org-029	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Perfluorododecanoic acid	µg/kg	0.5	Org-029	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Perfluorotetradecanoic acid	µg/kg	5	Org-029	[NT]	19	<5	<5	0	[NT]	[NT]
4:2 FTS	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
10:2 FTS	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Perfluorooctane sulfonamide	µg/kg	1	Org-029	[NT]	19	<1	<1	0	[NT]	[NT]
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	[NT]	19	<1	<1	0	[NT]	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	[NT]	19	<1	<1	0	[NT]	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	[NT]	19	<1	<1	0	[NT]	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	[NT]	19	<5	<5	0	[NT]	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	19	100	102	2	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	19	106	99	7	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	[NT]	19	76	79	4	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	19	89	96	8	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	19	88	93	6	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	[NT]	19	81	90	11	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	[NT]	19	79	84	6	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	[NT]	19	81	89	9	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	[NT]	19	83	87	5	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	19	86	91	6	[NT]	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	[NT]	19	89	99	11	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	[NT]	19	90	89	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	[NT]	19	81	88	8	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	[NT]	19	97	103	6	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	[NT]	19	95	102	7	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	[NT]	19	73	77	5	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	19	83	96	15	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	19	91	100	9	[NT]	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	[NT]	19	88	94	7	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	[NT]	19	81	88	8	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	[NT]	19	81	90	11	[NT]	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	[NT]	19	85	92	8	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	[NT]	19	90	92	2	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	[NT]	19	88	102	15	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	[NT]	19	90	98	9	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			02/09/2021	1	02/06/2021	02/06/2021		02/09/2021	[NT]
Date analysed	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	1	6300	6200	2	97	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	1	1.1	1.1	0	97	[NT]
Density in Soils/Solids	g/cc		Ext-062	[NT]	1	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	02/06/2021	02/06/2021		02/09/2021	[NT]
Date analysed	-			[NT]	11	06/09/2021	06/09/2021		06/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	[NT]	11	5000	5300	6	103	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	[NT]	11	0.9	0.9	0	103	[NT]
Density in Soils/Solids	g/cc		Ext-062	[NT]	11	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	02/06/2021	02/06/2021		[NT]	[NT]
Date analysed	-			[NT]	21	06/09/2021	06/09/2021		[NT]	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	[NT]	21	6100	5800	5	[NT]	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	[NT]	21	1	1	0	[NT]	[NT]
Density in Soils/Solids	g/cc		Ext-062	[NT]	21	#	#		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	276460-9
Date prepared	-			27/08/2021	8	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Date analysed	-			27/08/2021	8	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Antimony - low level	mg/kg	1	Metals-022	<1	8	<1	<1	0	96	#
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	8	3	4	29	101	86
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	8	<0.1	<0.1	0	98	77
Copper - low level	mg/kg	0.5	Metals-022	<0.5	8	5.2	7.5	36	100	99
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	8	17	25	38	106	90
Lead - low level	mg/kg	0.5	Metals-022	<0.5	8	6.6	9.0	31	101	82
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	8	0.04	0.05	22	107	90
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	8	8.5	12	34	99	84
Silver - low level	mg/kg	0.5	Metals-022	<0.5	8	<0.5	<0.5	0	81	85
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	8	22	31	34	98	81

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	27/08/2021	27/08/2021		[NT]	[NT]
Date analysed	-			[NT]	19	27/08/2021	27/08/2021		[NT]	[NT]
Antimony - low level	mg/kg	1	Metals-022	[NT]	19	<1	<1	0	[NT]	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	[NT]	19	5.5	5.3	4	[NT]	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Copper - low level	mg/kg	0.5	Metals-022	[NT]	19	3	3	0	[NT]	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	[NT]	19	10	9.9	1	[NT]	[NT]
Lead - low level	mg/kg	0.5	Metals-022	[NT]	19	4	4	0	[NT]	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	[NT]	19	0.02	0.02	0	[NT]	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	[NT]	19	5	5	0	[NT]	[NT]
Silver - low level	mg/kg	0.5	Metals-022	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	[NT]	19	12	12	0	[NT]	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	276460-24
Date extracted	-			31/08/2021	23	31/08/2021	31/08/2021		31/08/2021	31/08/2021
Date analysed	-			31/08/2021	23	31/08/2021	31/08/2021		31/08/2021	31/08/2021
Naphthalene	µg/L	0.2	Org-022/025	<0.2	23	<0.2	<0.2	0	100	98
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	87	85
Fluorene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	100	100
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	116	122
Anthracene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	97	102
Pyrene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	100	105
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	74	78
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	23	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	90	95
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	23	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	71	23	88	92	4	84	87

QUALITY CONTROL: Organotin Compounds in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			26/08/2021	[NT]	[NT]	[NT]	[NT]	26/08/2021	[NT]
Date analysed	-			30/08/2021	[NT]	[NT]	[NT]	[NT]	30/08/2021	[NT]
Monobutyltin as Sn	µg/L	0.005	Ext-054	<0.005	[NT]	[NT]	[NT]	[NT]	83	[NT]
Dibutyltin as Sn	µg/L	0.002	Ext-054	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Tributyltin as Sn	µg/L	0.002	Ext-054	<0.002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate Triphenyltin	%		Ext-054	97	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	276460-24
Date prepared	-			03/09/2021	23	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Date analysed	-			03/09/2021	23	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	23	<0.0004	<0.0004	0	101	109
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	23	<0.001	<0.001	0	98	97
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	23	0.0008	0.0009	12	103	107
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	23	<0.001	<0.001	0	102	107
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	23	0.002	0.002	0	103	104
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	101	93
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	101	101
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	106	105
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	23	0.0008	0.0007	13	108	111
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	23	<0.0004	<0.0004	0	110	111
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	23	0.0008	0.0007	13	102	105
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	23	<0.001	<0.001	0	100	104
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	106	106
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	104	112
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	23	<0.005	<0.005	0	101	103
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	23	<0.01	<0.01	0	100	97
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	23	<0.05	<0.05	0	104	108
4:2 FTS	µg/L	0.001	Org-029	<0.001	23	<0.001	<0.001	0	104	105
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	23	<0.0004	<0.0004	0	106	112
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	23	<0.0004	<0.0004	0	99	111
10:2 FTS	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	87	87
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	23	<0.01	<0.01	0	107	107
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	23	<0.005	<0.005	0	110	108
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	23	<0.01	<0.01	0	102	106
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	23	<0.005	<0.005	0	114	105
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	23	<0.05	<0.05	0	107	107
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	103	94
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	23	<0.002	<0.002	0	98	102
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	23	97	103	6	100	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	23	92	91	1	93	93

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	276460-24
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	84	23	77	86	11	85	80
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	81	23	83	90	8	81	83
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	79	23	78	85	9	78	80
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	89	23	34	35	3	83	34
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	75	23	55	58	5	70	56
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	97	23	87	94	8	92	87
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	89	23	85	93	9	83	88
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	95	23	92	100	8	91	90
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	84	23	79	86	8	83	81
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	90	23	84	96	13	86	85
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	87	23	87	88	1	91	83
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	97	23	96	101	5	99	94
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	48	23	75	79	5	71	73
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	94	23	93	100	7	91	96
Extracted ISTD$^{13}C_2$ 6:2FTS	%		Org-029	97	23	84	97	14	91	86
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	91	23	80	85	6	89	77
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	78	23	76	85	11	75	76
Extracted ISTD d_3 N MeFOSA	%		Org-029	35	23	41	43	5	40	46
Extracted ISTD d_5 N EtFOSA	%		Org-029	35	23	40	44	10	45	45
Extracted ISTD d_7 N MeFOSE	%		Org-029	71	23	68	73	7	68	72

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	276460-24
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	72	23	70	78	11	71	72
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	110	23	126	120	5	119	115
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	120	23	138	140	1	137	116

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	27	03/09/2021	03/09/2021		[NT]	[NT]
Date analysed	-			[NT]	27	03/09/2021	03/09/2021		[NT]	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	[NT]	27	<0.0004	<0.0004	0	[NT]	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	[NT]	27	<0.001	<0.001	0	[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	27	<0.0002	<0.0002	0	[NT]	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	[NT]	27	<0.001	<0.001	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	27	<0.0002	<0.0002	0	[NT]	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	[NT]	27	<0.0004	<0.0004	0	[NT]	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	[NT]	27	<0.0004	<0.0004	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	27	<0.0002	<0.0002	0	[NT]	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	[NT]	27	<0.001	<0.001	0	[NT]	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	[NT]	27	<0.005	<0.005	0	[NT]	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	[NT]	27	<0.01	<0.01	0	[NT]	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	[NT]	27	<0.05	<0.05	0	[NT]	[NT]
4:2 FTS	µg/L	0.001	Org-029	[NT]	27	<0.001	<0.001	0	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	27	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	27	<0.0004	<0.0004	0	[NT]	[NT]
10:2 FTS	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	[NT]	27	<0.01	<0.01	0	[NT]	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	[NT]	27	<0.005	<0.005	0	[NT]	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	[NT]	27	<0.01	<0.01	0	[NT]	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	[NT]	27	<0.005	<0.005	0	[NT]	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	[NT]	27	<0.05	<0.05	0	[NT]	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	27	<0.002	<0.002	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	27	103	100	3	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	27	91	92	1	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	[NT]	27	85	87	2	[NT]	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	[NT]	27	88	87	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	[NT]	27	80	82	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	[NT]	27	82	85	4	[NT]	[NT]
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	[NT]	27	73	81	10	[NT]	[NT]
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	[NT]	27	95	98	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	[NT]	27	90	96	6	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	[NT]	27	99	104	5	[NT]	[NT]
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	[NT]	27	89	88	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	[NT]	27	92	90	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	[NT]	27	80	83	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	[NT]	27	72	80	11	[NT]	[NT]
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	[NT]	27	66	62	6	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	[NT]	27	95	95	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	[NT]	27	91	95	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	[NT]	27	86	89	3	[NT]	[NT]
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	[NT]	27	77	80	4	[NT]	[NT]
Extracted ISTD d_3 N MeFOSA	%		Org-029	[NT]	27	28	35	22	[NT]	[NT]
Extracted ISTD d_5 N EtFOSA	%		Org-029	[NT]	27	40	48	18	[NT]	[NT]
Extracted ISTD d_7 N MeFOSE	%		Org-029	[NT]	27	62	67	8	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	[NT]	27	76	81	6	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	[NT]	27	83	92	10	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	[NT]	27	142	141	1	[NT]	[NT]

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			27/08/2021	23	27/08/2021	27/08/2021		27/08/2021	[NT]
Date analysed	-			27/08/2021	23	27/08/2021	27/08/2021		27/08/2021	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	83	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	23	3	3	0	101	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	103	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	99	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	100	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	100	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	23	<2	<2	0	108	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	23	3	4	29	102	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	23	<0.2	<0.2	0	101	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	23	<0.05	[NT]		100	[NT]

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	276460-24
Date prepared	-			27/08/2021	23	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Date analysed	-			27/08/2021	23	27/08/2021	27/08/2021		27/08/2021	27/08/2021
Antimony-Total	µg/L	1	Metals-022	<1	23	<2	<2	0	109	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	23	3	3	0	111	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	23	2	3	40	114	[NT]
Copper-Total	µg/L	1	Metals-022	<1	23	<2	<2	0	115	[NT]
Lead-Total	µg/L	1	Metals-022	<1	23	<2	<2	0	109	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	23	<2	<2	0	113	[NT]
Silver-Total	µg/L	1	Metals-022	<1	23	<2	<2	0	116	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	23	4	3	29	116	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	23	<2	<2	0	112	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	23	<0.05	<0.05	0	117	111

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

All Metals in soil - # Low spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS

All metals in water-dissolved - The PQL has been raised due to the sample matrix requiring dilution.

All metals in water - total - The PQL has been raised due to the sample matrix requiring dilution.

PAHs in Sediment & Organotin Compound in Soil and Water analysed by MPL Laboratories. Report No. 267678

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in water trace level:
PFTeDA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1390
View attached report

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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	276460
Date Sample Received	25/08/2021
Date Instructions Received	25/08/2021
Date Results Expected to be Reported	07/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	22 Sediment, 4 Seawater, 8 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water-dissolved	All metals in water - total	On Hold
BH-DG-01_0.0-0.5_210819				✓	✓	✓	✓																
BH-DG-02_0.0-0.5_210819				✓	✓	✓	✓																
BH-DG-03_0.0-0.5_210819				✓	✓	✓	✓																
BH-DG-04_0.0-0.5_210819				✓	✓	✓	✓																
BH-DG-05_0.0-0.5_210819				✓	✓	✓	✓																
BH-DG-06_0.0-0.5_210819				✓	✓	✓	✓																
QC103_210819				✓	✓	✓	✓																
BH-OH-01_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-02_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-03_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-04_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-05_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-06_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-07 _0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-08_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-09_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-10_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-11_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-12_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-OH-13_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water-dissolved	All metals in water - total	On Hold
BH-OH-14_0.0-0.5_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
QC102_210819	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
SW-DG-01_210819																		✓	✓	✓	✓	✓	
SW-DG-02_210819																		✓	✓	✓	✓	✓	
SW-DG-03_210819																		✓	✓	✓	✓	✓	
QC501_210819																		✓	✓	✓	✓	✓	
QC300_210819																		✓	✓	✓		✓	
QC301_210819																		✓	✓	✓		✓	
QC302_210819																		✓	✓	✓		✓	
QC303_210819																		✓	✓	✓		✓	
QC304_210819																		✓	✓	✓		✓	
QC305_210819																		✓	✓	✓		✓	
QC400_210819																				✓			
Seawater																							✓

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

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Additional Info

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

CHAIN OF CUSTODY FORM - Client

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Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:
Additional 250ml glass for each sample for potential elutriate analysis

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
1	BH-BP-19_0.0-0.5_210826		26/08/2021	Sediment																X	
2	BH-BP-19_0.5-1.0_210826		26/08/2021	Sediment	X	X	X	X	X	X	X										
3	BH-BP-19_1.0-1.5_210826		26/08/2021	Sediment																X	
4	BH-BP-19_1.5-2.0_210826		26/08/2021	Sediment	X	X	X	X	X	X	X										
5	BH-BP-19_2.0-2.5_210826		26/08/2021	Sediment																X	
6	BH-BP-19_2.5-3.0_210826		26/08/2021	Sediment	X	X	X	X	X	X	X										
7	BH-BP-19_3.5-4.0_210826		26/08/2021	Sediment																X	
8	BH-BP-19_4.5-5.0_210826		26/08/2021	Sediment																X	
9	BH-BP-19_5.5-6.0_210826		26/08/2021	Sediment																X	
10	BH-BP-19_6.5-7.0_210826		26/08/2021	Sediment																X	
X 11	PW-BP-19_210826		26/08/2021	Porewater																X	
12	QC104 _210826		26/08/2021	Sediment	X	X	X	X	X	X	X										

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ES	Lab Use Only
Print Name:	Print Name: CLOFF	Job number: 276673 / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 1/9/21 8:30	Temperature: 4 / Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
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Perth Lab - MPL Laboratories
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Melbourne Lab - Envirolab Services
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Adelaide Office - Envirolab Services
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Brisbane Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day
Address:		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Phone:	Mob: [redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Results to:	[redacted]	Lab Comments:	
Email Invoice to:	[redacted]		

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)													Provide as much information about the sample as you can
13	QC306_210826		26/08/2021	Water	X	X	X	X													
14	QC204_210826		26/08/2021					X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ES
Print Name:		Print Name:	CHOOF.
Date & Time:		Date & Time:	1-9-21
Signature:		Signature:	

Lab Use Only

Job number:	276673
Temperature:	4
TAT Req - SAME day / 1 / 2 / 3 / 4 (STD)	
Cooling: Ice / (Ice pack) / None	
Security seal: Intact / Broken / (None)	

CHAIN OF CUSTODY FORM - Client

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National phone number 1300 424 344

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample Information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
15	BH-SB-30_0.0-0.5_210827		27/08/2021	Sediment																X	
16	BH-SB-30_0.5-1.0_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
17	BH-SB-30_1.0-1.5_210827		27/08/2021	Sediment																X	
18	BH-SB-30_1.5-2.0_210827		27/08/2021	Sediment	X	X	X	X	X	X	X									X	
19	BH-SB-30_2.0-2.5_210827		27/08/2021	Sediment																X	
20	BH-SB-30_2.5-3.0_210827		27/08/2021	Sediment																X	
21	BH-SB-30_3.5-4.0_210827		27/08/2021	Sediment																X	
22	BH-SB-30_4.5-5.0_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
23	PW-SB-30_210827		27/08/2021	Porewater																X	
24	QC106_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
25	QC307_210827		27/08/2021	Water	X	X	X	X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS	Lab Use Only	
Print Name:	Print Name: GEOFF	Job number: 276673	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 1/9/21 8:30	Temperature: 4	Security seal: Intact / Broken / ~~None~~
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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Brisbane Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample Information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
26	BH-SB-31_0.0-0.5_210827		27/08/2021	Sediment																X	
27	BH-SB-31_0.5-1.0_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
28	BH-SB-31_1.0-1.5_210827		27/08/2021	Sediment																X	
29	BH-SB-31_1.5-2.0_210827		27/08/2021	Sediment																X	
30	BH-SB-31_2.0-2.5_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
31	BH-SB-31_2.5-3.0_210827		27/08/2021	Sediment																X	
32	BH-SB-31_3.5-4.0_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
33	BH-SB-31_4.5-5.0_210827		27/08/2021	Sediment																X	
34	PW-SB-31_210827		27/08/2021	Porewater																X	
35	QC105_210827		27/08/2021	Sediment	X	X	X	X	X	X	X										
36	QC404_210827		27/08/2021	Water				X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS	Lab Use Only
Print Name:	Print Name: GEOFF.	Job number: 276673 — Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 1-9-21 8:3	Temperature: 4 — Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

5 Alvan Street
Mount Lawley, WA 6050
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ABN 65 133 060 787

Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street, Chatswood, NSW 2067
Contact name: [redacted]
Job number: 21_1390
Revision No.: 1
Date received: 26/08/2021
Date analysed: 14/09/2021
Date reported: 16/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments: **This report supersedes 21_1390_01 to 21_1390_41 Absolute density report following ASTM D5550 NATA Revision 0 issued on 15/09/2021 due to request to split by client job numbers.**

Sample preparation

The sample supplied by the client was a fine, damp, slurry with occasional large particulate throughout. Each sample was washed twice with RO water to remove any salts present and oven dried at 45 °C prior to analysis.

Analysis

The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

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Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
276673-2	21_1390_23	2.569 ± 0.001
276673-4	21_1390_24	2.566 ± 0.004
276673-6	21_1390_25	2.546 ± 0.001
276673-12	21_1390_26	2.574 ± 0.000
276673-16	21_1390_27	2.528 ± 0.002
276673-18	21_1390_28	2.653 ± 0.001
276673-22	21_1390_29	2.794 ± 0.000
276673-27	21_1390_31	2.590 ±0.002
276673-30	21_1390_32	2.648 ±0.001
276673-32	21_1390_33	2.659 ± 0.001

The results are representative only of the sample/s provided.

Analyst: [redacted]
B.Sc.(Multidisciplinary)

Reported: [redacted]B.Sc.(Archaeology)

Authorised: [redacted]B.Sc.(Nanotechnology)

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CERTIFICATE OF ANALYSIS 276673

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	32 Sediment, 4 Water
Date samples received	01/09/2021
Date completed instructions received	01/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	13/09/2021
Date of Issue	17/09/2021

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Jeremy Faircloth, Operations Manager, Sydney
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Date extracted	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	7.0	18	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	<5	<5	7
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	<5	<5	<5	<5	20
Pyrene	µg/kg	<5	<5	<5	<5	20
Benz(a)anthracene	µg/kg	<5	<5	<5	<5	10
Chrysene	µg/kg	<5	<5	<5	<5	8
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	<10	<10	30
Benzo(e)pyrene	µg/kg	<5	<5	<5	<5	12
Benzo(a)pyrene	µg/kg	<5	<5	<5	<5	20
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	<5	<5	20
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	<5	<5	<5	<5	10
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	100	98	80	91	98

PAH NAGD level in soil						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Date extracted	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	20	<5	<5
Anthracene	µg/kg	<5	<5	20	<5	<5
Fluoranthene	µg/kg	<5	<5	40	<5	<5
Pyrene	µg/kg	<5	<5	50	<5	<5
Benz(a)anthracene	µg/kg	<5	<5	30	<5	<5
Chrysene	µg/kg	<5	<5	20	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	70	<10	<10
Benzo(e)pyrene	µg/kg	<5	<5	30	<5	<5
Benzo(a)pyrene	µg/kg	<5	<5	58	<5	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	40	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	<5	<5	20	<5	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	98	99	95	104	95

Organotin Compunds in Soil						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Monobutyltin as Sn	µg/kg	<3.3	<3.3	<3.3	<3.3	<3.3
Dibutyltin as Sn	µg/kg	<2.6	<2.6	<2.6	<2.6	<2.6
Tributyltin as Sn	µg/kg	<2	<2	<2	<2	<2
Surrogate Triphenyltin	%	95	96	93	93	93

Organotin Compunds in Soil						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	01/09/2021	01/09/2021	01/09/2021	01/09/2021	01/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Monobutyltin as Sn	µg/kg	<3.3	<3.3	<3.3	<3.3	<3.3
Dibutyltin as Sn	µg/kg	<2.6	<2.6	<2.6	<2.6	<2.6
Tributyltin as Sn	µg/kg	<2	<2	<2	<2	<2
Surrogate Triphenyltin	%	92	95	97	96	95

PFAS in Soils Extended						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1	<0.1	0.6
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	105	105	101	105	108
Surrogate $^{13}C_2$ *PFOA*	%	119	125	121	120	116
Extracted ISTD $^{13}C_3$ *PFBS*	%	82	80	89	87	79
Extracted ISTD $^{18}O_2$ *PFHxS*	%	82	79	87	86	82
Extracted ISTD $^{13}C_4$ *PFOS*	%	83	83	93	92	81

PFAS in Soils Extended						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	66	69	75	75	69
Extracted ISTD $^{13}C_3$ *PFPeA*	%	70	70	76	74	71
Extracted ISTD $^{13}C_2$ *PFHxA*	%	74	80	85	83	78
Extracted ISTD $^{13}C_4$ *PFHpA*	%	75	76	84	85	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	78	77	83	84	79
Extracted ISTD $^{13}C_5$ *PFNA*	%	78	80	86	86	78
Extracted ISTD $^{13}C_2$ *PFDA*	%	76	86	94	85	84
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	89	88	87	89	81
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	86	92	92	93	89
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	85	89	101	101	92
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	57	63	64	67	57
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	59	63	71	67	57
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	67	67	70	74	69
Extracted ISTD $^{13}C_8$ *FOSA*	%	82	80	89	86	77
Extracted ISTD d_3 *N MeFOSA*	%	82	84	91	91	81
Extracted ISTD d_5 *N EtFOSA*	%	86	85	92	92	81
Extracted ISTD d_7 *N MeFOSE*	%	87	74	89	88	80
Extracted ISTD d_9 *N EtFOSE*	%	84	82	90	89	80
Extracted ISTD d_3 *N MeFOSAA*	%	70	68	72	73	67
Extracted ISTD d_5 *N EtFOSAA*	%	71	71	73	73	71
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1	<0.1	0.6
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	0.6
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1	<0.1	0.6

PFAS in Soils Extended						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	104	105	107	109	105
Surrogate $^{13}C_2$ *PFOA*	%	125	113	124	127	124
Extracted ISTD $^{13}C_3$ *PFBS*	%	84	96	78	77	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%	86	97	77	78	91
Extracted ISTD $^{13}C_4$ *PFOS*	%	89	95	77	75	91
Extracted ISTD $^{13}C_4$ *PFBA*	%	74	85	64	66	80

PFAS in Soils Extended						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	75	88	64	66	81
Extracted ISTD $^{13}C_2$ *PFHxA*	%	79	96	72	72	88
Extracted ISTD $^{13}C_4$ *PFHpA*	%	83	92	71	72	89
Extracted ISTD $^{13}C_4$ *PFOA*	%	80	93	70	70	85
Extracted ISTD $^{13}C_5$ *PFNA*	%	84	92	73	76	88
Extracted ISTD $^{13}C_2$ *PFDA*	%	92	95	75	77	89
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	92	101	83	88	103
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	91	97	89	78	96
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	92	105	89	82	109
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	61	79	51	52	67
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	71	85	57	57	71
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	73	78	67	60	74
Extracted ISTD $^{13}C_8$ *FOSA*	%	88	96	76	76	94
Extracted ISTD d_3 *N MeFOSA*	%	89	98	77	78	97
Extracted ISTD d_5 *N EtFOSA*	%	92	100	76	76	92
Extracted ISTD d_7 *N MeFOSE*	%	88	96	78	79	92
Extracted ISTD d_9 *N EtFOSE*	%	88	101	75	80	95
Extracted ISTD d_3 *N MeFOSAA*	%	73	84	63	58	75
Extracted ISTD d_5 *N EtFOSAA*	%	68	87	71	65	78
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	0.2	<0.1	<0.1

Miscellaneous Inorg - soil						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Total Organic Carbon (Combustion)	mg/kg	14,000	15,000	1,900	2,100	12,000
Organic Matter (Combustion)	%	2.4	2.6	0.3	0.4	2.0
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Total Organic Carbon (Combustion)	mg/kg	7,000	1,300	12,000	6,600	1,200
Organic Matter (Combustion)	%	1.2	0.2	2.0	1.1	0.2
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Particle Size Distribution in Soils						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Date analysed	-	08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	1	<1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	<1	<1
Medium Sand 0.3-0.425mm	%	2	<1	<1	1	<1
Fine Sand 0.15-0.3mm	%	15	15	17	5	14
Very Fine Sand 0.075-0.15mm	%	19	19	23	16	26
Coarse Silt 0.020-0.075mm	%	23	28	10	14	26
Fine Silt 0.002-0.020mm	%	17	15	4	6	8
Clay <0.002mm	%	24	23	46	57	26

Particle Size Distribution in Soils						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Date analysed	-	08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	1	<1	<1	<1	<1
Coarse Sand 0.6-1.18mm	%	2	<1	1	<1	<1
Medium Sand 0.425-0.6mm	%	1	<1	1	<1	<1
Medium Sand 0.3-0.425mm	%	5	<1	2	<1	<1
Fine Sand 0.15-0.3mm	%	21	3	12	7	<1
Very Fine Sand 0.075-0.15mm	%	16	45	27	19	3
Coarse Silt 0.020-0.075mm	%	13	17	17	23	24
Fine Silt 0.002-0.020mm	%	7	9	18	18	30
Clay <0.002mm	%	34	26	22	33	43

Acid Extractractable metals in soil						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Antimony - low level	mg/kg	1	<1	<1	<1	<1
Arsenic - low level	mg/kg	12	4	1	4	9.3
Cadmium - low level	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Copper - low level	mg/kg	6.1	2	5.4	4	8.1
Chromium - low level	mg/kg	32	10	21	8.1	18
Lead - low level	mg/kg	8.5	3	4	2	20
Mercury - low level	mg/kg	0.02	<0.01	0.02	<0.01	0.10
Nickel - low level	mg/kg	16	5.4	15	12	11
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	22	8.0	8.2	5	30

Acid Extractractable metals in soil						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Antimony - low level	mg/kg	<1	<1	2	<1	2
Arsenic - low level	mg/kg	8.1	5.9	14	8.8	5.5
Cadmium - low level	mg/kg	<0.1	<0.1	0.8	<0.1	<0.1
Copper - low level	mg/kg	5.3	2	21	6.5	5.3
Chromium - low level	mg/kg	17	4	39	21	21
Lead - low level	mg/kg	3	4	83	13	5.8
Mercury - low level	mg/kg	<0.01	0.01	0.32	0.04	0.01
Nickel - low level	mg/kg	9.1	6.6	22	13	22
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	10	10	70	20	33

Moisture						
Our Reference		276673-2	276673-4	276673-6	276673-12	276673-16
Your Reference	UNITS	BH-BP-19_0.5-1.0_210826	BH-BP-19_1.5-2.0_210826	BH-BP-19_2.5-3.0_210826	QC104 _210826	BH-SB-30_0.5-1.0_210827
Date Sampled		26/08/2021	26/08/2021	26/08/2021	26/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Moisture	%	55	54	37	33	52

Moisture						
Our Reference		276673-18	276673-22	276673-27	276673-30	276673-32
Your Reference	UNITS	BH-SB-30_1.5-2.0_210827	BH-SB-30_4.5-5.0_210827	BH-SB-31_0.5-1.0_210827	BH-SB-31_2.0-2.5_210827	BH-SB-31_3.5-4.0_210827
Date Sampled		27/08/2021	27/08/2021	27/08/2021	27/08/2021	27/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Moisture	%	36	20	55	46	21

PAHs in Water - Low Level			
Our Reference	UNITS	276673-13	276673-25
Your Reference		QC306_210826	QC307_210827
Date Sampled		26/08/2021	27/08/2021
Type of sample		Water	Water
Date extracted	-	02/09/2021	02/09/2021
Date analysed	-	02/09/2021	02/09/2021
Naphthalene	µg/L	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	83	84

Organotin Compunds in Water			
Our Reference		276673-13	276673-25
Your Reference	UNITS	QC306_210826	QC307_210827
Date Sampled		26/08/2021	27/08/2021
Type of sample		Water	Water
Date prepared	-	02/09/2021	02/09/2021
Date analysed	-	06/09/2021	06/09/2021
Monobutyltin as Sn	µg/L	<0.005	<0.005
Dibutyltin as Sn	µg/L	<0.002	<0.002
Tributyltin as Sn	µg/L	<0.002	<0.002
Surrogate Triphenyltin	%	93	92

PFAS in Waters Trace Extended					
Our Reference		276673-13	276673-14	276673-25	276673-36
Your Reference	UNITS	QC306_210826	QC204_210826	QC307_210827	QC404_210827
Date Sampled		26/08/2021	26/08/2021	27/08/2021	27/08/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0005	<0.0002	<0.0002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	97	98	93	95
Surrogate $^{13}C_2$ *PFOA*	%	86	90	88	90
Extracted ISTD $^{13}C_3$ *PFBS*	%	86	86	94	83
Extracted ISTD $^{18}O_2$ *PFHxS*	%	80	82	88	81
Extracted ISTD $^{13}C_4$ *PFOS*	%	80	83	85	77
Extracted ISTD $^{13}C_4$ *PFBA*	%	82	84	88	83

PFAS in Waters Trace Extended					
Our Reference		276673-13	276673-14	276673-25	276673-36
Your Reference	UNITS	QC306_210826	QC204_210826	QC307_210827	QC404_210827
Date Sampled		26/08/2021	26/08/2021	27/08/2021	27/08/2021
Type of sample		Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	80	75	78	75
Extracted ISTD $^{13}C_2$ *PFHxA*	%	96	100	102	97
Extracted ISTD $^{13}C_4$ *PFHpA*	%	90	91	96	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	99	103	106	97
Extracted ISTD $^{13}C_5$ *PFNA*	%	83	87	85	85
Extracted ISTD $^{13}C_2$ *PFDA*	%	86	94	96	85
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	86	94	89	85
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	86	108	100	101
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	47	47	68	46
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	90	88	92	86
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	99	102	107	99
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	84	94	91	83
Extracted ISTD $^{13}C_8$ *FOSA*	%	83	91	83	84
Extracted ISTD d_3 *N MeFOSA*	%	44	53	45	54
Extracted ISTD d_5 *N EtFOSA*	%	49	50	48	55
Extracted ISTD d_7 *N MeFOSE*	%	78	85	79	82
Extracted ISTD d_9 *N EtFOSE*	%	84	87	82	81
Extracted ISTD d_3 *N MeFOSAA*	%	115	133	118	121
Extracted ISTD d_5 *N EtFOSAA*	%	136	137	168	141
Total Positive PFHxS & PFOS	µg/L	0.0005	<0.0002	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.0005	<0.0002	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.0005	<0.0002	<0.0002	<0.0002

All metals in water - total			
Our Reference		276673-13	276673-25
Your Reference	UNITS	QC306_210826	QC307_210827
Date Sampled		26/08/2021	27/08/2021
Type of sample		Water	Water
Date prepared	-	02/09/2021	02/09/2021
Date analysed	-	02/09/2021	02/09/2021
Antimony-Total	µg/L	<1	<1
Arsenic-Total	µg/L	<1	<1
Chromium-Total	µg/L	<1	<1
Copper-Total	µg/L	<1	<1
Lead-Total	µg/L	<1	<1
Nickel-Total	µg/L	<1	<1
Silver-Total	µg/L	<1	<1
Zinc-Total	µg/L	2	<1
Cadmium-Total	µg/L	<0.1	<0.1
Mercury-Total	µg/L	<0.05	<0.05

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-4
Date extracted	-			01/09/2021	2	01/09/2021	01/09/2021		01/09/2021	01/09/2021
Date extracted	-			03/09/2021	2	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Naphthalene	µg/kg	5	Ext-054	<5	2	<5	<5	0	83	80
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	2	7.0	45	146	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	2	<5	<5	0	84	91
Phenanthrene	µg/kg	5	Ext-054	<5	2	<5	6	18	83	86
Anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	2	<5	6	18	96	102
Pyrene	µg/kg	5	Ext-054	<5	2	<5	7	33	91	101
Benz(a)anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	2	<5	<5	0	90	92
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	2	<10	<10	0	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	2	<5	<5	0	101	#
Perylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	110	2	100	129	25	91	100

QUALITY CONTROL: Organotin Compunds in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-4
Date prepared	-			01/09/2021	2	01/09/2021	01/09/2021		01/09/2021	01/09/2021
Date analysed	-			03/09/2021	2	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<3.3	<3.3	0	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<2.6	<2.6	0	91	131
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<2	<2	0	107	130
Surrogate Triphenyltin	%		Ext-054	100	2	95	95	0	114	93

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-4
Date prepared	-			02/09/2021	2	02/09/2021	02/09/2021		02/09/2021	02/09/2021
Date analysed	-			02/09/2021	2	02/09/2021	02/09/2021		02/09/2021	02/09/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	107	107
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	98
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	82	74
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	100
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	93	90
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	75	64
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	101	96
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	107	105
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	89	83
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	96	91
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	90	94
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	93	90
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	69	66
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	86	73
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	96	96
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	121	126
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	2	<5	<5	0	95	87
4:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	91	84
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	104	96
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	98	90
10:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	102	113
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	82	75
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	96	95
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	2	<1	<1	0	97	96
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	2	<1	<1	0	113	95
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	2	<5	<5	0	88	75
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	107	115
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	118	110
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	105	2	105	98	7	106	103
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	113	2	119	120	1	110	123

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-4
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	107	2	82	83	1	100	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	104	2	82	82	0	96	81
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	109	2	83	87	5	105	84
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	105	2	66	69	4	96	67
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	107	2	70	72	3	101	70
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	115	2	74	77	4	102	76
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	106	2	75	80	6	103	79
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	114	2	78	81	4	96	72
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	108	2	78	80	3	98	70
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	112	2	76	83	9	98	83
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	114	2	89	84	6	102	89
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	119	2	86	91	6	97	85
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	134	2	85	95	11	76	87
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	111	2	57	57	0	98	56
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	2	59	64	8	102	62
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	112	2	67	70	4	102	70
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	114	2	82	83	1	92	76
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	118	2	82	87	6	105	80
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	123	2	86	86	0	104	81
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	112	2	87	84	4	98	85

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-4
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	109	2	84	83	1	97	81
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	117	2	70	73	4	100	65
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	116	2	71	76	7	99	71

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/09/2021	2	06/09/2021	06/09/2021		06/09/2021	[NT]
Date analysed	-			08/09/2021	2	08/09/2021	08/09/2021		08/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	2	14000	14000	0	95	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	2	2.4	2.3	4	95	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	2	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date prepared	-			02/09/2021	2	02/09/2021	02/09/2021		02/09/2021	[NT]
Date analysed	-			03/09/2021	2	03/09/2021	03/09/2021		03/09/2021	[NT]
Antimony - low level	mg/kg	1	Metals-022	<1	2	1	1	0	90	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	2	12	11	9	95	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	2	<0.1	<0.1	0	90	[NT]
Copper - low level	mg/kg	0.5	Metals-022	<0.5	2	6.1	5.4	12	96	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	2	32	27	17	97	[NT]
Lead - low level	mg/kg	0.5	Metals-022	<0.5	2	8.5	7.8	9	94	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	2	0.02	0.02	0	99	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	2	16	14	13	96	[NT]
Silver - low level	mg/kg	0.5	Metals-022	<0.5	2	<0.5	<0.5	0	77	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	2	22	19	15	100	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			02/09/2021	[NT]	[NT]	[NT]	[NT]	02/09/2021	[NT]
Date analysed	-			02/09/2021	[NT]	[NT]	[NT]	[NT]	02/09/2021	[NT]
Naphthalene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	104	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	129	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	120	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	96	[NT]	[NT]	[NT]	[NT]	81	[NT]

QUALITY CONTROL: Organotin Compounds in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	276673-25
Date prepared	-			02/09/2021	13	02/09/2021	02/09/2021		02/09/2021	02/09/2021
Date analysed	-			06/09/2021	13	06/09/2021	06/09/2021		06/09/2021	06/09/2021
Monobutyltin as Sn	µg/L	0.005	Ext-054	<0.005	13	<0.005	<0.005	0	[NT]	[NT]
Dibutyltin as Sn	µg/L	0.002	Ext-054	<0.002	13	<0.002	<0.002	0	107	123
Tributyltin as Sn	µg/L	0.002	Ext-054	<0.002	13	<0.002	<0.002	0	93	107
Surrogate Triphenyltin	%		Ext-054	93	13	93	91	2	91	91

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/09/2021	[NT]	[NT]	[NT]	[NT]	03/09/2021	[NT]
Date analysed	-			03/09/2021	[NT]	[NT]	[NT]	[NT]	03/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	104	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	87	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	107	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	110	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	114	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	107	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	85	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	81	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	79	[NT]	[NT]	[NT]	[NT]	78	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	75	[NT]	[NT]	[NT]	[NT]	70	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	92	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	89	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	95	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	90	[NT]	[NT]	[NT]	[NT]	86	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	87	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	48	[NT]	[NT]	[NT]	[NT]	71	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	75	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	35	[NT]	[NT]	[NT]	[NT]	40	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	35	[NT]	[NT]	[NT]	[NT]	45	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	71	[NT]	[NT]	[NT]	[NT]	68	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	71	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	110	[NT]	[NT]	[NT]	[NT]	119	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	120	[NT]	[NT]	[NT]	[NT]	137	[NT]

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			02/09/2021	[NT]	[NT]	[NT]	[NT]	02/09/2021	[NT]
Date analysed	-			02/09/2021	[NT]	[NT]	[NT]	[NT]	02/09/2021	[NT]
Antimony-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Copper-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Lead-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Silver-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	119	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	115	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Water trace level:
PFTeDA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

PAH in Sediment, Organotin Compounds in Soil & Water analysed by MPL Laboratories. Report No. 267966

PAH in Sediment:
- #4MS: # Percent recovery not possible to report as the analytes in the sample/s have caused interference.
- The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.

Organotin Compounds in Soil: PQLs have been raised due to a decrease in extracted internal standard efficiency. This may be due to sample matrix interferences.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1390
View attached report

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	276673
Date Sample Received	01/09/2021
Date Instructions Received	01/09/2021
Date Results Expected to be Reported	13/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	32 Sediment, 4 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water - total	On Hold
BH-BP-19_0.0-0.5_210826																						✓
BH-BP-19_0.5-1.0_210826	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-BP-19_1.0-1.5_210826																						✓
BH-BP-19_1.5-2.0_210826	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-BP-19_2.0-2.5_210826																						✓
BH-BP-19_2.5-3.0_210826	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-BP-19_3.5-4.0_210826																						✓
BH-BP-19_4.5-5.0_210826																						✓
BH-BP-19_5.5-6.0_210826																						✓
BH-BP-19_6.5-7.0_210826																						✓
PW-BP-19_210826																						✓
QC104 _210826	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
QC306_210826																		✓	✓	✓	✓	
QC204_210826																				✓		
BH-SB-30_0.0-0.5_210827																						✓
BH-SB-30_0.5-1.0_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-30_1.0-1.5_210827																						✓
BH-SB-30_1.5-2.0_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-30_2.0-2.5_210827																						✓
BH-SB-30_2.5-3.0_210827																						✓

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water - total	On Hold
BH-SB-30_3.5-4.0_210827																						✓
BH-SB-30_4.5-5.0_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
PW-SB-30_210827																						✓
QC106_210827																						✓
QC307_210827																		✓	✓	✓	✓	
BH-SB-31_0.0-0.5_210827																						✓
BH-SB-31_0.5-1.0_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-31_1.0-1.5_210827																						✓
BH-SB-31_1.5-2.0_210827																						✓
BH-SB-31_2.0-2.5_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-31_2.5-3.0_210827																						✓
BH-SB-31_3.5-4.0_210827	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-31_4.5-5.0_210827																						✓
PW-SB-31_210827																						✓
QC105_210827																						✓
QC404_210827																				✓		

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

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

Additional Info

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

CHAIN OF CUSTODY FORM - Client

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National phone number 1300 424 344

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Perth Lab - MPL Laboratories
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Melbourne Lab - Envirolab Services
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Adelaide Office - Envirolab Services
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Brisbane Office - Envirolab Services
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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
					Sample information	**Tests Required**															**Comments**
1	BH-SB-32_0.0-1.0_210830			Sediment	X	X	X	X	X	X	X										
2	BH-SB-32_1.0-1.5_210830			Sediment																X	
3	BH-SB-32_1.7-2.0_210830			Sediment																X	
4	BH-SB-32_2.0-2.5_210830			Sediment																X	
5	BH-SB-32_2.5-3.0_210830			Sediment	X	X	X	X	X	X	X										
6	PW-SB-32_210830			Porewater																X	
7	QC108_210830			Sediment	X	X	X	X	X	X	X										
8	QC406_210830			Water				X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ES
Print Name:	Print Name: CEOFF.
Date & Time:	Date & Time: 2-9-21 15:00
Signature:	Signature:

Lab Use Only

Job number: 276959	Cooling: Ice / Ice pack / None
Temperature: 4	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

CHAIN OF CUSTODY FORM - Client

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National phone number 1300 424 344

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Adelaide Office - Envirolab Services
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Brisbane Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
9	BH-SB-33_1.5-2.0_210830			Sediment	X	X	X	X	X	X	X										
10	BH-SB-33_2.0-2.5_210830			Sediment																X	
11	BH-SB-33_2.5-3.0_210830			Sediment																X	
12	BH-SB-33_3.5-4.0_210830			Sediment																X	
13	BH-SB-33_4.5-5.0_210830			Sediment																X	
14	PW-SB-33_210830			Porewater																X	
15	QC107_210830			Sediment	X	X	X	X	X	X	X										
16	QC308_210830			Water	X	X	X	X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS	Lab Use Only
Print Name:	Print Name: CEOFF	Job number: 276959 — Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 2.9.21 1000	Temperature: 4 — Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

CHAIN OF CUSTODY FORM - Client

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Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density								HOLD	FREEZE and HOLD	Provide as much information about the sample as you can
17	QC309_210831			Water															X	X	
18	BH-BP-22_3.0-4.0_210831			Sediment																X	
19	BH-BP-22_4.0-5.0_210831			Sediment	X	X	X	X	X	X	X										
20	BH-BP-22_5.0-6.0_210831			Sediment																X	
21	BH-BP-22_6.0-7.0_210831			Sediment																X	
22	PW-BP-22_210831			Porewater																X	
23	QC109_210831			Sediment	X	X	X	X	X	X	X										

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ES	Lab Use Only
Print Name:	Print Name: CROFF.	Job number: 276959 / Cooling: Ice / (Ice pack) / None
Date & Time:	Date & Time: 22.4.21	Temperature: 4 / Security seal: Intact / Broken / (None)
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / (STD)

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 276959

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	20 Sediment, 3 Water
Date samples received	02/09/2021
Date completed instructions received	02/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	14/09/2021
Date of Issue	01/10/2021

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Diego Bigolin, Inorganics Supervisor
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	6	<5	7	6	<5
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	20	<5	20	20	<5
Pyrene	µg/kg	20	<5	20	20	<5
Benz(a)anthracene	µg/kg	9	<5	10	10	<5
Chrysene	µg/kg	8	<5	8	9	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	20	<10	20	30	<10
Benzo(e)pyrene	µg/kg	9.0	<5	10	10	<5
Benzo(a)pyrene	µg/kg	20	<5	20	20	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	10	<5	10	10	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	8	<5	10	10	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	61	76	69	64	66

PAH NAGD level in soil				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Date extracted	-	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5
Phenanthrene	µg/kg	5	<5	<5
Anthracene	µg/kg	<5	<5	<5
Fluoranthene	µg/kg	20	<5	<5
Pyrene	µg/kg	20	<5	<5
Benz(a)anthracene	µg/kg	8	<5	<5
Chrysene	µg/kg	7	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	20	<10	<10
Benzo(e)pyrene	µg/kg	9.0	<5	<5
Benzo(a)pyrene	µg/kg	20	<5	<5
Perylene	µg/kg	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	10	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5
Benzo(ghi)perylene	µg/kg	8	<5	<5
Coronene	µg/kg	<5	<5	<5
Surrogate p-Terphenyl-d14	%	70	73	76

Organotin Compunds in Soil						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	11/09/2021	11/09/2021	11/09/2021	11/09/2021	11/09/2021
Monobutyltin as Sn	µg/kg	<1.7	<1.7	<1.7	<2.7	<1.7
Dibutyltin as Sn	µg/kg	<1.3	<1.3	<1.3	<3.0	<1.3
Tributyltin as Sn	µg/kg	<1	<1	<1	<1	<1
Surrogate Triphenyltin	%	90	93	91	92	94

Organotin Compunds in Soil				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	11/09/2021	11/09/2021	11/09/2021
Monobutyltin as Sn	µg/kg	<1.7	<1.7	<1.7
Dibutyltin as Sn	µg/kg	<1.3	<1.3	<1.3
Tributyltin as Sn	µg/kg	<1	<1	<1
Surrogate Triphenyltin	%	90	91	93

PFAS in Soils Extended						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	07/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	07/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.3	<0.1	<0.1	0.1	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	101	95	98	101	97
Surrogate $^{13}C_2$ *PFOA*	%	87	86	86	87	94
Extracted ISTD $^{13}C_3$ *PFBS*	%	78	92	77	78	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	71	79	73	69	76
Extracted ISTD $^{13}C_4$ *PFOS*	%	80	95	84	79	91

PFAS in Soils Extended						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	63	76	64	59	81
Extracted ISTD $^{13}C_3$ *PFPeA*	%	68	84	74	72	87
Extracted ISTD $^{13}C_2$ *PFHxA*	%	80	90	81	72	89
Extracted ISTD $^{13}C_4$ *PFHpA*	%	68	76	68	64	91
Extracted ISTD $^{13}C_4$ *PFOA*	%	77	90	79	75	93
Extracted ISTD $^{13}C_5$ *PFNA*	%	71	82	73	67	91
Extracted ISTD $^{13}C_2$ *PFDA*	%	75	88	79	76	86
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	81	89	79	79	89
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	96	109	96	92	94
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	79	87	83	77	84
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	63	74	64	58	87
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	62	74	69	59	70
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	63	74	66	59	73
Extracted ISTD $^{13}C_8$ *FOSA*	%	81	93	84	80	90
Extracted ISTD d_3 *N MeFOSA*	%	87	101	88	81	89
Extracted ISTD d_5 *N EtFOSA*	%	93	114	94	90	91
Extracted ISTD d_7 *N MeFOSE*	%	75	87	77	74	102
Extracted ISTD d_9 *N EtFOSE*	%	79	91	81	77	101
Extracted ISTD d_3 *N MeFOSAA*	%	84	87	82	78	86
Extracted ISTD d_5 *N EtFOSAA*	%	89	90	85	85	78
Total Positive PFHxS & PFOS	µg/kg	0.3	<0.1	<0.1	0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	0.3	<0.1	<0.1	0.1	<0.1
Total Positive PFAS	µg/kg	0.3	<0.1	<0.1	0.1	<0.1

PFAS in Soils Extended				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	99	100	94
Surrogate $^{13}C_2$ *PFOA*	%	84	87	87
Extracted ISTD $^{13}C_3$ *PFBS*	%	74	93	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	68	84	75
Extracted ISTD $^{13}C_4$ *PFOS*	%	82	90	93
Extracted ISTD $^{13}C_4$ *PFBA*	%	59	74	72

PFAS in Soils Extended				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	73	88	84
Extracted ISTD $^{13}C_2$ *PFHxA*	%	76	89	84
Extracted ISTD $^{13}C_4$ *PFHpA*	%	62	73	70
Extracted ISTD $^{13}C_4$ *PFOA*	%	76	88	86
Extracted ISTD $^{13}C_5$ *PFNA*	%	67	83	78
Extracted ISTD $^{13}C_2$ *PFDA*	%	76	92	88
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	78	93	86
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	90	104	103
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	76	90	88
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	58	71	67
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	62	77	71
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	58	75	72
Extracted ISTD $^{13}C_8$ *FOSA*	%	83	96	93
Extracted ISTD d_3 *N MeFOSA*	%	81	98	97
Extracted ISTD d_5 *N EtFOSA*	%	89	111	108
Extracted ISTD d_7 *N MeFOSE*	%	75	87	85
Extracted ISTD d_9 *N EtFOSE*	%	75	94	91
Extracted ISTD d_3 *N MeFOSAA*	%	85	88	87
Extracted ISTD d_5 *N EtFOSAA*	%	84	89	86
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1

Miscellaneous Inorg - soil						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Total Organic Carbon (Combustion)	mg/kg	17,000	1,400	17,000	7,200	2,100
Organic Matter (Combustion)	%	2.9	0.2	2.9	1.2	0.3
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	09/09/2021	09/09/2021	09/09/2021
Total Organic Carbon (Combustion)	mg/kg	6,900	2,000	1,700
Organic Matter (Combustion)	%	1.2	0.3	0.3
Density in Soils/Solids	g/cm^3	#	#	#

Particle Size Distribution in Soils						
Our Reference		276959-1	276959-5	276959-9	276959-12	276959-19
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830	BH-BP-22_4.0-5.0_210831
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Date analysed	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	2	<1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	<1	<1
Medium Sand 0.3-0.425mm	%	<1	<1	<1	1	<1
Fine Sand 0.15-0.3mm	%	7	<1	5	3	7
Very Fine Sand 0.075-0.15mm	%	16	3	12	11	16
Coarse Silt 0.020-0.075mm	%	21	14	24	23	15
Fine Silt 0.002-0.020mm	%	19	35	12	13	8
Clay <0.002mm	%	37	48	47	46	53

Particle Size Distribution in Soils		
Our Reference		276959-23
Your Reference	UNITS	QC109_210831
Date Sampled		31/08/2021
Type of sample		Sediment
Date prepared	-	08/09/2021
Date analysed	-	09/09/2021
Cobbles >75mm	%	<1
Cobbles/Coarse Gravel 63-75mm	%	<1
Coarse Gravel 37.5-63mm	%	<1
Coarse Gravel 26.5-37.5mm	%	<1
Coarse Gravel 19-26.5mm	%	<1
Medium Gravel 13.2-19mm	%	<1
Medium Gravel 9.5-13.2mm	%	<1
Medium Gravel 6.7-9.5mm	%	<1
Medium Gravel 4.75-6.7mm	%	<1
Fine Gravel 2.36-4.75mm	%	<1
Very Coarse Sand 1.18-2.36mm	%	1
Coarse Sand 0.6-1.18mm	%	3
Medium Sand 0.425-0.6mm	%	2
Medium Sand 0.3-0.425mm	%	5
Fine Sand 0.15-0.3mm	%	7
Very Fine Sand 0.075-0.15mm	%	16
Coarse Silt 0.020-0.075mm	%	12
Fine Silt 0.002-0.020mm	%	5
Clay <0.002mm	%	50

Acid Extractractable metals in soil						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-15
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	QC107_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Antimony - low level	mg/kg	<1	2	2	<1	1
Arsenic - low level	mg/kg	9.2	5	10	8.2	13
Cadmium - low level	mg/kg	0.4	0.1	0.9	0.9	0.3
Copper - low level	mg/kg	10	10	15	14	8.2
Chromium - low level	mg/kg	22	20	35	25	31
Lead - low level	mg/kg	63	7.4	41	56	19
Mercury - low level	mg/kg	0.20	0.01	0.23	0.25	0.06
Nickel - low level	mg/kg	13	22	20	16	16
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	40	35	49	51	30

Acid Extractractable metals in soil				
Our Reference		276959-19	276959-23	276959-24
Your Reference	UNITS	BH-BP-22_4.0-5.0_210831	QC109_210831	BH-SB-32_0.0-1.0_210830 - [TRIPLICATE]
Date Sampled		31/08/2021	31/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	03/09/2021	03/09/2021	03/09/2021
Antimony - low level	mg/kg	2	2	2
Arsenic - low level	mg/kg	5.8	6.2	12
Cadmium - low level	mg/kg	<0.1	0.1	0.5
Copper - low level	mg/kg	10	9.3	14
Chromium - low level	mg/kg	27	33	36
Lead - low level	mg/kg	6.5	7.4	89
Mercury - low level	mg/kg	0.01	0.01	0.26
Nickel - low level	mg/kg	20	24	19
Silver - low level	mg/kg	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	16	18	55

Moisture						
Our Reference		276959-1	276959-5	276959-7	276959-9	276959-12
Your Reference	UNITS	BH-SB-32_0.0-1.0_210830	BH-SB-32_2.5-3.0_210830	QC108_210830	BH-SB-33_1.5-2.0_210830	BH-SB-33_3.0-4.0_210830
Date Sampled		30/08/2021	30/08/2021	30/08/2021	30/08/2021	30/08/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	04/09/2021	04/09/2021	04/09/2021	04/09/2021	04/09/2021
Moisture	%	53	22	54	54	24

Moisture				
Our Reference		276959-15	276959-19	276959-23
Your Reference	UNITS	QC107_210830	BH-BP-22_4.0-5.0_210831	QC109_210831
Date Sampled		30/08/2021	31/08/2021	31/08/2021
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	03/09/2021	03/09/2021	03/09/2021
Date analysed	-	04/09/2021	04/09/2021	04/09/2021
Moisture	%	53	30	33

PFAS in Waters Trace Extended		
Our Reference		276959-8
Your Reference	UNITS	QC406_210830
Date Sampled		30/08/2021
Type of sample		Water
Date prepared	-	03/09/2021
Date analysed	-	03/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.002
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	97
Surrogate $^{13}C_2$ *PFOA*	%	88
Extracted ISTD $^{13}C_3$ *PFBS*	%	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	80
Extracted ISTD $^{13}C_4$ *PFOS*	%	76
Extracted ISTD $^{13}C_4$ *PFBA*	%	84

PFAS in Waters Trace Extended		
Our Reference		276959-8
Your Reference	UNITS	QC406_210830
Date Sampled		30/08/2021
Type of sample		Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	75
Extracted ISTD $^{13}C_2$ *PFHxA*	%	94
Extracted ISTD $^{13}C_4$ *PFHpA*	%	87
Extracted ISTD $^{13}C_4$ *PFOA*	%	97
Extracted ISTD $^{13}C_5$ *PFNA*	%	84
Extracted ISTD $^{13}C_2$ *PFDA*	%	89
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	89
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	103
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	54
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	88
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	95
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	86
Extracted ISTD $^{13}C_8$ *FOSA*	%	84
Extracted ISTD d_3 *N MeFOSA*	%	53
Extracted ISTD d_5 *N EtFOSA*	%	50
Extracted ISTD d_7 *N MeFOSE*	%	79
Extracted ISTD d_9 *N EtFOSE*	%	79
Extracted ISTD d_3 *N MeFOSAA*	%	120
Extracted ISTD d_5 *N EtFOSAA*	%	129
Total Positive PFHxS & PFOS	µg/L	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002
Total Positive PFAS	µg/L	<0.0002

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			10/09/2021	12	10/09/2021	10/09/2021		10/09/2021	[NT]
Date analysed	-			13/09/2021	12	13/09/2021	13/09/2021		13/09/2021	[NT]
Naphthalene	µg/kg	5	Ext-054	<5	12	<5	<5	0	100	[NT]
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	12	<5	<5	0	96	[NT]
Phenanthrene	µg/kg	5	Ext-054	<5	12	<5	<5	0	106	[NT]
Anthracene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	12	<5	<5	0	98	[NT]
Pyrene	µg/kg	5	Ext-054	<5	12	<5	<5	0	100	[NT]
Benz(a)anthracene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	12	<5	<5	0	103	[NT]
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	12	<10	<10	0	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	12	<5	<5	0	86	[NT]
Perylene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	12	<5	<5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	60	12	66	68	3	61	[NT]

QUALITY CONTROL: Organotin Compunds in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date prepared	-			09/09/2021	[NT]	[NT]	[NT]	[NT]	09/09/2021	[NT]
Date analysed	-			11/09/2021	[NT]	[NT]	[NT]	[NT]	11/09/2021	[NT]
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	[NT]	[NT]	[NT]	[NT]	63	[NT]
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	[NT]	[NT]	[NT]	[NT]	84	[NT]
Surrogate Triphenyltin	%		Ext-054	94	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	276959-5
Date prepared	-			03/09/2021	1	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Date analysed	-			03/09/2021	1	03/09/2021	03/09/2021		03/09/2021	03/09/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	99	102
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	88	85
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	104	97
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	113	109
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	1	0.3	0.2	40	96	99
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	101	112
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	99	101
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	99	100
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	106	107
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	108	108
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	101	101
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	101	104
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	104	103
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	109	104
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	99	99
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	81	98
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	1	<5	<5	0	115	115
4:2 FTS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	106	106
6:2 FTS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	101	107
8:2 FTS	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	105	113
10:2 FTS	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	89	113
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	1	<1	<1	0	115	116
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	1	<1	<1	0	105	108
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	1	<1	<1	0	104	104
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	1	<1	<1	0	96	101
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	1	<5	<5	0	114	112
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	96	99
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	113	110
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	99	1	101	103	2	99	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	86	1	87	88	1	89	86

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	276959-5
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	96	1	78	83	6	101	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	89	1	71	69	3	88	81
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	104	1	80	78	3	102	89
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	93	1	63	60	5	92	73
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	98	1	68	67	1	98	82
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	101	1	80	79	1	102	89
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	91	1	68	67	1	87	76
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	103	1	77	76	1	100	86
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	92	1	71	67	6	91	77
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	103	1	75	75	0	97	86
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	97	1	81	81	0	96	92
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	120	1	96	96	0	94	101
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	92	1	79	79	0	51	89
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	85	1	63	61	3	88	76
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	92	1	62	59	5	93	73
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	93	1	63	62	2	89	71
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	106	1	81	81	0	102	90
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	111	1	87	84	4	113	98
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	129	1	93	94	1	121	107
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	95	1	75	74	1	95	83

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	276959-5
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	103	1	79	79	0	99	90
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	98	1	84	83	1	98	86
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	104	1	89	83	7	98	93

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date prepared	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	[NT]
Date analysed	-			09/09/2021	1	09/09/2021	09/09/2021		09/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	1	17000	14000	19	100	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	1	2.9	2.4	19	100	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	1	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date prepared	-			03/09/2021	1	03/09/2021	03/09/2021		03/09/2021	[NT]
Date analysed	-			03/09/2021	1	03/09/2021	03/09/2021		03/09/2021	[NT]
Antimony - low level	mg/kg	1	Metals-022	<1	1	<1	1	0	89	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	1	9.2	12	26	91	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	1	0.4	0.4	0	86	[NT]
Copper - low level	mg/kg	0.5	Metals-022	<0.5	1	10	13	26	92	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	1	22	33	40	95	[NT]
Lead - low level	mg/kg	0.5	Metals-022	<0.5	1	63	81	25	92	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	1	0.20	0.23	14	114	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	1	13	18	32	92	[NT]
Silver - low level	mg/kg	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	86	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	1	40	49	20	95	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/09/2021	8	03/09/2021	03/09/2021		03/09/2021	[NT]
Date analysed	-			03/09/2021	8	03/09/2021	03/09/2021		03/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	8	<0.0004	<0.0004	0	101	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	8	<0.001	<0.001	0	98	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	8	<0.0002	<0.0002	0	103	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	8	<0.001	<0.001	0	102	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	8	<0.0002	<0.0002	0	103	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	101	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	101	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	106	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	8	<0.0004	<0.0004	0	108	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	8	<0.0004	<0.0004	0	110	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	8	<0.0002	<0.0002	0	102	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	8	<0.001	<0.001	0	100	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	106	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	104	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	8	<0.005	<0.005	0	101	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	8	<0.01	<0.01	0	100	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	8	<0.05	<0.05	0	104	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	8	<0.001	<0.001	0	104	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	8	<0.0004	<0.0004	0	106	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	8	<0.0004	<0.0004	0	99	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	87	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	8	<0.01	<0.01	0	107	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	8	<0.005	<0.005	0	110	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	8	<0.01	<0.01	0	102	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	8	<0.005	<0.005	0	114	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	8	<0.05	<0.05	0	107	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	103	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	8	<0.002	<0.002	0	98	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	8	97	101	4	100	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	8	88	92	4	93	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	84	8	85	82	4	85	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	81	8	80	84	5	81	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	79	8	76	83	9	78	[NT]
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	89	8	84	83	1	83	[NT]
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	75	8	75	79	5	70	[NT]
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	97	8	94	95	1	92	[NT]
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	89	8	87	89	2	83	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	95	8	97	96	1	91	[NT]
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	84	8	84	84	0	83	[NT]
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	90	8	89	96	8	86	[NT]
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	87	8	89	95	7	91	[NT]
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	97	8	103	113	9	99	[NT]
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	48	8	54	81	40	71	[NT]
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	94	8	88	83	6	91	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	97	8	95	97	2	91	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	91	8	86	88	2	89	[NT]
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	78	8	84	82	2	75	[NT]
Extracted ISTD d_3 N MeFOSA	%		Org-029	35	8	53	48	10	40	[NT]
Extracted ISTD d_5 N EtFOSA	%		Org-029	35	8	50	48	4	45	[NT]
Extracted ISTD d_7 N MeFOSE	%		Org-029	71	8	79	77	3	68	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	72	8	79	84	6	71	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	110	8	120	139	15	119	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	120	8	129	157	20	137	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFTeDA, MeFOSA, EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 276959-1 for Cr. Therefore a triplicate result has been issued as laboratory sample number 276959-24.

PAH in Sediment & Organotin Compounds in Soil analysed by MPL Laboratories. Report No. 268182

Organotin Compounds in Soil: Some PQLs have been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1390 (Sample #1,5,7,9,15,19&23)
View attached report

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1551 (Sample #12)
View attached report

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LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street, Chatswood, NSW 2067
Contact name: [redacted]
Job number: 21_1390
Revision No.: 1
Date received: 26/08/2021
Date analysed: 14/09/2021
Date reported: 16/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments: **This report supersedes 21_1390_01 to 21_1390_41 Absolute density report following ASTM D5550 NATA Revision 0 issued on 15/09/2021 due to request to split by client job numbers.**

Sample preparation

The sample supplied by the client was a fine, damp, slurry with occasional large particulate throughout. Each sample was washed twice with RO water to remove any salts present and oven dried at 45 °C prior to analysis.

Analysis

The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

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Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
276959-1	21_1390_35	2.596 ± 0.001
276959-5	21_1390_36	2.690 ± 0.001
276959-7	21_1390_37	2.576 ± 0.001
276959-9	21_1390_38	2.587 ± 0.000
276959-15	21_1390_39	2.589 ± 0.001
276959-19	21_1390_40	2.614 ± 0.000
276959-23	21_1390_42	2.576 ± 0.000

The results are representative only of the sample/s provided.

Analyst: [redacted]
B.Sc.(Multidisciplinary)

Reported: [redacted] B.Sc.(Archaeology)

Authorised: [redacted] B.Sc.(Nanotechnology)

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LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street CHATSWOOD NSW 2067
Job number: 21_1551

Date received: 21/09/2021
Date analysed: 28/09/2021
Date reported: 29/09/2021

Analysis: Absolute density by helium pycnometry following ASTM D5550

Revision No.: 0
Comments: None

Sample preparation

A representative sub-sample was taken and oven dried at 105 °C prior to analysis.

Analysis

The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

Summary

The density results are as follows:

Client ID	Lab ID	Density (g/cc)
276959 12	21_1551_01	2.6323 ± 0.0007

The results are representative only of the sample/s provided.

Analyst: [redacted] Cert IV (Laboratory Techniques)

Reported: [redacted] Cert IV (Laboratory Techniques)

Authorised: [redacted], B.Sc.(Hons)Physics, MAIP

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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	276959
Date Sample Received	02/09/2021
Date Instructions Received	02/09/2021
Date Results Expected to be Reported	14/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	20 Sediment, 3 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Missing bag sample for QC108_210830

Recd - 2 x bag for QC107_210830

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water-dissolved	All metals in water - total	On Hold
BH-SB-32_0.0-1.0_210830	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-SB-32_1.0-1.5_210830																							✓
BH-SB-32_1.7-2.0_210830																							✓
BH-SB-32_2.0-2.5_210830																							✓
BH-SB-32_2.5-3.0_210830	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
PW-SB-32_210830																							✓
QC108_210830	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
QC406_210830																				✓			
BH-SB-33_1.5-2.0_210830	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-SB-33_2.0-2.5_210830																							✓
BH-SB-33_2.5-3.0_210830																							✓
BH-SB-33_3.0-4.0_210830	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-SB-33_4.0-5.0_210830																							✓
PW-SB-33_210830																							✓
QC107_210830	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
QC308_210830																		✓	✓	✓	✓	✓	
QC309_210831																							✓
BH-BP-22_3.0-4.0_210831																							✓
BH-BP-22_4.0-5.0_210831	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-22_5.0-6.0_210831																							✓

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water-dissolved	All metals in water - total	On Hold
BH-BP-22_6.0-7.0_210831																							✓
PW-BP-22_210831																							✓
QC109_210831	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						

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

Additional Info

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

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

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

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

CHAIN OF CUSTODY FORM - Client

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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:	[redacted]	Envirolab Quote No.:	21SY185_Rev1
Sampler:	BC	Date results required:	Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day
Address:		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Phone:	Mob: [redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Results to:	[redacted]	Lab Comments:	
Email Invoice to:	[redacted]		

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Comments: Provide as much information about the sample as you can
1	BH-BP-20_0.0-1.0_210901			Sediment	x	x	x	x	x	x	x										
2	BH-BP-20_1.0-1.5_210901			Sediment																x	
3	BH-BP-20_1.5-2.0_210901			Sediment																x	
4	BH-BP-20_2.0-3.0_210901			Sediment	x	x	x	x	x	x	x										
5	BH-BP-20_3.0-4.0_210901			Sediment																x	
6	BH-BP-20_4.0-5.0_210901			Sediment	x	x	x	x	x	x	x										
7	BH-BP-20_5.0-6.0_210901			Sediment																x	
8	PW-BP-20_210901			Porewater																x	
9	QC110_210901			Sediment	x	x	x	x	x	x	x										

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ELS
Print Name:		Print Name:	BROOKE
Date & Time:		Date & Time:	3-9-21 10:00
Signature:		Signature:	

Lab Use Only

Job number:	277161
Temperature:	4
TAT Req - SAME day / 1 / 2 / 3 / 4 / (STD)	
Cooling: Ice / (Ice pack) / None	
Security seal: Intact / Broken / (None)	

CHAIN OF CUSTODY FORM - Client updated

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08 7087 6800 | adelaide@envirolab.com.au

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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM	**Client Project Name/Number/Site etc (ie report title):**	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	**PO No. (if applicable):**	
Project Mgr:	[redacted]	**Envirolab Quote No. :**	21SY185_Rev1
Sampler:	BC	**Date results required:**	
Address:		**Or choose:**	☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day
Phone:	**Mob:** [redacted]	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	
Email Results to:	[redacted]	**Additional report format:**	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	**Lab Comments:**	

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density								FREEZE and HOLD	Provide as much information about the sample as you can
10	BH-BP-21_0.0-1.0_210901			Sediment	X	X	X	X	X	X	X									
11	BH-BP-21_1.0-1.5_210901			Sediment															X	
12	BH-BP-21_2.0-3.0_210901			Sediment	X	X	X	X	X	X	X									
13	BH-BP-21_3.0-4.0_210901			Sediment	X	X	X	X	X	X	X									
14	BH-BP-21_4.0-5.0_210901			Sediment															X	
15	BH-BP-21_5.0-6.0_210901			Sediment															X	
16	PW-BP-21_210901			Porewater															X	
17	QC111_210901			Sediment	X	X	X	X	X	X	X									
18	QC310_210903			Water	X	X	X	X												
19	QC408_210903			Water				X												

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	**Received by (Company):** OLS	*Lab Use Only*	
Print Name:	**Print Name:**	**Job number:**	**Cooling: Ice / Ice pack / None**
Date & Time:	**Date & Time:**	**Temperature:**	**Security seal: Intact / Broken / None**
Signature:	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**	

CHAIN OF CUSTODY FORM - Client

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Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required: Or choose:	☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day
Address:		Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Phone: / Mob:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Results to:	[redacted]	Lab Comments:	
Email Invoice to:	[redacted]		

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density								FREEZE and HOLD	Provide as much information about the sample as you can
10	BH-BP-21_0.0-1.0_210901			Sediment	X	X	X	X	X	X	X									
11	BH-BP-21_1.0-1.5_210901			Sediment															X	
X	BH-BP-21_1.5-2.0_210901			Sediment	X	X	X	X	X	X	X									
12	BH-BP-21_2.0-3.0_210901			Sediment															X	
13	BH-BP-21_3.0-4.0_210901			Sediment	X	X	X	X	X	X	X									
14	BH-BP-21_4.0-5.0_210901			Sediment															X	
15	BH-BP-21_5.0-6.0_210901			Sediment															X	
16	PW-BP-21_210901			Porewater															X	
17	QC111_210901			Sediment	X	X	X	X	X	X	X									
18	QC310_210903			Water	X	X	X	X												
19	QC408_210903			Water				X												

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ELS
Print Name:		Print Name:	GEOFF
Date & Time:		Date & Time:	3-9-21 10:00
Signature:		Signature:	

Lab Use Only

Job number:	277161
Temperature:	4
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	
Cooling: Ice / Ice pack / None	
Security seal: Intact / Broken / None	

5 Alvan Street
Mount Lawley, WA 6050
+61 8 9225 5810
ABN 65 133 060 787

Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street CHATSWOOD NSW 2067
Contact name: [redacted]
Job number: 21_1462
Revision No.: 0
Date received: 7/09/2021
Date analysed: 16/09/2021
Date reported: 17/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments: **none**

Sample preparation
Representative sub-samples were taken and oven dried at 105 °C prior to analysis.

Analysis
The samples were analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analyses were conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
277161-1	21_1462_1	2.6151±0.0010
277161-4	21_1462_2	2.6579±0.0011
277161-6	21_1462_3	2.6429±0.0003
277161-10	21_1462_4	2.6148±0.0020
277161-12	21_1462_5	2.5897±0.0017
277161-13	21_1462_6	2.6305±0.0012

The results are representative only of the sample/s provided.

Analyst: [redacted] Cert IV (Laboratory Techniques)

Reported: [redacted] Cert IV (Laboratory Techniques)

Authorised: [redacted] B.Sc.(Chemistry)

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 277161

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	15 Sediment, 2 Porewater, 2 Water
Date samples received	03/09/2021
Date completed instructions received	03/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	16/09/2021
Date of Issue	21/09/2021

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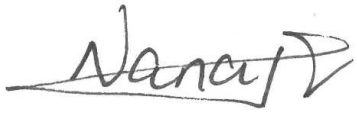
Results Approved By
Diego Bigolin, Inorganics Supervisor
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	20	<5	<5	30	<5
Anthracene	µg/kg	8	<5	<5	9	<5
Fluoranthene	µg/kg	50	<5	<5	60	<5
Pyrene	µg/kg	54	<5	<5	64	<5
Benz(a)anthracene	µg/kg	30	<5	<5	30	<5
Chrysene	µg/kg	20	<5	<5	30	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	80	<10	<10	110	<10
Benzo(e)pyrene	µg/kg	31	<5	<5	59	<5
Benzo(a)pyrene	µg/kg	58	<5	<5	85	<5
Perylene	µg/kg	7.0	<5	<5	15	<5
Indeno(1,2,3-cd)pyrene	µg/kg	30	<5	<5	53	<5
Dibenz(ah)anthracene	µg/kg	<6	<5	<5	<12	<5
Benzo(ghi)perylene	µg/kg	30	<5	<5	55	<5
Coronene	µg/kg	8.0	<5	<5	14	<5
Surrogate p-Terphenyl-d14	%	60	70	67	75	63

PAH NAGD level in soil		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date extracted	-	10/09/2021
Date analysed	-	13/09/2021
Naphthalene	µg/kg	<5
2-Methylnaphthalene	µg/kg	<5
Acenaphthylene	µg/kg	<5
Acenaphthene	µg/kg	<5
Fluorene	µg/kg	<5
Phenanthrene	µg/kg	<5
Anthracene	µg/kg	<5
Fluoranthene	µg/kg	<5
Pyrene	µg/kg	<5
Benz(a)anthracene	µg/kg	<5
Chrysene	µg/kg	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10
Benzo(e)pyrene	µg/kg	<5
Benzo(a)pyrene	µg/kg	<5
Perylene	µg/kg	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5
Dibenz(ah)anthracene	µg/kg	<5
Benzo(ghi)perylene	µg/kg	<5
Coronene	µg/kg	<5
Surrogate p-Terphenyl-d14	%	60

Organotin Compunds in Soil						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	11/09/2021	11/09/2021	11/09/2021	11/09/2021	11/09/2021
Monobutyltin as Sn	µg/kg	<6.7	<1.7	<1.7	<3.7	<1.7
Dibutyltin as Sn	µg/kg	<4.1	<1.3	<1.3	<3.7	<1.3
Tributyltin as Sn	µg/kg	<1	<1	<1	<1	<1
Surrogate Triphenyltin	%	88	90	89	89	92

Organotin Compunds in Soil		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	09/09/2021
Date analysed	-	11/09/2021
Monobutyltin as Sn	µg/kg	<1.7
Dibutyltin as Sn	µg/kg	<1.3
Tributyltin as Sn	µg/kg	<1
Surrogate Triphenyltin	%	91

PFAS in Soils Extended						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1	0.3	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	103	104	100	108	104
Surrogate $^{13}C_2$ *PFOA*	%	116	124	130	122	118
Extracted ISTD $^{13}C_3$ *PFBS*	%	74	88	89	81	79
Extracted ISTD $^{18}O_2$ *PFHxS*	%	81	91	92	85	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	68	78	83	73	72

PFAS in Soils Extended						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	71	82	84	73	74
Extracted ISTD $^{13}C_3$ *PFPeA*	%	62	75	76	68	67
Extracted ISTD $^{13}C_2$ *PFHxA*	%	63	75	77	68	67
Extracted ISTD $^{13}C_4$ *PFHpA*	%	65	75	80	69	69
Extracted ISTD $^{13}C_4$ *PFOA*	%	66	71	75	65	69
Extracted ISTD $^{13}C_5$ *PFNA*	%	72	77	82	72	73
Extracted ISTD $^{13}C_2$ *PFDA*	%	78	81	86	80	78
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	82	88	86	82	82
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	78	86	87	82	79
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	81	90	88	85	79
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	46	59	61	52	54
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	57	63	71	58	55
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	62	64	72	58	61
Extracted ISTD $^{13}C_8$ *FOSA*	%	79	93	96	82	83
Extracted ISTD d_3 *N MeFOSA*	%	67	78	80	70	70
Extracted ISTD d_5 *N EtFOSA*	%	60	72	79	64	66
Extracted ISTD d_7 *N MeFOSE*	%	75	93	94	86	82
Extracted ISTD d_9 *N EtFOSE*	%	75	89	91	76	79
Extracted ISTD d_3 *N MeFOSAA*	%	52	55	56	50	50
Extracted ISTD d_5 *N EtFOSAA*	%	92	68	65	63	62
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1	0.3	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1	0.3	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1	0.3	<0.1

PFAS in Soils Extended		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	06/09/2021
Date analysed	-	06/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2
Perfluorobutanoic acid	µg/kg	<0.2
Perfluoropentanoic acid	µg/kg	<0.2
Perfluorohexanoic acid	µg/kg	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1
Perfluorononanoic acid	µg/kg	<0.1
Perfluorodecanoic acid	µg/kg	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5
Perfluorododecanoic acid	µg/kg	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5
Perfluorotetradecanoic acid	µg/kg	<5
4:2 FTS	µg/kg	<0.1
6:2 FTS	µg/kg	<0.1
8:2 FTS	µg/kg	<0.2
10:2 FTS	µg/kg	<0.2
Perfluorooctane sulfonamide	µg/kg	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	105
Surrogate $^{13}C_2$ *PFOA*	%	126
Extracted ISTD $^{13}C_3$ *PFBS*	%	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89
Extracted ISTD $^{13}C_4$ *PFOS*	%	74
Extracted ISTD $^{13}C_4$ *PFBA*	%	79

PFAS in Soils Extended		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	69
Extracted ISTD $^{13}C_2$ *PFHxA*	%	66
Extracted ISTD $^{13}C_4$ *PFHpA*	%	68
Extracted ISTD $^{13}C_4$ *PFOA*	%	69
Extracted ISTD $^{13}C_5$ *PFNA*	%	72
Extracted ISTD $^{13}C_2$ *PFDA*	%	83
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	81
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	78
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	86
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	53
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	58
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	60
Extracted ISTD $^{13}C_8$ *FOSA*	%	88
Extracted ISTD d_3 *N MeFOSA*	%	74
Extracted ISTD d_5 *N EtFOSA*	%	70
Extracted ISTD d_7 *N MeFOSE*	%	90
Extracted ISTD d_9 *N EtFOSE*	%	87
Extracted ISTD d_3 *N MeFOSAA*	%	51
Extracted ISTD d_5 *N EtFOSAA*	%	61
Total Positive PFHxS & PFOS	µg/kg	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1
Total Positive PFAS	µg/kg	<0.1

Miscellaneous Inorg - soil						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Total Organic Carbon (Combustion)	mg/kg	15,000	6,700	5,200	17,000	21,000
Organic Matter (Combustion)	%	2.6	1.2	0.9	2.9	3.7
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	06/09/2021
Date analysed	-	09/09/2021
Total Organic Carbon (Combustion)	mg/kg	6,900
Organic Matter (Combustion)	%	1.2
Density in Soils/Solids	g/cm^3	#

Particle Size Distribution in Soils						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	1	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	1	2	<1	<1
Medium Sand 0.425-0.6mm	%	<1	2	3	<1	<1
Medium Sand 0.3-0.425mm	%	1	5	8	<1	<1
Fine Sand 0.15-0.3mm	%	7	5	27	2	<1
Very Fine Sand 0.075-0.15mm	%	17	15	22	31	7
Coarse Silt 0.020-0.075mm	%	29	20	14	26	43
Fine Silt 0.002-0.020mm	%	17	7	1	10	15
Clay <0.002mm	%	28	45	22	31	35

Particle Size Distribution in Soils		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	09/09/2021
Date analysed	-	10/09/2021
Cobbles >75mm	%	<1
Cobbles/Coarse Gravel 63-75mm	%	<1
Coarse Gravel 37.5-63mm	%	<1
Coarse Gravel 26.5-37.5mm	%	<1
Coarse Gravel 19-26.5mm	%	<1
Medium Gravel 13.2-19mm	%	<1
Medium Gravel 9.5-13.2mm	%	<1
Medium Gravel 6.7-9.5mm	%	<1
Medium Gravel 4.75-6.7mm	%	<1
Fine Gravel 2.36-4.75mm	%	<1
Very Coarse Sand 1.18-2.36mm	%	2
Coarse Sand 0.6-1.18mm	%	7
Medium Sand 0.425-0.6mm	%	5
Medium Sand 0.3-0.425mm	%	6
Fine Sand 0.15-0.3mm	%	10
Very Fine Sand 0.075-0.15mm	%	21
Coarse Silt 0.020-0.075mm	%	21
Fine Silt 0.002-0.020mm	%	5
Clay <0.002mm	%	24

Acid Extractractable metals in soil						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Antimony - low level	mg/kg	3	2	<1	2	2
Arsenic - low level	mg/kg	14	8.7	4	12	9.0
Cadmium - low level	mg/kg	2.0	<0.1	<0.1	1.0	0.2
Copper - low level	mg/kg	28	4	3	22	10
Chromium - low level	mg/kg	36	27	20	38	38
Lead - low level	mg/kg	120	5.6	3	55	44
Mercury - low level	mg/kg	0.76	0.02	0.01	0.49	0.16
Nickel - low level	mg/kg	21	14	11	21	19
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	84	17	12	69	37

Acid Extractractable metals in soil		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	06/09/2021
Date analysed	-	06/09/2021
Antimony - low level	mg/kg	2
Arsenic - low level	mg/kg	32
Cadmium - low level	mg/kg	0.2
Copper - low level	mg/kg	10
Chromium - low level	mg/kg	31
Lead - low level	mg/kg	8.0
Mercury - low level	mg/kg	0.01
Nickel - low level	mg/kg	22
Silver - low level	mg/kg	<0.5
Zinc - low level	mg/kg	19

Moisture						
Our Reference		277161-1	277161-4	277161-6	277161-10	277161-12
Your Reference	UNITS	BH-BP-20_0.0-1.0_210901	BH-BP-20_2.0-3.0_210901	BH-BP-20_4.0-5.0_210901	BH-BP-21_0.0-1.0	BH-BP-21_2.0-3.0
Date Sampled		1/09/2021	1/09/2021	1/09/2021	1/09/2021	1/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	06/09/2021	06/09/2021	06/09/2021	06/09/2021	06/09/2021
Date analysed	-	07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Moisture	%	56	35	28	49	51

Moisture		
Our Reference		277161-13
Your Reference	UNITS	BH-BP-21_3.0-4.0
Date Sampled		1/09/2021
Type of sample		Sediment
Date prepared	-	06/09/2021
Date analysed	-	07/09/2021
Moisture	%	44

PFAS in Waters Trace Extended		
Our Reference		277161-19
Your Reference	UNITS	QC408_210901
Date Sampled		1/09/2021
Type of sample		Water
Date prepared	-	06/09/2021
Date analysed	-	06/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.002
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	99
Surrogate $^{13}C_2$ *PFOA*	%	101
Extracted ISTD $^{13}C_3$ *PFBS*	%	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	103
Extracted ISTD $^{13}C_4$ *PFOS*	%	96
Extracted ISTD $^{13}C_4$ *PFBA*	%	106

PFAS in Waters Trace Extended		
Our Reference		277161-19
Your Reference	UNITS	QC408_210901
Date Sampled		1/09/2021
Type of sample		Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	89
Extracted ISTD $^{13}C_2$ *PFHxA*	%	119
Extracted ISTD $^{13}C_4$ *PFHpA*	%	99
Extracted ISTD $^{13}C_4$ *PFOA*	%	102
Extracted ISTD $^{13}C_5$ *PFNA*	%	106
Extracted ISTD $^{13}C_2$ *PFDA*	%	109
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	126
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	122
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	68
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	144
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	128
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	143
Extracted ISTD $^{13}C_8$ *FOSA*	%	66
Extracted ISTD d_3 *N MeFOSA*	%	#
Extracted ISTD d_5 *N EtFOSA*	%	#
Extracted ISTD d_7 *N MeFOSE*	%	42
Extracted ISTD d_9 *N EtFOSE*	%	45
Extracted ISTD d_3 *N MeFOSAA*	%	115
Extracted ISTD d_5 *N EtFOSAA*	%	93
Total Positive PFHxS & PFOS	µg/L	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002
Total Positive PFAS	µg/L	<0.0002

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277161-4
Date extracted	-			10/09/2021	1	10/09/2021	10/09/2021		10/09/2021	10/09/2021
Date analysed	-			13/09/2021	1	13/09/2021	13/09/2021		13/09/2021	13/09/2021
Naphthalene	µg/kg	5	Ext-054	<5	1	<5	<5	0	100	70
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	1	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	1	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	1	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	1	<5	<5	0	96	107
Phenanthrene	µg/kg	5	Ext-054	<5	1	20	30	40	106	117
Anthracene	µg/kg	5	Ext-054	<5	1	8	10	22	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	1	50	57	13	98	113
Pyrene	µg/kg	5	Ext-054	<5	1	54	62	14	100	115
Benz(a)anthracene	µg/kg	5	Ext-054	<5	1	30	30	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	1	20	30	40	103	116
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	1	80	70	13	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	1	31	32	3	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	1	58	58	0	86	118
Perylene	µg/kg	5	Ext-054	<5	1	7.0	8.0	13	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	1	30	30	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	1	<6	<6	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	1	30	30	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	1	8.0	8.0	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	60	1	60	70	15	61	67

QUALITY CONTROL: Organotin Compounds in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			09/09/2021	12	09/09/2021	09/09/2021		09/09/2021	[NT]
Date analysed	-			11/09/2021	12	11/09/2021	11/09/2021		11/09/2021	[NT]
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	12	<1.7	<1.7	0	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	12	<1.3	<1.3	0	63	[NT]
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	12	<1	<1	0	84	[NT]
Surrogate Triphenyltin	%		Ext-054	94	12	92	92	0	95	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277161-4
Date prepared	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	06/09/2021
Date analysed	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	06/09/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	101	107
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	93	98
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	90	96
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	106	112
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	1	<0.1	0.1	0	98	104
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	85	88
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	94	98
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	99	109
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	91	100
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	94	104
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	95	99
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	96	98
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	103	94
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	88	88
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	107	113
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	1	<0.5	<0.5	0	101	108
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	1	<5	<5	0	99	102
4:2 FTS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	97	104
6:2 FTS	µg/kg	0.1	Org-029	<0.1	1	<0.1	<0.1	0	91	100
8:2 FTS	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	91	102
10:2 FTS	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	104	133
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	1	<1	<1	0	97	95
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	1	<1	<1	0	101	107
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	1	<1	<1	0	107	117
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	1	<1	<1	0	101	109
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	1	<5	<5	0	92	92
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	107	125
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	1	<0.2	<0.2	0	97	101
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	106	1	103	104	1	104	101
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	104	1	116	122	5	108	124

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277161-4
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	104	1	74	81	9	102	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	108	1	81	81	0	107	89
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	98	1	68	67	1	98	80
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	114	1	71	70	1	110	81
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	102	1	62	64	3	101	71
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	101	1	63	63	0	100	74
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	98	1	65	65	0	98	73
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	103	1	66	64	3	98	72
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	108	1	72	71	1	98	76
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	104	1	78	76	3	100	85
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	107	1	82	78	5	110	90
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	106	1	78	81	4	97	76
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	121	1	81	84	4	117	85
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	97	1	46	47	2	97	55
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	116	1	57	51	11	106	63
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	1	62	57	8	99	59
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	117	1	79	81	2	107	86
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	100	1	67	67	0	100	79
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	97	1	60	64	6	93	72
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	108	1	75	76	1	109	89

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277161-4
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	107	1	75	77	3	105	88
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	91	1	52	49	6	89	52
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	101	1	92	59	44	103	68

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	[NT]
Date analysed	-			09/09/2021	1	09/09/2021	09/09/2021		09/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	1	15000	13000	14	100	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	1	2.6	2.2	17	100	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	1	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	277161-4
Date prepared	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	06/09/2021
Date analysed	-			06/09/2021	1	06/09/2021	06/09/2021		06/09/2021	06/09/2021
Antimony - low level	mg/kg	1	Metals-022	<1	1	3	3	0	88	#
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	1	14	14	0	90	102
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	1	2.0	2.1	5	90	94
Copper - low level	mg/kg	0.5	Metals-022	<0.5	1	28	30	7	90	114
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	1	36	43	18	89	108
Lead - low level	mg/kg	0.5	Metals-022	<0.5	1	120	120	0	90	72
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	1	0.76	0.65	16	112	84
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	1	21	25	17	90	85
Silver - low level	mg/kg	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	100	113
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	1	84	91	8	90	74

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			06/09/2021	[NT]	[NT]	[NT]	[NT]	06/09/2021	[NT]
Date analysed	-			06/09/2021	[NT]	[NT]	[NT]	[NT]	06/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	81	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	85	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	83	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	78	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	96	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	102	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	96	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	97	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	88	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	104	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	97	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	93	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	93	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	108	[NT]	[NT]	[NT]	[NT]	107	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	83	[NT]	[NT]	[NT]	[NT]	85	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	113	[NT]	[NT]	[NT]	[NT]	113	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	108	[NT]	[NT]	[NT]	[NT]	109	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	116	[NT]	[NT]	[NT]	[NT]	114	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	129	[NT]	[NT]	[NT]	[NT]	129	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	118	[NT]	[NT]	[NT]	[NT]	114	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	71	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	137	[NT]	[NT]	[NT]	[NT]	131	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	147	[NT]	[NT]	[NT]	[NT]	142	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	139	[NT]	[NT]	[NT]	[NT]	139	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	69	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	35	[NT]	[NT]	[NT]	[NT]	34	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	40	[NT]	[NT]	[NT]	[NT]	35	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	61	[NT]	[NT]	[NT]	[NT]	56	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	61	[NT]	[NT]	[NT]	[NT]	56	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	125	[NT]	[NT]	[NT]	[NT]	122	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PAH in Sediment & Organotin in Soil analysed by MPL Laboratories. Report No. 268368

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

Organotin in Soil: Some PQLs have been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

All Metals in soil - # Low spike recovery was obtained for this sample. The sample was re-digested and re-spiked and the low recovery was confirmed. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1462
View attached report

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277161
Date Sample Received	03/09/2021
Date Instructions Received	03/09/2021
Date Results Expected to be Reported	16/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	15 Sediment, 2 Porewater, 2 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	4
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Missing sample BH-BP-21_1.5-2.0_210901

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PAHs in Water - Low Level	Organotin Compunds in Water	PFAS in Waters Trace Extended	All metals in water-dissolved	All metals in water - total	On Hold
BH-BP-20_0.0-1.0_210901	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-20_1.0-1.5_210901																							✓
BH-BP-20_1.5-2.0_210901																							✓
BH-BP-20_2.0-3.0_210901	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-20_3.0-4.0_210901																							✓
BH-BP-20_4.0-5.0_210901	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-20_5.0-6.0_210901																							✓
PW-BP-20_210901																							✓
QC110_210901	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-21_0.0-1.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-21_1.0-1.5																							✓
BH-BP-21_2.0-3.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-21_3.0-4.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
BH-BP-21_4.0-5.0																							✓
BH-BP-21_5.0-6.0																							✓
PW-BP-21_210901																							✓
QC111_210901	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
QC310_210901																		✓	✓	✓	✓	✓	
QC408_210901																				✓			

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

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Additional Info

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

CHAIN OF CUSTODY FORM - Client

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National phone number 1300 424 344

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

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

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

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

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample Information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
1	BH-SB-28_0.0-0.5_210906			Sediment																X	
2	BH-SB-28_0.5-1.0_210906			Sediment																X	
3	BH-SB-28_1.0-1.5_210906			Sediment	X	X	X	X	X	X	X										
4	BH-SB-28_1.5-2.0_210906			Sediment																X	
5	BH-SB-28_2.0-2.5_210906			Sediment	X	X	X	X	X	X	X										
6	BH-SB-28_2.5-3.0_210906			Sediment																X	
7	BH-SB-28_4.0-5.0_210906			Sediment	X	X	X	X	X	X	X										
8	PW-SB-28_210906			Porewater																X	
9	QC112_210906			Sediment																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): Ev	*Lab Use Only*
Print Name:	Print Name: Phay	Job number: 277486 / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 9/9/2021 10:30	Temperature: 11 / Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

CHAIN OF CUSTODY FORM - Client

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

Adelaide Office - Envirolab Services
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✆ 07 3266 9532 | ✉ brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
✆ 08 8967 1201 | ✉ darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
10	BH-SB-29_0.0-0.5_210906			Sediment	X	X	X	X	X	X	X										
11	BH-SB-29_0.5-1.0_210906			Sediment																X	
12	BH-SB-29_1.0-1.5_210906			Sediment																X	
13	BH-SB-29_1.5-2.0_210906			Sediment																X	
14	BH-SB-29_2.0-2.5_210906			Sediment	X	X	X	X	X	X	X										
15	BH-SB-29_2.5-3.0_210906			Sediment																X	
16	BH-SB-29_3.0-4.0_210906			Sediment																X	
17	BH-SB-29_4.0-5.0_210906			Sediment																X	
18	BH-SB-29_5.0-6.0_210906			Sediment	X	X	X	X	X	X	X									-	
19	PW-SB-29_210906			Porewater																X	
20	QC113 _210906			Sediment																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): EN	*Lab Use Only*
Print Name:	Print Name: Ray	Job number: 277486 / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 8/9/2021 10:30	Temperature: 11 / Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

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Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
PO No. (if applicable):	
Envirolab Quote No. :	21SY185_Rev1
Date results required:	Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format:	☑ Esdat ☐ Equis
Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)												HOLD	Provide as much information about the sample as you can
21	QC311 _210906			Water																X	
22	QC312_210906			Water																X	
23	QC410_210906			Water				X													

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): EL	*Lab Use Only*
Print Name:	Print Name: Phey	Job number: 277486 / Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 8/09/2021 10:30	Temperature: 12° / Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

5 Alvan Street
Mount Lawley, WA 6050
+61 8 9225 5810
ABN 65 133 060 787

Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street, CHATSWOOD NSW 2067
Contact name: [redacted]
Job number: 21_1471
Revision No.: 0
Date received: 9/9/2021
Date analysed: 20/09/2021
Date reported: 20/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments:

Sample preparation
Representative sub-samples were taken and oven dried at 105 °C prior to analysis.

Analysis
The samples were analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analyses were conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
277486-3	21_1471_01	2.564 ± 0.001
277486-5	21_1471_02	2.623 ± 0.001
277486-7	21_1471_03	2.684 ± 0.001
277486-10	21_1471_04	2.637 ± 0.001
277486-14	21_1471_05	2.582 ±0.001
277486-18	21_1471_06	2.646 ± 0.001

The results are representative only of the sample/s provided.

Analyst: [redacted] B.A.

Reported: [redacted] B.A.

Authorised: [redacted] B.Sc.(Nanotechnology)

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CERTIFICATE OF ANALYSIS 277486

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	18 Sediment, 2 Porewater, 3 Water
Date samples received	08/09/2021
Date completed instructions received	08/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	13/09/2021
Date of Issue	21/09/2021

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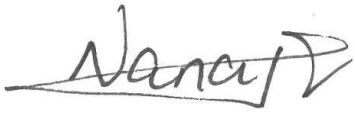
Results Approved By
Diego Bigolin, Inorganics Supervisor
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	<5	<5	<5	8	<5
Anthracene	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	µg/kg	10	<5	<5	20	<5
Pyrene	µg/kg	10	<5	<5	20	<5
Benz(a)anthracene	µg/kg	7	<5	<5	10	<5
Chrysene	µg/kg	6	<5	<5	10	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	20	<10	<10	40	<10
Benzo(e)pyrene	µg/kg	8.0	<5	<5	17	<5
Benzo(a)pyrene	µg/kg	20	<5	<5	30	<5
Perylene	µg/kg	<5	<5	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	10	<5	<5	20	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	8	<5	<5	20	<5
Coronene	µg/kg	<5	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	61	72	64	63	63

PAH NAGD level in soil		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date extracted	-	10/09/2021
Date analysed	-	13/09/2021
Naphthalene	µg/kg	<5
2-Methylnaphthalene	µg/kg	<5
Acenaphthylene	µg/kg	<5
Acenaphthene	µg/kg	<5
Fluorene	µg/kg	<5
Phenanthrene	µg/kg	<5
Anthracene	µg/kg	<5
Fluoranthene	µg/kg	<5
Pyrene	µg/kg	<5
Benz(a)anthracene	µg/kg	<5
Chrysene	µg/kg	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	<10
Benzo(e)pyrene	µg/kg	<5
Benzo(a)pyrene	µg/kg	<5
Perylene	µg/kg	<5
Indeno(1,2,3-cd)pyrene	µg/kg	<5
Dibenz(ah)anthracene	µg/kg	<5
Benzo(ghi)perylene	µg/kg	<5
Coronene	µg/kg	<5
Surrogate p-Terphenyl-d14	%	60

Organotin Compunds in Soil						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	11/09/2021	11/09/2021	11/09/2021	11/09/2021	11/09/2021
Monobutyltin as Sn	µg/kg	<1.7	<1.7	<1.7	<4.8	<1.7
Dibutyltin as Sn	µg/kg	<1.3	<1.3	<1.3	<3.3	<1.3
Tributyltin as Sn	µg/kg	<1	<1	<1	<1.1	<1
Surrogate Triphenyltin	%	92	90	89	87	90

Organotin Compunds in Soil		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	09/09/2021
Date analysed	-	11/09/2021
Monobutyltin as Sn	µg/kg	<1.7
Dibutyltin as Sn	µg/kg	<1.3
Tributyltin as Sn	µg/kg	<1
Surrogate Triphenyltin	%	93

PFAS in Soils Extended						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.2	<0.1	<0.1	0.3	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	99	99	96	100	103
Surrogate $^{13}C_2$ *PFOA*	%	111	117	113	116	117
Extracted ISTD $^{13}C_3$ *PFBS*	%	88	94	101	86	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	90	98	104	90	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	73	83	88	76	74

PFAS in Soils Extended						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Extracted ISTD $^{13}C_4$ *PFBA*	%	72	82	88	74	76
Extracted ISTD $^{13}C_3$ *PFPeA*	%	70	78	86	73	74
Extracted ISTD $^{13}C_2$ *PFHxA*	%	72	84	89	76	77
Extracted ISTD $^{13}C_4$ *PFHpA*	%	76	84	91	74	78
Extracted ISTD $^{13}C_4$ *PFOA*	%	75	82	89	73	80
Extracted ISTD $^{13}C_5$ *PFNA*	%	76	87	91	79	82
Extracted ISTD $^{13}C_2$ *PFDA*	%	86	92	101	85	87
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	91	92	103	83	90
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	86	92	101	85	93
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	82	90	104	88	87
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	40	48	56	37	43
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	54	62	71	53	56
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	66	73	86	69	69
Extracted ISTD $^{13}C_8$ *FOSA*	%	87	93	102	88	93
Extracted ISTD d_3 *N MeFOSA*	%	75	83	88	74	76
Extracted ISTD d_5 *N EtFOSA*	%	69	77	85	71	74
Extracted ISTD d_7 *N MeFOSE*	%	89	97	98	92	93
Extracted ISTD d_9 *N EtFOSE*	%	82	90	96	85	87
Extracted ISTD d_3 *N MeFOSAA*	%	61	63	74	62	64
Extracted ISTD d_5 *N EtFOSAA*	%	72	76	88	68	67
Total Positive PFHxS & PFOS	µg/kg	0.2	<0.1	<0.1	0.3	<0.1
Total Positive PFOS & PFOA	µg/kg	0.2	<0.1	<0.1	0.3	<0.1
Total Positive PFAS	µg/kg	0.2	<0.1	<0.1	0.3	<0.1

PFAS in Soils Extended		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	10/09/2021
Date analysed	-	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2
Perfluorobutanoic acid	µg/kg	<0.2
Perfluoropentanoic acid	µg/kg	<0.2
Perfluorohexanoic acid	µg/kg	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1
Perfluorononanoic acid	µg/kg	<0.1
Perfluorodecanoic acid	µg/kg	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5
Perfluorododecanoic acid	µg/kg	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5
Perfluorotetradecanoic acid	µg/kg	<5
4:2 FTS	µg/kg	<0.1
6:2 FTS	µg/kg	<0.1
8:2 FTS	µg/kg	<0.2
10:2 FTS	µg/kg	<0.2
Perfluorooctane sulfonamide	µg/kg	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	102
Surrogate $^{13}C_2$ *PFOA*	%	117
Extracted ISTD $^{13}C_3$ *PFBS*	%	101
Extracted ISTD $^{18}O_2$ *PFHxS*	%	100
Extracted ISTD $^{13}C_4$ *PFOS*	%	81
Extracted ISTD $^{13}C_4$ *PFBA*	%	84

PFAS in Soils Extended		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Extracted ISTD $^{13}C_3$ *PFPeA*	%	83
Extracted ISTD $^{13}C_2$ *PFHxA*	%	85
Extracted ISTD $^{13}C_4$ *PFHpA*	%	89
Extracted ISTD $^{13}C_4$ *PFOA*	%	87
Extracted ISTD $^{13}C_5$ *PFNA*	%	91
Extracted ISTD $^{13}C_2$ *PFDA*	%	102
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	107
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	100
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	100
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	56
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	75
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	93
Extracted ISTD $^{13}C_8$ *FOSA*	%	98
Extracted ISTD d_3 *N MeFOSA*	%	83
Extracted ISTD d_5 *N EtFOSA*	%	80
Extracted ISTD d_7 *N MeFOSE*	%	97
Extracted ISTD d_9 *N EtFOSE*	%	88
Extracted ISTD d_3 *N MeFOSAA*	%	78
Extracted ISTD d_5 *N EtFOSAA*	%	107
Total Positive PFHxS & PFOS	µg/kg	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1
Total Positive PFAS	µg/kg	<0.1

Miscellaneous Inorg - soil						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Total Organic Carbon (Combustion)	mg/kg	16,000	4,900	2,700	8,000	12,000
Organic Matter (Combustion)	%	2.8	0.9	0.5	1.4	2.1
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	13/09/2021
Date analysed	-	14/09/2021
Total Organic Carbon (Combustion)	mg/kg	900
Organic Matter (Combustion)	%	0.2
Density in Soils/Solids	g/cm^3	#

Particle Size Distribution in Soils						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	8	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	2	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	8	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	8	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	2	17	<1	<1
Medium Sand 0.425-0.6mm	%	<1	3	7	1	<1
Medium Sand 0.3-0.425mm	%	<1	3	<1	<1	2
Fine Sand 0.15-0.3mm	%	3	10	7	3	4
Very Fine Sand 0.075-0.15mm	%	15	20	17	16	20
Coarse Silt 0.020-0.075mm	%	29	28	11	33	31
Fine Silt 0.002-0.020mm	%	20	10	4	14	17
Clay <0.002mm	%	33	24	12	32	26

Particle Size Distribution in Soils		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	13/09/2021
Date analysed	-	14/09/2021
Cobbles >75mm	%	<1
Cobbles/Coarse Gravel 63-75mm	%	<1
Coarse Gravel 37.5-63mm	%	<1
Coarse Gravel 26.5-37.5mm	%	<1
Coarse Gravel 19-26.5mm	%	<1
Medium Gravel 13.2-19mm	%	<1
Medium Gravel 9.5-13.2mm	%	<1
Medium Gravel 6.7-9.5mm	%	<1
Medium Gravel 4.75-6.7mm	%	<1
Fine Gravel 2.36-4.75mm	%	<1
Very Coarse Sand 1.18-2.36mm	%	1
Coarse Sand 0.6-1.18mm	%	2
Medium Sand 0.425-0.6mm	%	1
Medium Sand 0.3-0.425mm	%	2
Fine Sand 0.15-0.3mm	%	8
Very Fine Sand 0.075-0.15mm	%	35
Coarse Silt 0.020-0.075mm	%	20
Fine Silt 0.002-0.020mm	%	5
Clay <0.002mm	%	27

Acid Extractractable metals in soil						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Antimony - low level	mg/kg	2	2	<1	2	3
Arsenic - low level	mg/kg	11	12	5	16	14
Cadmium - low level	mg/kg	0.3	<0.1	<0.1	0.4	<0.1
Copper - low level	mg/kg	16	4	11	20	8.3
Chromium - low level	mg/kg	53	27	12	40	49
Lead - low level	mg/kg	65	5.5	6.4	39	11
Mercury - low level	mg/kg	0.18	0.01	<0.01	0.24	0.04
Nickel - low level	mg/kg	26	14	6.8	21	24
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	53	15	9.1	60	31

Acid Extractractable metals in soil		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	09/09/2021
Date analysed	-	10/09/2021
Antimony - low level	mg/kg	<1
Arsenic - low level	mg/kg	21
Cadmium - low level	mg/kg	<0.1
Copper - low level	mg/kg	5.5
Chromium - low level	mg/kg	15
Lead - low level	mg/kg	4
Mercury - low level	mg/kg	0.04
Nickel - low level	mg/kg	8.0
Silver - low level	mg/kg	<0.5
Zinc - low level	mg/kg	8.0

Moisture						
Our Reference		277486-3	277486-5	277486-7	277486-10	277486-14
Your Reference	UNITS	BH-SB-28_1.0-1.5_210906	BH-SB-28_2.0-2.5_210906	BH-SB-28_4.0-5.0_210906	BH-SB-29_0.0-0.5_210906	BH-SB-29_2.0-2.5_210906
Date Sampled		6/09/2021	6/09/2021	6/09/2021	6/09/2021	6/09/2021
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Moisture	%	52	36	19	49	49

Moisture		
Our Reference		277486-18
Your Reference	UNITS	BH-SB-29_5.0-6.0_210906
Date Sampled		6/09/2021
Type of sample		Sediment
Date prepared	-	09/09/2021
Date analysed	-	10/09/2021
Moisture	%	20

PFAS in Waters Trace Extended		
Our Reference		277486-23
Your Reference	UNITS	QC410_210906
Date Sampled		6/09/2021
Type of sample		Water
Date prepared	-	10/09/2021
Date analysed	-	10/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.002
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	99
Surrogate $^{13}C_2$ *PFOA*	%	100
Extracted ISTD $^{13}C_3$ *PFBS*	%	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89
Extracted ISTD $^{13}C_4$ *PFOS*	%	88
Extracted ISTD $^{13}C_4$ *PFBA*	%	96

PFAS in Waters Trace Extended		
Our Reference		277486-23
Your Reference	UNITS	QC410_210906
Date Sampled		6/09/2021
Type of sample		Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	80
Extracted ISTD $^{13}C_2$ *PFHxA*	%	100
Extracted ISTD $^{13}C_4$ *PFHpA*	%	100
Extracted ISTD $^{13}C_4$ *PFOA*	%	99
Extracted ISTD $^{13}C_5$ *PFNA*	%	95
Extracted ISTD $^{13}C_2$ *PFDA*	%	101
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	100
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	108
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	88
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	119
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	93
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	104
Extracted ISTD $^{13}C_8$ *FOSA*	%	74
Extracted ISTD d_3 *N MeFOSA*	%	31
Extracted ISTD d_5 *N EtFOSA*	%	30
Extracted ISTD d_7 *N MeFOSE*	%	61
Extracted ISTD d_9 *N EtFOSE*	%	60
Extracted ISTD d_3 *N MeFOSAA*	%	112
Extracted ISTD d_5 *N EtFOSAA*	%	109
Total Positive PFHxS & PFOS	µg/L	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002
Total Positive PFAS	µg/L	<0.0002

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Date extracted	-			10/09/2021	14	10/09/2021	10/09/2021		10/09/2021	[NT]
Date analysed	-			13/09/2021	14	13/09/2021	13/09/2021		13/09/2021	[NT]
Naphthalene	µg/kg	5	Ext-054	<5	14	<5	<5	0	100	[NT]
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	14	<5	<5	0	96	[NT]
Phenanthrene	µg/kg	5	Ext-054	<5	14	<5	<5	0	106	[NT]
Anthracene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	14	<5	<5	0	98	[NT]
Pyrene	µg/kg	5	Ext-054	<5	14	<5	<5	0	100	[NT]
Benz(a)anthracene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	14	<5	<5	0	103	[NT]
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	14	<10	<10	0	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	14	<5	<5	0	86	[NT]
Perylene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	14	<5	<5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	60	14	63	66	5	61	[NT]

QUALITY CONTROL: Organotin Compounds in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	277486-5
Date prepared	-			09/09/2021	3	09/09/2021	09/09/2021		09/09/2021	09/09/2021
Date analysed	-			11/09/2021	3	11/09/2021	11/09/2021		11/09/2021	11/09/2021
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	3	<1.7	<1.7	0	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	3	<1.3	<1.3	0	63	68
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	3	<1	<1	0	84	86
Surrogate Triphenyltin	%		Ext-054	94	3	92	90	2	95	90

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Date prepared	-			10/09/2021	3	10/09/2021	10/09/2021		10/09/2021	[NT]
Date analysed	-			10/09/2021	3	10/09/2021	10/09/2021		10/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	95	[NT]
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	100	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	101	[NT]
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	100	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	3	0.2	0.1	67	96	[NT]
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	86	[NT]
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	101	[NT]
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	100	[NT]
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	100	[NT]
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	103	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	98	[NT]
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	95	[NT]
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	3	<0.5	<0.5	0	101	[NT]
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	3	<0.5	<0.5	0	101	[NT]
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	3	<0.5	<0.5	0	96	[NT]
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	3	<0.5	<0.5	0	95	[NT]
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	3	<5	<5	0	104	[NT]
4:2 FTS	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	95	[NT]
6:2 FTS	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	107	[NT]
8:2 FTS	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	104	[NT]
10:2 FTS	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	111	[NT]
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	3	<1	<1	0	103	[NT]
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	3	<1	<1	0	106	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	3	<1	<1	0	106	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	3	<1	<1	0	101	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	3	<5	<5	0	107	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	107	[NT]
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	108	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	112	3	99	101	2	100	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	3	111	112	1	97	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	101	3	88	93	6	104	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	102	3	90	94	4	102	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	99	3	73	78	7	102	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	102	3	72	77	7	100	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	101	3	70	75	7	99	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	103	3	72	81	12	103	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	101	3	76	80	5	101	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	104	3	75	80	6	105	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	108	3	76	81	6	106	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	109	3	86	90	5	101	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	107	3	91	99	8	107	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	110	3	86	90	5	112	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	108	3	82	88	7	107	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	111	3	40	45	12	107	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	109	3	54	61	12	100	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	112	3	66	70	6	103	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	112	3	87	90	3	104	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	108	3	75	81	8	100	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	110	3	69	76	10	101	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	108	3	89	93	4	108	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	110	3	82	90	9	106	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	113	3	61	67	9	105	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	106	3	72	81	12	100	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Date prepared	-			13/09/2021	[NT]	[NT]	[NT]	[NT]	13/09/2021	[NT]
Date analysed	-			13/09/2021	[NT]	[NT]	[NT]	[NT]	13/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	[NT]	[NT]	[NT]	[NT]	111	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	[NT]	[NT]	[NT]	[NT]	111	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Date prepared	-			09/09/2021	[NT]	[NT]	[NT]	[NT]	09/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Antimony - low level	mg/kg	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Copper - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Lead - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Silver - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	110	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	71	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	90	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	103	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	104	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	94	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	117	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	110	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	108	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	114	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	110	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	95	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	109	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	79	[NT]	[NT]	[NT]	[NT]	78	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	129	[NT]	[NT]	[NT]	[NT]	125	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	104	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	33	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	34	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	66	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	69	[NT]	[NT]	[NT]	[NT]	61	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	109	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	94	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Water Trace Level:
MeFOSA and EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

PAH in Sediment and Organotin Compounds in Soil analysed by MPL Laboratories. Report No. 268501

Organotin Compounds in Soil: Some PQLs have been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1471
View attached report

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

SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277486
Date Sample Received	08/09/2021
Date Instructions Received	08/09/2021
Date Results Expected to be Reported	13/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	18 Sediment, 2 Porewater, 3 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	11
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PFAS in Waters Trace Extended	On Hold
BH-SB-28_0.0-0.5_210906																			✓
BH-SB-28_0.5-1.0_210906																			✓
BH-SB-28_1.0-1.5_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-28_1.5-2.0_210906																			✓
BH-SB-28_2.0-2.5_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-28_2.5-3.0_210906																			✓
BH-SB-28_4.0-5.0_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
PW-SB-28_210906																			✓
QC112_210906																			✓
BH-SB-29_0.0-0.5_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-29_0.5-1.0_210906																			✓
BH-SB-29_1.0-1.5_210906																			✓
BH-SB-29_1.5-2.0_210906																			✓
BH-SB-29_2.0-2.5_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-29_2.5-3.0_210906																			✓
BH-SB-29_3.0-4.0_210906																			✓
BH-SB-29_4.0-5.0_210906																			✓
BH-SB-29_5.0-6.0_210906	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
PW-SB-29_210906																			✓
QC113 _210906																			✓

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PFAS in Waters Trace Extended	On Hold
QC311 _210906																			✓
QC312_210906																			✓
QC410_210906																		✓	

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

Additional Info

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

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

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

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

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample Information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 snalytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
1	BH-SB-33_0.0-0.5_2108			Sediment																X	
2	BH-SB-33_0.5-1.0_2108			Sediment	X	X	X	X	X	X	X										
3	BH-SB-33_1.0-1.5_2108			Sediment																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS - SYD	*Lab Use Only*	
Print Name:	Print Name: V.VECA	Job number: 277569	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 9/9/21 @ 0915	Temperature: 15°C	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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08 8967 1201 | darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 snalytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
4	BH-SB-34_0.0-0.5_210907			Sediment	X	X	X	X	X	X	X										
5	BH-SB-34_0.5-1.0_210907			Sediment																X	
6	BH-SB-34_1.0-1.5_210907			Sediment																X	
7	BH-SB-34_1.5-2.0_210907			Sediment																X	
8	BH-SB-34_2.0-2.5_210907			Sediment	X	X	X	X	X	X	X										
9	BH-SB-34_2.5-3.0_210907			Sediment	X	X	X	X	X	X	X										
10	BH-SB-34_3.0-4.5_210907			Sediment																X	
11	PW-SB-34_210907			Porewater																X	
12	QC114_210907			Sediment																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS - SYD	Lab Use Only	
Print Name:	Print Name: V. VEGA	Job number: 277569	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 9/9/21 @ 0815	Temperature: 15 · C	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 snalytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
13	BH-SB-35_0.0-0.5_210907			Sediment																X	
14	BH-SB-35_0.5-1.0_210907			Sediment																X	
15	BH-SB-35_1.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
16	BH-SB-35_1.5-2.0_210907			Sediment																X	
17	BH-SB-35_2.0-2.5_210907			Sediment	X	X	X	X	X	X	X										
18	BH-SB-35_2.5-3.0_210907			Sediment																X	
19	BH-SB-35_3.5-4.0_210907			Sediment																X	
20	BH-SB-35_4.5-5.0_210907			Sediment	X	X	X	X	X	X	X										
21	PW-SB-35_210907			Porewater																X	
22	QC117_210907			Porewater																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS - SYD	Lab Use Only	
Print Name:	Print Name: V. VEGA	Job number: 277569	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 9/9/21 @ 0815	Temperature: 15°C	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 snalytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Provide as much information about the sample as you can
23	BH-SWTP-01_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
24	BH-SWTP-02_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
25	BH-SWTP-03_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
26	BH-SWTP-04_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
27	BH-SWTP-05_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
28	BH-SWTP-06_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
29	BH-SWTP-07_0.0-1.5_210907			Sediment	X	X	X	X	X	X	X										
30	QC115 _210907			Sediment	X	X	X	X	X	X	X										
31	QC116 _210907			Sediment																X	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ECS - SYD	Lab Use Only	
Print Name:	Print Name: V. VEGA	Job number: 277569	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 9/9/21 @ 0815	Temperature: 15°C	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / (3) / 4 / STD	

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Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)												HOLD	Provide as much information about the sample as you can
32	QC313_210907			Water																X	
33	QC314_210907			Water	X	X	X	X													
34	QC412_210907			Water				X													
(extra) 35	QC217-210906-																				

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ES Syd.
Print Name:		Print Name:	
Date & Time:		Date & Time:	9/09/21 08:15
Signature:		Signature:	

Lab Use Only	
Job number:	277569
Temperature:	15.°C
Cooling: Ice / Ice pack / None	
Security seal: Intact / Broken / None	
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Updated COC

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Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:		Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Sample information					Tests Required																Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 snalytes)												HOLD	Provide as much information about the sample as you can
32	QC313_210907			Water																X	
33	QC314_210907			Water	X	X	X	X													
34	QC412_210907			Water		X															
(EXTRA) 35	QC217_210907B			~~SOIL~~ POREWATER																	

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		Received by (Company):	ELS - SYD
Print Name:		Print Name:	V. VEGA
Date & Time:		Date & Time:	9/9/21 @ 0815
Signature:		Signature:	

Lab Use Only	
Job number:	277569
Temperature:	15°C
Cooling: Ice / Ice pack / None	
Security seal: Intact / Broken / None	
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client: Envirolab Services
Client Address: 12 Ashley Street CHATSWOOD NSW 2067
Contact name: [redacted]
Job number: 21_1483
Lab ID: Various see table 1.
Revision No.: 0
Date received: 10/09/2021
Date analysed: 22/09/2021
Date reported: 23/09/2021
Analysis: Absolute density by helium pycnometry following ASTM D5550

Comments: none

Sample preparation

A representative sub-sample was taken and oven dried at 105 °C prior to analysis.

Analysis

The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

Summary

The density results are as follows:

Table 1: Table of Absolute Density results.

Client ID	Lab ID	Density (g/cc)
277569-2	21_1483_01	2.5992 ± 0.0009
277569-4	21_1483_02	2.6025 ± 0.0008
277569-8	21_1483_03	2.6460 ± 0.0009
277569-9	21_1483_04	2.6352 ± 0.0005
277569-15	21_1483_05	2.6218 ± 0.0009
277569-17	21_1483_06	2.6227 ± 0.0006
277569-20	21_1483_07	2.6455 ± 0.0006
277569-23	21_1483_08	2.5378 ± 0.0007
277569-24	21_1483_09	2.5876 ± 0.0004
277569-25	21_1483_10	2.5769 ± 0.0008
277569-26	21_1483_11	2.609 ± 0.001
277569-27	21_1483_12	2.5796 ± 0.0004

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277569-28	21_1483_13	2.5750 ± 0.0006
277569-29	21_1483_14	2.5812 ± 0.0003
277569-30	21_1483_15	2.5550 ± 0.0003

The results are representative only of the sample/s provided.

Analyst: [redacted] Cert IV (Laboratory Techniques)

Reported: [redacted] Cert IV (Laboratory Techniques)

Authorised: [redacted] B.Sc.(Nanotechnology)

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CERTIFICATE OF ANALYSIS 277569

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	28 Soil, 4 Porewater, 3 Water
Date samples received	09/09/2021
Date completed instructions received	09/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	14/09/2021
Date of Issue	27/09/2021

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Results Approved By
Diego Bigolin, Inorganics Supervisor
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	20	10	<5	<5	<5
Anthracene	µg/kg	10	7	<5	<5	<5
Fluoranthene	µg/kg	40	40	<5	<5	<5
Pyrene	µg/kg	50	40	<5	<5	<5
Benz(a)anthracene	µg/kg	20	20	<5	<5	<5
Chrysene	µg/kg	20	20	<5	<5	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	60	70	<10	<10	<10
Benzo(e)pyrene	µg/kg	26	28	<5	<5	<5
Benzo(a)pyrene	µg/kg	50	50	<5	<5	<5
Perylene	µg/kg	8.0	7.0	<5	<5	<5
Indeno(1,2,3-cd)pyrene	µg/kg	30	40	<5	<5	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	20	30	<5	<5	<5
Coronene	µg/kg	6.0	8.0	<5	<5	<5
Surrogate p-Terphenyl-d14	%	72	73	61	75	61

PAH NAGD level in soil						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	7
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	7.0
Acenaphthylene	µg/kg	<5	<5	<5	<5	<6
Acenaphthene	µg/kg	<5	<5	<5	<5	<6
Fluorene	µg/kg	<5	<5	<5	<5	5
Phenanthrene	µg/kg	<5	<5	<5	20	53
Anthracene	µg/kg	<5	<5	<5	<5	20
Fluoranthene	µg/kg	<5	<5	9	30	81
Pyrene	µg/kg	<5	<5	10	30	88
Benz(a)anthracene	µg/kg	<5	<5	6	10	40
Chrysene	µg/kg	<5	<5	<5	10	40
Benzo(b,j)&(k)fluoranthene	µg/kg	<10	<10	10	30	110
Benzo(e)pyrene	µg/kg	<5	<5	7.0	11	45
Benzo(a)pyrene	µg/kg	<5	<5	10	20	86
Perylene	µg/kg	<5	<5	<5	<5	10
Indeno(1,2,3-cd)pyrene	µg/kg	<5	<5	8	10	56
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	<5	<10
Benzo(ghi)perylene	µg/kg	<5	<5	7	10	53
Coronene	µg/kg	<5	<5	<5	<5	13
Surrogate p-Terphenyl-d14	%	60	65	88	98	81

PAH NAGD level in soil						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	20	20	10	30	50
Anthracene	µg/kg	10	7	6	10	7
Fluoranthene	µg/kg	40	40	20	57	75
Pyrene	µg/kg	40	40	20	62	67
Benz(a)anthracene	µg/kg	20	20	10	30	30
Chrysene	µg/kg	20	20	10	30	30
Benzo(b,j)&(k)fluoranthene	µg/kg	60	50	30	50	60
Benzo(e)pyrene	µg/kg	24	22	13	26	24
Benzo(a)pyrene	µg/kg	50	40	30	51	50
Perylene	µg/kg	5	6.0	<5	9.0	7.0
Indeno(1,2,3-cd)pyrene	µg/kg	30	20	20	30	20
Dibenz(ah)anthracene	µg/kg	<6	<5	<5	<5	<5
Benzo(ghi)perylene	µg/kg	30	20	20	20	20
Coronene	µg/kg	7.0	<5	<5	<5	<5
Surrogate p-Terphenyl-d14	%	113	114	77	123	126

Organotin Compunds in Soil						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	12/09/2021	12/09/2021	12/09/2021	12/09/2021	12/09/2021
Monobutyltin as Sn	µg/kg	<1.7	<1.7	<1.7	<1.7	<1.7
Dibutyltin as Sn	µg/kg	<1.3	<2.3	<1.3	<1.3	<1.3
Tributyltin as Sn	µg/kg	<1	<1	<1	<1	<1
Surrogate Triphenyltin	%	87	84	87	86	90

Organotin Compunds in Soil						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	12/09/2021	12/09/2021	12/09/2021	12/09/2021	12/09/2021
Monobutyltin as Sn	µg/kg	<1.7	<1.7	<4.5	<4.9	<7.5
Dibutyltin as Sn	µg/kg	<1.3	<1.3	<2.2	<2.6	<5.7
Tributyltin as Sn	µg/kg	<1	<1	<1	<1	<1.3
Surrogate Triphenyltin	%	87	91	87	86	86

Organotin Compunds in Soil						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/09/2021	09/09/2021	09/09/2021	09/09/2021	09/09/2021
Date analysed	-	12/09/2021	12/09/2021	12/09/2021	12/09/2021	12/09/2021
Monobutyltin as Sn	µg/kg	<1.9	<14.3	<5.7	<1.7	<2.4
Dibutyltin as Sn	µg/kg	<1.3	<2.9	<4.5	<1.3	<3.2
Tributyltin as Sn	µg/kg	<1	<1	<1	<1	<1
Surrogate Triphenyltin	%	81	86	86	89	80

PFAS in Soils Extended						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	0.5	<0.1	<0.1	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	107	108	104	102	103
Surrogate $^{13}C_2$ *PFOA*	%	112	114	119	120	125
Extracted ISTD $^{13}C_3$ *PFBS*	%	81	82	84	89	87
Extracted ISTD $^{18}O_2$ *PFHxS*	%	84	88	89	96	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	67	67	72	69

PFAS in Soils Extended						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_4$ *PFBA*	%	71	71	69	77	71
Extracted ISTD $^{13}C_3$ *PFPeA*	%	67	68	67	74	67
Extracted ISTD $^{13}C_2$ *PFHxA*	%	72	72	71	76	71
Extracted ISTD $^{13}C_4$ *PFHpA*	%	74	71	71	81	74
Extracted ISTD $^{13}C_4$ *PFOA*	%	75	73	71	78	69
Extracted ISTD $^{13}C_5$ *PFNA*	%	79	80	79	79	78
Extracted ISTD $^{13}C_2$ *PFDA*	%	84	84	84	88	81
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	84	85	84	90	88
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	89	95	83	82	81
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	83	88	81	75	78
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	37	35	37	41	37
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	51	53	56	57	52
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	60	61	62	71	59
Extracted ISTD $^{13}C_8$ *FOSA*	%	83	85	84	90	86
Extracted ISTD d_3 *N MeFOSA*	%	73	71	69	76	73
Extracted ISTD d_5 *N EtFOSA*	%	68	68	68	73	68
Extracted ISTD d_7 *N MeFOSE*	%	88	83	86	98	87
Extracted ISTD d_9 *N EtFOSE*	%	82	75	80	86	84
Extracted ISTD d_3 *N MeFOSAA*	%	60	62	58	59	55
Extracted ISTD d_5 *N EtFOSAA*	%	66	69	68	66	62
Total Positive PFHxS & PFOS	µg/kg	<0.1	0.5	<0.1	<0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	0.5	<0.1	<0.1	<0.1
Total Positive PFAS	µg/kg	<0.1	0.5	<0.1	<0.1	<0.1

PFAS in Soils Extended						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	0.5	0.6	0.3
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	102	109	102	102	96
Surrogate $^{13}C_2$ *PFOA*	%	123	118	121	118	122
Extracted ISTD $^{13}C_3$ *PFBS*	%	87	101	86	87	84
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	102	88	88	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	69	76	69	67	70
Extracted ISTD $^{13}C_4$ *PFBA*	%	72	86	70	70	68

PFAS in Soils Extended						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_3$ *PFPeA*	%	69	80	69	65	65
Extracted ISTD $^{13}C_2$ *PFHxA*	%	76	84	71	68	73
Extracted ISTD $^{13}C_4$ *PFHpA*	%	75	86	70	73	72
Extracted ISTD $^{13}C_4$ *PFOA*	%	74	85	71	72	71
Extracted ISTD $^{13}C_5$ *PFNA*	%	79	91	78	76	81
Extracted ISTD $^{13}C_2$ *PFDA*	%	88	103	88	82	84
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	91	101	90	91	65
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	90	100	86	91	80
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	78	98	87	87	88
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	36	47	40	37	37
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	52	65	59	56	53
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	62	70	74	69	69
Extracted ISTD $^{13}C_8$ *FOSA*	%	88	100	81	82	84
Extracted ISTD d_3 *N MeFOSA*	%	72	84	68	66	63
Extracted ISTD d_5 *N EtFOSA*	%	69	80	64	69	66
Extracted ISTD d_7 *N MeFOSE*	%	88	100	87	86	85
Extracted ISTD d_9 *N EtFOSE*	%	84	94	82	82	80
Extracted ISTD d_3 *N MeFOSAA*	%	56	69	59	59	57
Extracted ISTD d_5 *N EtFOSAA*	%	61	77	66	64	58
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	0.5	0.6	0.3
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	0.5	0.6	0.3
Total Positive PFAS	µg/kg	<0.1	<0.1	0.5	0.6	0.3

PFAS in Soils Extended						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.4	0.3	0.6	0.3	0.5
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	103	99	96	102	101
Surrogate $^{13}C_2$ *PFOA*	%	129	114	95	119	123
Extracted ISTD $^{13}C_3$ *PFBS*	%	85	81	82	89	83
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89	85	85	91	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	65	64	61	70	61
Extracted ISTD $^{13}C_4$ *PFBA*	%	69	63	65	74	68

PFAS in Soils Extended						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_3$ *PFPeA*	%	63	66	65	70	65
Extracted ISTD $^{13}C_2$ *PFHxA*	%	68	68	68	75	70
Extracted ISTD $^{13}C_4$ *PFHpA*	%	71	71	71	79	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	67	71	74	75	71
Extracted ISTD $^{13}C_5$ *PFNA*	%	75	72	72	83	75
Extracted ISTD $^{13}C_2$ *PFDA*	%	85	84	86	91	82
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	82	84	90	97	84
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	86	84	84	82	83
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	85	83	84	92	86
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	38	34	34	45	36
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	53	50	53	58	54
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	59	59	66	80	60
Extracted ISTD $^{13}C_8$ *FOSA*	%	84	80	79	87	81
Extracted ISTD d_3 *N MeFOSA*	%	68	66	64	70	67
Extracted ISTD d_5 *N EtFOSA*	%	64	64	62	70	63
Extracted ISTD d_7 *N MeFOSE*	%	82	83	80	93	86
Extracted ISTD d_9 *N EtFOSE*	%	82	78	77	87	80
Extracted ISTD d_3 *N MeFOSAA*	%	58	54	57	67	59
Extracted ISTD d_5 *N EtFOSAA*	%	68	61	65	78	67
Total Positive PFHxS & PFOS	µg/kg	0.4	0.3	0.6	0.3	0.5
Total Positive PFOS & PFOA	µg/kg	0.4	0.3	0.6	0.3	0.5
Total Positive PFAS	µg/kg	0.4	0.3	0.6	0.3	0.5

Miscellaneous Inorg - soil						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Total Organic Carbon (Combustion)	mg/kg	12,000	11,000	5,100	2,700	12,000
Organic Matter (Combustion)	%	2.0	1.9	0.9	0.5	2.0
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Total Organic Carbon (Combustion)	mg/kg	4,600	1,100	16,000	15,000	13,000
Organic Matter (Combustion)	%	0.8	0.2	2.7	2.5	2.2
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Miscellaneous Inorg - soil						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Total Organic Carbon (Combustion)	mg/kg	19,000	18,000	19,000	24,000	20,000
Organic Matter (Combustion)	%	3.2	3.1	3.2	4.2	3.4
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Particle Size Distribution in Soils						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	1	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	4	1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	<1	<1
Medium Sand 0.3-0.425mm	%	<1	<1	<1	1	<1
Fine Sand 0.15-0.3mm	%	2	10	6	5	3
Very Fine Sand 0.075-0.15mm	%	14	16	18	20	19
Coarse Silt 0.020-0.075mm	%	24	25	21	19	24
Fine Silt 0.002-0.020mm	%	21	19	11	7	20
Clay <0.002mm	%	39	30	43	42	33

Particle Size Distribution in Soils						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	2	<1	<1
Coarse Sand 0.6-1.18mm	%	1	<1	11	<1	<1
Medium Sand 0.425-0.6mm	%	<1	<1	9	<1	2
Medium Sand 0.3-0.425mm	%	1	<1	5	<1	4
Fine Sand 0.15-0.3mm	%	2	3	11	2	12
Very Fine Sand 0.075-0.15mm	%	11	4	12	14	24
Coarse Silt 0.020-0.075mm	%	20	27	15	29	21
Fine Silt 0.002-0.020mm	%	12	38	14	22	17
Clay <0.002mm	%	52	27	22	34	21

Particle Size Distribution in Soils						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	2	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	7	<1
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	8	<1
Coarse Sand 0.6-1.18mm	%	<1	<1	<1	10	<1
Medium Sand 0.425-0.6mm	%	<1	<1	<1	5	<1
Medium Sand 0.3-0.425mm	%	<1	<1	<1	4	<1
Fine Sand 0.15-0.3mm	%	4	10	5	15	6
Very Fine Sand 0.075-0.15mm	%	10	16	20	21	17
Coarse Silt 0.020-0.075mm	%	32	24	27	13	24
Fine Silt 0.002-0.020mm	%	22	23	17	8	19
Clay <0.002mm	%	32	27	31	7	34

Acid Extractractable metals in soil						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Antimony - low level	mg/kg	<1	<1	1	<1	<1
Arsenic - low level	mg/kg	11	8.0	16	27	12
Cadmium - low level	mg/kg	0.5	1.2	0.1	<0.1	<0.1
Copper - low level	mg/kg	17	22	15	5.5	3
Chromium - low level	mg/kg	28	32	43	11	17
Lead - low level	mg/kg	100	86	8.3	7.6	7.5
Mercury - low level	mg/kg	0.25	0.46	0.02	<0.01	0.02
Nickel - low level	mg/kg	16	19	29	8.6	8.8
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	59	88	27	10	17

Acid Extractractable metals in soil						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Antimony - low level	mg/kg	<1	<1	1	<1	2
Arsenic - low level	mg/kg	5.6	12	17	15	17
Cadmium - low level	mg/kg	<0.1	<0.1	0.6	0.9	1.2
Copper - low level	mg/kg	3	19	40	34	49
Chromium - low level	mg/kg	20	17	42	29	46
Lead - low level	mg/kg	3	14	48	58	130
Mercury - low level	mg/kg	0.01	0.02	0.41	0.31	0.40
Nickel - low level	mg/kg	11	17	23	18	24
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	14	37	100	100	110

Acid Extractractable metals in soil						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Antimony - low level	mg/kg	2	3	<1	<1	2
Arsenic - low level	mg/kg	20	24	8.7	11	17
Cadmium - low level	mg/kg	1.7	2.0	0.5	0.3	2.8
Copper - low level	mg/kg	43	59	24	21	45
Chromium - low level	mg/kg	52	67	19	19	60
Lead - low level	mg/kg	110	200	44	18	92
Mercury - low level	mg/kg	0.51	0.70	0.29	0.10	0.56
Nickel - low level	mg/kg	28	35	12	19	34
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	120	140	81	56	140

Moisture						
Our Reference		277569-2	277569-4	277569-8	277569-9	277569-15
Your Reference	UNITS	BH-SB-33_0.5-1.0_2108	BH-SB-34_0.0-0.5_210907	BH-SB-34_2.0-2.5_210907	BH-SB-34_2.5-3.0_210907	BH-SB-35_1.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Moisture	%	56	55	52	44	49

Moisture						
Our Reference		277569-17	277569-20	277569-23	277569-24	277569-25
Your Reference	UNITS	BH-SB-35_2.0-2.5_210907	BH-SB-35_4.0-5.0_210907	BH-SWTP-01_0.0-1.5_210907	BH-SWTP-02_0.0-1.5_210907	BH-SWTP-03_0.0-1.5_210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Moisture	%	46	29	57	58	48

Moisture						
Our Reference		277569-26	277569-27	277569-28	277569-29	277569-30
Your Reference	UNITS	BH-SWTP-04_0.0-1.5_210907	BH-SWTP-05_0.0-1.5_210907	BH-SWTP-06_0.0-1.5_210907	BH-SWTP-07_0.0-1.5_210907	QC115 _210907
Date Sampled		07/09/2021	07/09/2021	07/09/2021	07/09/2021	07/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/09/2021	10/09/2021	10/09/2021	10/09/2021	10/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Moisture	%	62	64	55	42	61

PFAS in Waters Trace Extended			
Our Reference		277569-33	277569-34
Your Reference	UNITS	QC314_210907	QC412_210907
Date Sampled		07/09/2021	07/09/2021
Type of sample		Water	Water
Date prepared	-	10/09/2021	10/09/2021
Date analysed	-	10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002
Perfluorohexanoic acid	µg/L	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	96	95
Surrogate $^{13}C_2$ *PFOA*	%	97	100
Extracted ISTD $^{13}C_3$ *PFBS*	%	87	83
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	93	89
Extracted ISTD $^{13}C_4$ *PFBA*	%	101	98

PFAS in Waters Trace Extended			
Our Reference		277569-33	277569-34
Your Reference	UNITS	QC314_210907	QC412_210907
Date Sampled		07/09/2021	07/09/2021
Type of sample		Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	84	83
Extracted ISTD $^{13}C_2$ *PFHxA*	%	103	101
Extracted ISTD $^{13}C_4$ *PFHpA*	%	102	99
Extracted ISTD $^{13}C_4$ *PFOA*	%	102	98
Extracted ISTD $^{13}C_5$ *PFNA*	%	97	96
Extracted ISTD $^{13}C_2$ *PFDA*	%	106	100
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	106	107
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	112	109
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	113	79
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	128	130
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	103	91
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	111	101
Extracted ISTD $^{13}C_8$ *FOSA*	%	72	74
Extracted ISTD d_3 *N MeFOSA*	%	34	34
Extracted ISTD d_5 *N EtFOSA*	%	32	32
Extracted ISTD d_7 *N MeFOSE*	%	68	64
Extracted ISTD d_9 *N EtFOSE*	%	67	61
Extracted ISTD d_3 *N MeFOSAA*	%	113	109
Extracted ISTD d_5 *N EtFOSAA*	%	121	103
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002

PAHs in Water - Low Level		
Our Reference		277569-33
Your Reference	UNITS	QC314_210907
Date Sampled		07/09/2021
Type of sample		Water
Date extracted	-	10/09/2021
Date analysed	-	10/09/2021
Naphthalene	µg/L	<0.2
Acenaphthylene	µg/L	<0.1
Acenaphthene	µg/L	<0.1
Fluorene	µg/L	<0.1
Phenanthrene	µg/L	<0.1
Anthracene	µg/L	<0.1
Fluoranthene	µg/L	<0.1
Pyrene	µg/L	<0.1
Benzo(a)anthracene	µg/L	<0.1
Chrysene	µg/L	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2
Benzo(a)pyrene	µg/L	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5
Total +ve PAH's	µg/L	<0.1
Surrogate p-Terphenyl-d14	%	77

Organotin Compunds in Water		
Our Reference		277569-33
Your Reference	UNITS	QC314_210907
Date Sampled		07/09/2021
Type of sample		Water
Date prepared	-	14/09/2021
Date analysed	-	14/09/2021
Monobutyltin as Sn	µg/L	<0.04
Dibutyltin as Sn	µg/L	<0.003
Tributyltin as Sn	µg/L	<0.002
Surrogate Triphenyltin	%	100

All metals in water - total		
Our Reference		277569-33
Your Reference	UNITS	QC314_210907
Date Sampled		07/09/2021
Type of sample		Water
Date prepared	-	10/09/2021
Date analysed	-	10/09/2021
Antimony-Total	µg/L	<1
Arsenic-Total	µg/L	<1
Cadmium-Total	µg/L	<0.1
Chromium-Total	µg/L	<1
Copper-Total	µg/L	<1
Lead-Total	µg/L	<1
Mercury-Total	µg/L	<0.05
Nickel-Total	µg/L	<1
Silver-Total	µg/L	<1
Zinc-Total	µg/L	3

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277569-4
Date extracted	-			10/09/2021	2	10/09/2021	10/09/2021		10/09/2021	10/09/2021
Date analysed	-			13/09/2021	2	13/09/2021	13/09/2021		13/09/2021	13/09/2021
Naphthalene	µg/kg	5	Ext-054	<5	2	<5	<5	0	73	61
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	2	<5	<5	0	76	63
Phenanthrene	µg/kg	5	Ext-054	<5	2	20	8	86	79	82
Anthracene	µg/kg	5	Ext-054	<5	2	10	<5	67	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	2	40	20	67	90	#
Pyrene	µg/kg	5	Ext-054	<5	2	50	20	86	90	#
Benz(a)anthracene	µg/kg	5	Ext-054	<5	2	20	10	67	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	2	20	10	67	93	115
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	2	60	30	67	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	2	26	12	74	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	2	50	20	86	118	#
Perylene	µg/kg	5	Ext-054	<5	2	8.0	<5	46	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	2	30	10	100	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	2	20	10	67	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	2	6.0	<5	18	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	71	2	72	72	0	80	61

QUALITY CONTROL: PAH NAGD level in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	26	10/09/2021	10/09/2021		[NT]	[NT]
Date analysed	-			[NT]	26	13/09/2021	13/09/2021		[NT]	[NT]
Naphthalene	µg/kg	5	Ext-054	[NT]	26	<5	<5	0	[NT]	[NT]
2-Methylnaphthalene	µg/kg	5	Ext-054	[NT]	26	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	[NT]	26	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	[NT]	26	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	[NT]	26	<5	<5	0	[NT]	[NT]
Phenanthrene	µg/kg	5	Ext-054	[NT]	26	20	10	67	[NT]	[NT]
Anthracene	µg/kg	5	Ext-054	[NT]	26	10	7	35	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	[NT]	26	40	20	67	[NT]	[NT]
Pyrene	µg/kg	5	Ext-054	[NT]	26	40	30	29	[NT]	[NT]
Benz(a)anthracene	µg/kg	5	Ext-054	[NT]	26	20	20	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	[NT]	26	20	10	67	[NT]	[NT]
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	[NT]	26	60	40	40	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	[NT]	26	24	17	34	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	[NT]	26	50	40	22	[NT]	[NT]
Perylene	µg/kg	5	Ext-054	[NT]	26	5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	[NT]	26	30	20	40	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	[NT]	26	<6	<6	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	[NT]	26	30	20	40	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	[NT]	26	7.0	<5	33	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	[NT]	26	113	112	1	[NT]	[NT]

QUALITY CONTROL: Organotin Compunds in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277569-4
Date prepared	-			09/09/2021	2	09/09/2021	09/09/2021		09/09/2021	09/09/2021
Date analysed	-			12/09/2021	2	12/09/2021	12/09/2021		12/09/2021	12/09/2021
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<1.7	<1.7	0	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<1.3	<1.3	0	90	90
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<1	<1	0	116	73
Surrogate Triphenyltin	%		Ext-054	97	2	87	87	0	96	84

QUALITY CONTROL: Organotin Compunds in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	26	09/09/2021	09/09/2021		[NT]	[NT]
Date analysed	-			[NT]	26	12/09/2021	12/09/2021		[NT]	[NT]
Monobutyltin as Sn	µg/kg	0.5	Ext-054	[NT]	26	<1.9	<6.3	107	[NT]	[NT]
Dibutyltin as Sn	µg/kg	0.5	Ext-054	[NT]	26	<1.3	<3.3	87	[NT]	[NT]
Tributyltin as Sn	µg/kg	0.5	Ext-054	[NT]	26	<1	<1	0	[NT]	[NT]
Surrogate Triphenyltin	%		Ext-054	[NT]	26	81	88	8	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277569-4
Date prepared	-			10/09/2021	2	10/09/2021	10/09/2021		10/09/2021	10/09/2021
Date analysed	-			10/09/2021	2	10/09/2021	10/09/2021		10/09/2021	10/09/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	99	98
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	96	89
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	95	89
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	103	100
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	96	98
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	93	79
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	101	102
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	98	97
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	102	89
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	98	96
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	96	92
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	91	83
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	93	80
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	103	91
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	102	94
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	100	77
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	2	<5	<5	0	101	105
4:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	100
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	107	105
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	97	90
10:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	103	118
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	96	79
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	105	109
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	2	<1	<1	0	108	115
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	2	<1	<1	0	111	97
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	2	<5	<5	0	102	87
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	118	132
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	98	100
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	2	107	106	1	102	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	111	2	112	119	6	100	110

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277569-4
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	99	2	81	84	4	102	114
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	101	2	84	85	1	105	122
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	100	2	71	71	0	100	91
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	105	2	71	72	1	104	89
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	101	2	67	68	1	102	84
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	102	2	72	73	1	100	93
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	100	2	74	71	4	104	99
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	100	2	75	73	3	102	98
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	104	2	79	77	3	103	98
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	103	2	84	83	1	109	110
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	111	2	84	86	2	97	101
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	111	2	89	87	2	105	94
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	92	2	83	84	1	103	67
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	101	2	37	38	3	100	45
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	101	2	51	53	4	101	67
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	103	2	60	65	8	104	84
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	108	2	83	84	1	106	94
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	101	2	73	70	4	101	54
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	97	2	68	68	0	98	54
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	103	2	88	91	3	105	80

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277569-4
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	102	2	82	79	4	104	71
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	104	2	60	60	0	96	69
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	104	2	66	65	2	105	84

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	27	10/09/2021	10/09/2021		[NT]	[NT]
Date analysed	-			[NT]	27	10/09/2021	10/09/2021		[NT]	[NT]
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	27	0.3	0.3	0	[NT]	[NT]
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
Perfluorobutanoic acid	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
Perfluoropentanoic acid	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
Perfluorohexanoic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluorononanoic acid	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
Perfluorodecanoic acid	µg/kg	0.5	Org-029	[NT]	27	<0.5	<0.5	0	[NT]	[NT]
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	[NT]	27	<0.5	<0.5	0	[NT]	[NT]
Perfluorododecanoic acid	µg/kg	0.5	Org-029	[NT]	27	<0.5	<0.5	0	[NT]	[NT]
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	[NT]	27	<0.5	<0.5	0	[NT]	[NT]
Perfluorotetradecanoic acid	µg/kg	5	Org-029	[NT]	27	<5	<5	0	[NT]	[NT]
4:2 FTS	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	27	<0.1	<0.1	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
10:2 FTS	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
Perfluorooctane sulfonamide	µg/kg	1	Org-029	[NT]	27	<1	<1	0	[NT]	[NT]
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	[NT]	27	<1	<1	0	[NT]	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	[NT]	27	<1	<1	0	[NT]	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	[NT]	27	<1	<1	0	[NT]	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	[NT]	27	<5	<5	0	[NT]	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	[NT]	27	<0.2	<0.2	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	27	99	99	0	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	27	114	114	0	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	[NT]	27	81	81	0	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	27	85	85	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	27	64	64	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	[NT]	27	63	63	0	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	[NT]	27	66	66	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	[NT]	27	68	68	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	[NT]	27	71	71	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	27	71	71	0	[NT]	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	[NT]	27	72	72	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	[NT]	27	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	[NT]	27	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	[NT]	27	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	[NT]	27	83	83	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	[NT]	27	34	34	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	27	50	50	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	27	59	59	0	[NT]	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	[NT]	27	80	80	0	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	[NT]	27	66	66	0	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	[NT]	27	64	64	0	[NT]	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	[NT]	27	83	83	0	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	[NT]	27	78	78	0	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	[NT]	27	54	54	0	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	[NT]	27	61	61	0	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			13/09/2021	2	13/09/2021	13/09/2021		13/09/2021	[NT]
Date analysed	-			14/09/2021	2	14/09/2021	14/09/2021		14/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	2	12000	12000	0	104	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	2	2.0	2.0	0	104	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	2	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	27	13/09/2021	13/09/2021		[NT]	[NT]
Date analysed	-			[NT]	27	14/09/2021	14/09/2021		[NT]	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	[NT]	27	18000	18000	0	[NT]	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	[NT]	27	3.1	3.0	3	[NT]	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	27	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	277569-4
Date prepared	-			13/09/2021	2	13/09/2021	13/09/2021		13/09/2021	13/09/2021
Date analysed	-			13/09/2021	2	13/09/2021	13/09/2021		13/09/2021	13/09/2021
Antimony - low level	mg/kg	1	Metals-022	<1	2	<1	<1	0	86	#
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	2	11	10	10	91	88
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	2	0.5	0.5	0	89	76
Copper - low level	mg/kg	0.5	Metals-022	<0.5	2	17	16	6	90	110
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	2	28	25	11	89	104
Lead - low level	mg/kg	0.5	Metals-022	<0.5	2	100	97	3	92	79
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	2	0.25	0.21	17	91	106
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	2	16	14	13	92	89
Silver - low level	mg/kg	0.5	Metals-022	<0.5	2	<0.5	<0.5	0	83	103
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	2	59	57	3	100	87

QUALITY CONTROL: Acid Extractractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	27	13/09/2021	13/09/2021		[NT]	[NT]
Date analysed	-			[NT]	27	13/09/2021	13/09/2021		[NT]	[NT]
Antimony - low level	mg/kg	1	Metals-022	[NT]	27	3	3	0	[NT]	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	[NT]	27	24	23	4	[NT]	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	[NT]	27	2.0	2.5	22	[NT]	[NT]
Copper - low level	mg/kg	0.5	Metals-022	[NT]	27	59	60	2	[NT]	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	[NT]	27	67	71	6	[NT]	[NT]
Lead - low level	mg/kg	0.5	Metals-022	[NT]	27	200	210	5	[NT]	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	[NT]	27	0.70	0.70	0	[NT]	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	[NT]	27	35	37	6	[NT]	[NT]
Silver - low level	mg/kg	0.5	Metals-022	[NT]	27	<0.5	<0.5	0	[NT]	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	[NT]	27	140	160	13	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	71	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	95	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	92	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	86	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	90	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	103	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	104	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	94	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	117	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	110	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	108	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	114	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	110	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	95	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	94	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	81	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	97	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	103	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	109	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	79	[NT]	[NT]	[NT]	[NT]	78	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	129	[NT]	[NT]	[NT]	[NT]	125	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	104	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	74	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	33	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	34	[NT]	[NT]	[NT]	[NT]	32	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	72	[NT]	[NT]	[NT]	[NT]	66	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	69	[NT]	[NT]	[NT]	[NT]	61	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	109	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	106	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Naphthalene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	124	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	121	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	65	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	68	[NT]	[NT]	[NT]	[NT]	80	[NT]

QUALITY CONTROL: Organotin Compounds in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			14/09/2021	[NT]	[NT]	[NT]	[NT]	14/09/2021	[NT]
Date analysed	-			14/09/2021	[NT]	[NT]	[NT]	[NT]	14/09/2021	[NT]
Monobutyltin as Sn	µg/L	0.005	Ext-054	<0.005	[NT]	[NT]	[NT]	[NT]	112	[NT]
Dibutyltin as Sn	µg/L	0.002	Ext-054	<0.002	[NT]	[NT]	[NT]	[NT]	134	[NT]
Tributyltin as Sn	µg/L	0.002	Ext-054	<0.002	[NT]	[NT]	[NT]	[NT]	125	[NT]
Surrogate Triphenyltin	%		Ext-054	99	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: All metals in water - total					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Date analysed	-			10/09/2021	[NT]	[NT]	[NT]	[NT]	10/09/2021	[NT]
Antimony-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Copper-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Lead-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	115	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Silver-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Water Trace Level:
MeFOSA and EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

All Metals in soil - # Low spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS

PAH in Sediment, Organotin Compounds in Soil & Water analysed by MPL Laboratories. Report No. 268556

PAH in Sediment:
- PQL has been raised due to interference from analytes (other than those being tested) in the sample/s.
- #4ms: # Percent recovery is not possible to report as the analytes in the sample/s have caused interference.
- The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.

Organotin Compounds in Soil:
Some PQLs have been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

Organotin Compounds in Water
PQL has been raised due to insufficient sample provided and requiring dilution.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1483
View attached report

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277569
Date Sample Received	09/09/2021
Date Instructions Received	09/09/2021
Date Results Expected to be Reported	14/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	28 Soil, 4 Porewater, 3 Water
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	15
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Extra sample received QC217_210906

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PFAS in Waters Trace Extended	PAHs in Water - Low Level	Organotin Compunds in Water	All metals in water - total	On Hold
BH-SB-33_0.0-0.5_2108																						✓
BH-SB-33_0.5-1.0_2108	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-33_1.0-1.5_2108																						✓
BH-SB-34_0.0-0.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-34_0.5-1.0_210907																						✓
BH-SB-34_1.0-1.5_210907																						✓
BH-SB-34_1.5-2.0_210907																						✓
BH-SB-34_2.0-2.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-34_2.5-3.0_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-34_3.0-3.5_210907																						✓
PW-SB-34_210907																						✓
QC114_210907																						✓
BH-SB-35_0.0-0.5_210907																						✓
BH-SB-35_0.5-1.0_210907																						✓
BH-SB-35_1.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-35_1.5-2.0_210907																						✓
BH-SB-35_2.0-2.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SB-35_2.5-3.0_210907																						✓
BH-SB-35_3.0-4.0_210907																						✓
BH-SB-35_4.0-5.0_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					

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Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PFAS in Waters Trace Extended	PAHs in Water - Low Level	Organotin Compunds in Water	All metals in water - total	On Hold
PW-SB-35_210907																						✓
QC117_210907																						✓
BH-SWTP-01_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-02_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-03_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-04_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-05_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-06_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH-SWTP-07_0.0-1.5_210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
QC115 _210907	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
QC116 _210907																						✓
QC313_210907																						✓
QC314_210907																		✓	✓	✓	✓	
QC412_210907																		✓				
QC217_210906																						✓

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

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Additional Info

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

CHAIN OF CUSTODY FORM - Client

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National phone number 1300 424 344

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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
✆ 08 8967 1201 | ✉ darwin@envirolab.com.au

Company:	AECOM	Client Project Name/Number/Site etc (ie report title):	60642423 - Viva Energy Gas Terminal Project
Contact Person:	[redacted]	PO No. (if applicable):	
Project Mgr:	[redacted]	Envirolab Quote No. :	21SY185_Rev1
Sampler:	BC	Date results required:	
Address:		Or choose:	☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day
Phone:	Mob: [redacted]	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	
Email Results to:	[redacted]	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	[redacted]	Lab Comments:	

Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)	TOC/TOM	Particle Size Dist - Sieving and Hydrometer	Particle Density									FREEZE and HOLD	Comments: Provide as much information about the sample as you can
	Sample information				**Tests Required**																
1	BH-SB-36_0.0-0.5_210908			Sediment																X	
2	BH-SB-36_0.5-1.0_210908			Sediment	X	X	X	X	X	X	X										
3	BH-SB-36_1.0-1.5_210908			Sediment																X	
4	BH-SB-36_1.5-2.0_210908			Sediment	X	X	X	X	X	X	X										
5	BH-SB-36_2.0-2.5_210908			Sediment																X	
6	BH-SB-36_2.5-3.0_210908			Sediment	X	X	X	X	X	X	X										
7	BH-BP-22_0.0-0.5_210908			Sediment	X	X	X	X	X	X	X										
8	BH-BP-22_2.0-2.5_210908			Sediment	X	X	X	X	X	X	X										
9	BH-BP-22_2.5-3.0_210908			Sediment																X	
10	PW-SB-36_210908			Porewater																X	

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company):		Received by (Company):	ELS - SYD
Print Name:		Print Name:	V. SEGA
Date & Time:		Date & Time:	10/9/21 0900
Signature:		Signature:	

Lab Use Only	
Job number: 277707	Cooling: Ice / Ice pack / None
Temperature: 10°C	Security seal: Intact / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

CHAIN OF CUSTODY FORM - Client

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Unit 20/119 Reichardt Road, Winnellie, NT 0820
✆ 08 8967 1201 | ✉ darwin@envirolab.com.au

Company:	AECOM
Contact Person:	[redacted]
Project Mgr:	[redacted]
Sampler:	BC
Address:	
Phone:	Mob: [redacted]
Email Results to:	[redacted]
Email Invoice to:	[redacted]

Client Project Name/Number/Site etc (ie report title): 60642423 - Viva Energy Gas Terminal Project

PO No. (if applicable):

Envirolab Quote No. : 21SY185_Rev1

Date results required:

Or choose: ☐ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☑ 3 day

Note: Inform lab in advance if urgent turnaround is required - surcharges apply

Additional report format: ☑ Esdat ☐ Equis

Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Metals and metalloids: (Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn)	PAH	Organotins	PFAS - Extended Suite (28 analytes)											HOLD	Provide as much information about the sample as you can
11	QC315 _210908			Water															X	
12	QC414 _210908			Water				X												

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS - SYD	Lab Use Only	
Print Name:	Print Name: V. VEGA	Job number: 277707	Cooling: Ice / Ice pack / None
Date & Time:	Date & Time: 10/9/21 @ 0900	Temperature: 10 °C	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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CERTIFICATE OF ANALYSIS 277707

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]
Address	Level 9, 8 Exhibition St, Melbourne, VIC, 3000

Sample Details

Your Reference	**60642423 - Viva Energy Gas Terminal**
Number of Samples	9 Soil, 1 Porewater, 2 Water
Date samples received	10/09/2021
Date completed instructions received	10/09/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	15/09/2021
Date of Issue	27/09/2021

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Diego Bigolin, Inorganics Supervisor
Greta Petzold, Senior Report Coordinator
Hannah Nguyen, Metals Supervisor
Josh Williams, LC Supervisor
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

PAH NAGD level in soil						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Date analysed	-	15/09/2021	15/09/2021	15/09/2021	15/09/2021	15/09/2021
Naphthalene	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	µg/kg	<5	<5	<5	<5	<5
Fluorene	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	µg/kg	20	<5	<5	72	<5
Anthracene	µg/kg	<5	<5	<5	20	<5
Fluoranthene	µg/kg	30	<5	<5	170	<5
Pyrene	µg/kg	40	<5	<5	190	<5
Benz(a)anthracene	µg/kg	20	<5	<5	110	<5
Chrysene	µg/kg	20	<5	<5	86	<5
Benzo(b,j)&(k)fluoranthene	µg/kg	20	<10	<10	80	<10
Benzo(e)pyrene	µg/kg	18	<5	<5	74	<5
Benzo(a)pyrene	µg/kg	30	<5	<5	120	<5
Perylene	µg/kg	<5	<5	<5	25	<5
Indeno(1,2,3-cd)pyrene	µg/kg	20	<5	<5	84	<5
Dibenz(ah)anthracene	µg/kg	<5	<5	<5	10	<5
Benzo(ghi)perylene	µg/kg	20	<5	<5	67	<5
Coronene	µg/kg	<5	<5	<5	16	<5
Surrogate p-Terphenyl-d14	%	98	103	117	95	95

Organotin Compunds in Soil						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Date analysed	-	15/09/2021	15/09/2021	15/09/2021	15/09/2021	15/09/2021
Monobutyltin as Sn	µg/kg	<3.3	<1.7	<1.7	<1.3	<1.7
Dibutyltin as Sn	µg/kg	<3.1	<1.3	<1.3	<1.5	<1.3
Tributyltin as Sn	µg/kg	<1.2	<1	<1	<1	<1
Surrogate Triphenyltin	%	90	88	91	88	91

PFAS in Soils Extended						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Perfluorobutanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.3	<0.1	<0.1	0.2	<0.1
Perfluorodecanesulfonic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluoropentanoic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid	µg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid	µg/kg	<5	<5	<5	<5	<5
4:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide	µg/kg	<1	<1	<1	<1	<1
N-Ethyl perfluorooctanesulfon amide	µg/kg	<1	<1	<1	<1	<1
N-Me perfluorooctanesulfonamid oethanol	µg/kg	<1	<1	<1	<1	<1
N-Et perfluorooctanesulfonamid oethanol	µg/kg	<5	<5	<5	<5	<5
MePerfluorooctanesulf- amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EtPerfluorooctanesulf amid oacetic acid	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	106	94	105	99	100
Surrogate $^{13}C_2$ *PFOA*	%	117	113	112	119	117
Extracted ISTD $^{13}C_3$ *PFBS*	%	81	91	87	78	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	97	94	84	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	64	80	78	66	79

PFAS in Soils Extended						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Extracted ISTD $^{13}C_4$ *PFBA*	%	70	77	76	63	73
Extracted ISTD $^{13}C_3$ *PFPeA*	%	65	76	73	65	75
Extracted ISTD $^{13}C_2$ *PFHxA*	%	74	83	78	69	79
Extracted ISTD $^{13}C_4$ *PFHpA*	%	74	83	79	73	80
Extracted ISTD $^{13}C_4$ *PFOA*	%	72	84	81	68	80
Extracted ISTD $^{13}C_5$ *PFNA*	%	78	81	82	78	83
Extracted ISTD $^{13}C_2$ *PFDA*	%	84	91	86	82	87
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	81	98	90	81	84
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	71	84	83	73	80
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	76	84	74	76	82
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	41	51	45	36	48
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	55	64	58	51	65
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	66	73	64	64	69
Extracted ISTD $^{13}C_8$ *FOSA*	%	86	98	92	79	93
Extracted ISTD d_3 *N MeFOSA*	%	72	81	75	66	76
Extracted ISTD d_5 *N EtFOSA*	%	66	77	73	64	75
Extracted ISTD d_7 *N MeFOSE*	%	85	95	92	82	91
Extracted ISTD d_9 *N EtFOSE*	%	79	88	89	76	89
Extracted ISTD d_3 *N MeFOSAA*	%	56	67	62	51	58
Extracted ISTD d_5 *N EtFOSAA*	%	67	71	69	64	71
Total Positive PFHxS & PFOS	µg/kg	0.3	<0.1	<0.1	0.2	<0.1
Total Positive PFOS & PFOA	µg/kg	0.3	<0.1	<0.1	0.2	<0.1
Total Positive PFAS	µg/kg	0.3	<0.1	<0.1	0.2	<0.1

Miscellaneous Inorg - soil						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/09/2021	15/09/2021	15/09/2021	15/09/2021	15/09/2021
Date analysed	-	15/09/2021	15/09/2021	15/09/2021	15/09/2021	15/09/2021
Total Organic Carbon (Combustion)	mg/kg	11,000	8,700	2,000	21,000	7,200
Organic Matter (Combustion)	%	1.8	1.5	0.4	3.6	1.2
Density in Soils/Solids	g/cm^3	#	#	#	#	#

Particle Size Distribution in Soils						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/09/2021	15/09/2021	15/09/2021	15/09/2021	15/09/2021
Date analysed	-	16/09/2021	16/09/2021	16/09/2021	16/09/2021	16/09/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	<1	<1	<1	<1	<1
Very Coarse Sand 1.18-2.36mm	%	<1	1	<1	<1	<1
Coarse Sand 0.6-1.18mm	%	<1	3	<1	1	5
Medium Sand 0.425-0.6mm	%	<1	1	<1	1	3
Medium Sand 0.3-0.425mm	%	<1	1	<1	1	2
Fine Sand 0.15-0.3mm	%	4	6	<1	5	10
Very Fine Sand 0.075-0.15mm	%	15	21	36	25	35
Coarse Silt 0.020-0.075mm	%	21	17	28	20	6
Fine Silt 0.002-0.020mm	%	16	8	7	14	7
Clay <0.002mm	%	44	41	29	32	32

Acid Extractractable metals in soil						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Antimony - low level	mg/kg	1	<1	2	1	2
Arsenic - low level	mg/kg	11	16	21	13	8.3
Cadmium - low level	mg/kg	0.5	<0.1	0.1	1.0	0.2
Copper - low level	mg/kg	13	6.0	4	23	21
Chromium - low level	mg/kg	39	19	26	39	54
Lead - low level	mg/kg	31	9.9	5	65	6.9
Mercury - low level	mg/kg	0.02	<0.01	<0.01	0.02	<0.01
Nickel - low level	mg/kg	21	20	13	20	34
Silver - low level	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc - low level	mg/kg	46	15	32	77	28

Moisture						
Our Reference		277707-2	277707-4	277707-6	277707-7	277707-8
Your Reference	UNITS	BH-SB-36_0.5-1.0_210908	BH-SB-36_1.5-2.0_210908	BH-SB-36_2.5-3.0_210908	BH-BP-22_0.0-0.5_210908	BH-BP-22_2.0-2.5_210908
Date Sampled		08/09/2021	08/09/2021	08/09/2021	08/09/2021	08/09/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2021	13/09/2021	13/09/2021	13/09/2021	13/09/2021
Date analysed	-	14/09/2021	14/09/2021	14/09/2021	14/09/2021	14/09/2021
Moisture	%	47	33	25	40	29

PFAS in Waters Trace Extended		
Our Reference		277707-12
Your Reference	UNITS	QC414 _210908
Date Sampled		08/09/2021
Type of sample		Water
Date prepared	-	15/09/2021
Date analysed	-	15/09/2021
Perfluorobutanesulfonic acid	µg/L	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002
Perfluorobutanoic acid	µg/L	<0.002
Perfluoropentanoic acid	µg/L	<0.002
Perfluorohexanoic acid	µg/L	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002
Perfluorononanoic acid	µg/L	<0.001
Perfluorodecanoic acid	µg/L	<0.002
Perfluoroundecanoic acid	µg/L	<0.002
Perfluorododecanoic acid	µg/L	<0.005
Perfluorotridecanoic acid	µg/L	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05
4:2 FTS	µg/L	<0.001
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
10:2 FTS	µg/L	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	99
Surrogate $^{13}C_2$ *PFOA*	%	93
Extracted ISTD $^{13}C_3$ *PFBS*	%	91
Extracted ISTD $^{18}O_2$ *PFHxS*	%	88
Extracted ISTD $^{13}C_4$ *PFOS*	%	92
Extracted ISTD $^{13}C_4$ *PFBA*	%	91

PFAS in Waters Trace Extended		
Our Reference		277707-12
Your Reference	UNITS	QC414 _210908
Date Sampled		08/09/2021
Type of sample		Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	82
Extracted ISTD $^{13}C_2$ *PFHxA*	%	100
Extracted ISTD $^{13}C_4$ *PFHpA*	%	102
Extracted ISTD $^{13}C_4$ *PFOA*	%	110
Extracted ISTD $^{13}C_5$ *PFNA*	%	100
Extracted ISTD $^{13}C_2$ *PFDA*	%	111
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	115
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	121
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	61
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	121
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	100
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	103
Extracted ISTD $^{13}C_8$ *FOSA*	%	92
Extracted ISTD d_3 *N MeFOSA*	%	51
Extracted ISTD d_5 *N EtFOSA*	%	50
Extracted ISTD d_7 *N MeFOSE*	%	101
Extracted ISTD d_9 *N EtFOSE*	%	96
Extracted ISTD d_3 *N MeFOSAA*	%	141
Extracted ISTD d_5 *N EtFOSAA*	%	106
Total Positive PFHxS & PFOS	µg/L	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002
Total Positive PFAS	µg/L	<0.0002

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Ext-062	Analysed by Microanalysis Australia
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PAH NAGD level in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277707-4
Date extracted	-			14/09/2021	2	14/09/2021	14/09/2021		14/09/2021	14/09/2021
Date analysed	-			15/09/2021	2	15/09/2021	15/09/2021		15/09/2021	15/09/2021
Naphthalene	µg/kg	5	Ext-054	<5	2	<5	<5	0	107	112
2-Methylnaphthalene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Acenaphthylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Acenaphthene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Fluorene	µg/kg	5	Ext-054	<5	2	<5	<5	0	103	98
Phenanthrene	µg/kg	5	Ext-054	<5	2	20	10	67	97	91
Anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Fluoranthene	µg/kg	5	Ext-054	<5	2	30	30	0	101	93
Pyrene	µg/kg	5	Ext-054	<5	2	40	30	29	101	93
Benz(a)anthracene	µg/kg	5	Ext-054	<5	2	20	20	0	[NT]	[NT]
Chrysene	µg/kg	5	Ext-054	<5	2	20	20	0	98	89
Benzo(b,j)&(k)fluoranthene	µg/kg	10	Ext-054	<10	2	20	20	0	[NT]	[NT]
Benzo(e)pyrene	µg/kg	5	Ext-054	<5	2	18	18	0	[NT]	[NT]
Benzo(a)pyrene	µg/kg	5	Ext-054	<5	2	30	30	0	104	90
Perylene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Indeno(1,2,3-cd)pyrene	µg/kg	5	Ext-054	<5	2	20	20	0	[NT]	[NT]
Dibenz(ah)anthracene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Benzo(ghi)perylene	µg/kg	5	Ext-054	<5	2	20	20	0	[NT]	[NT]
Coronene	µg/kg	5	Ext-054	<5	2	<5	<5	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Ext-054	107	2	98	87	12	102	87

QUALITY CONTROL: Organotin Compounds in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277707-4
Date prepared	-			14/09/2021	2	14/09/2021	14/09/2021		14/09/2021	14/09/2021
Date analysed	-			15/09/2021	2	15/09/2021	15/09/2021		15/09/2021	15/09/2021
Monobutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<3.3	<3.3	0	94	116
Dibutyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<3.1	<3.1	0	69	71
Tributyltin as Sn	µg/kg	0.5	Ext-054	<0.5	2	<1.2	<1.2	0	82	86
Surrogate Triphenyltin	%		Ext-054	98	2	90	94	4	96	88

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277707-4
Date prepared	-			14/09/2021	2	14/09/2021	14/09/2021		14/09/2021	14/09/2021
Date analysed	-			14/09/2021	2	14/09/2021	14/09/2021		14/09/2021	14/09/2021
Perfluorobutanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	99	103
Perfluoropentanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	97	99
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	97	102
Perfluoroheptanesulfonic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	106	108
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	0.3	0.3	0	101	102
Perfluorodecanesulfonic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	91	92
Perfluorobutanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	113	111
Perfluoropentanoic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	101	99
Perfluorohexanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	97	94
Perfluoroheptanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	106	102
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	102
Perfluorononanoic acid	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	96	90
Perfluorodecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	91	91
Perfluoroundecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	93	91
Perfluorododecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	105	90
Perfluorotridecanoic acid	µg/kg	0.5	Org-029	<0.5	2	<0.5	<0.5	0	112	101
Perfluorotetradecanoic acid	µg/kg	5	Org-029	<5	2	<5	<5	0	104	106
4:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	108	110
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	114	117
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	99	95
10:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	113	118
Perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	95	90
N-Methyl perfluorooctane sulfonamide	µg/kg	1	Org-029	<1	2	<1	<1	0	104	103
N-Ethyl perfluorooctanesulfon amide	µg/kg	1	Org-029	<1	2	<1	<1	0	111	118
N-Me perfluorooctanesulfonamid oethanol	µg/kg	1	Org-029	<1	2	<1	<1	0	105	104
N-Et perfluorooctanesulfonamid oethanol	µg/kg	5	Org-029	<5	2	<5	<5	0	92	87
MePerfluorooctanesulf- amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	118	119
EtPerfluorooctanesulf amid oacetic acid	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	95	102
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	97	2	106	104	2	102	99
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	123	2	117	119	2	109	117

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277707-4
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	97	2	81	78	4	102	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	107	2	87	83	5	105	93
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	86	2	64	62	3	91	76
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	95	2	70	67	4	97	75
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	95	2	65	65	0	97	75
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	96	2	74	70	6	97	81
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	95	2	74	72	3	94	82
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	93	2	72	71	1	93	79
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	98	2	78	74	5	101	85
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	101	2	84	79	6	106	88
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	99	2	81	86	6	102	91
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	96	2	71	71	0	97	86
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	108	2	76	74	3	108	81
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	84	2	41	37	10	94	49
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	95	2	55	51	8	101	60
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	88	2	66	60	10	94	69
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	107	2	86	85	1	103	91
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	89	2	72	69	4	90	80
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	85	2	66	66	0	86	73
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	110	2	85	87	2	109	93

QUALITY CONTROL: PFAS in Soils Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	277707-4
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	97	2	79	75	5	103	92
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	79	2	56	54	4	85	64
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	92	2	67	66	2	100	73

QUALITY CONTROL: Miscellaneous Inorg - soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			15/09/2021	7	15/09/2021	15/09/2021		15/09/2021	[NT]
Date analysed	-			15/09/2021	7	15/09/2021	15/09/2021		15/09/2021	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	7	21000	23000	9	102	[NT]
Organic Matter (Combustion)	%	0.1	Inorg-128	<0.1	7	3.6	4.0	11	102	[NT]
Density in Soils/Solids	g/cm^3		Ext-062	[NT]	7	#	[NT]		[NT]	[NT]

QUALITY CONTROL: Acid Extractractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			13/09/2021	[NT]	[NT]	[NT]	[NT]	13/09/2021	[NT]
Date analysed	-			13/09/2021	[NT]	[NT]	[NT]	[NT]	13/09/2021	[NT]
Antimony - low level	mg/kg	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Arsenic - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cadmium - low level	mg/kg	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Copper - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	109	[NT]
Chromium - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Lead - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	109	[NT]
Mercury - low level	mg/kg	0.01	Metals-021	<0.01	[NT]	[NT]	[NT]	[NT]	87	[NT]
Nickel - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	109	[NT]
Silver - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Zinc - low level	mg/kg	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			14/09/2021	12	15/09/2021	15/09/2021		14/09/2021	[NT]
Date analysed	-			14/09/2021	12	15/09/2021	15/09/2021		14/09/2021	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	12	<0.0004	<0.0004	0	103	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	12	<0.001	<0.001	0	98	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	12	<0.0002	<0.0002	0	110	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	12	<0.001	<0.001	0	111	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	12	<0.0002	<0.0002	0	104	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	102	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	102	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	102	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	12	<0.0004	<0.0004	0	112	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	12	<0.0004	<0.0004	0	104	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	12	<0.0002	<0.0002	0	103	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	12	<0.001	<0.001	0	110	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	102	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	97	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	12	<0.005	<0.005	0	103	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	12	<0.01	<0.01	0	76	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	12	<0.05	<0.05	0	113	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	12	<0.001	<0.001	0	105	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	12	<0.0004	<0.0004	0	108	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	12	<0.0004	<0.0004	0	113	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	137	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	12	<0.01	<0.01	0	104	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	12	<0.005	<0.005	0	88	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	12	<0.01	<0.01	0	90	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	12	<0.005	<0.005	0	104	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	12	<0.05	<0.05	0	96	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	94	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	12	<0.002	<0.002	0	106	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	94	12	99	93	6	100	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	12	93	88	6	92	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ PFBS	%		Org-029	87	12	91	86	6	86	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	87	12	88	87	1	85	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	96	12	92	91	1	88	[NT]
Extracted ISTD $^{13}C_4$ PFBA	%		Org-029	91	12	91	89	2	89	[NT]
Extracted ISTD $^{13}C_3$ PFPeA	%		Org-029	79	12	82	79	4	75	[NT]
Extracted ISTD $^{13}C_2$ PFHxA	%		Org-029	97	12	100	98	2	97	[NT]
Extracted ISTD $^{13}C_4$ PFHpA	%		Org-029	102	12	102	103	1	101	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	109	12	110	110	0	108	[NT]
Extracted ISTD $^{13}C_5$ PFNA	%		Org-029	99	12	100	99	1	96	[NT]
Extracted ISTD $^{13}C_2$ PFDA	%		Org-029	111	12	111	108	3	107	[NT]
Extracted ISTD $^{13}C_2$ PFUnDA	%		Org-029	120	12	115	108	6	115	[NT]
Extracted ISTD $^{13}C_2$ PFDoDA	%		Org-029	122	12	121	114	6	119	[NT]
Extracted ISTD $^{13}C_2$ PFTeDA	%		Org-029	55	12	61	62	2	50	[NT]
Extracted ISTD $^{13}C_2$ 4:2FTS	%		Org-029	114	12	121	117	3	109	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	98	12	100	100	0	100	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	99	12	103	106	3	96	[NT]
Extracted ISTD $^{13}C_8$ FOSA	%		Org-029	89	12	92	93	1	84	[NT]
Extracted ISTD d_3 N MeFOSA	%		Org-029	39	12	51	40	24	46	[NT]
Extracted ISTD d_5 N EtFOSA	%		Org-029	37	12	50	39	25	43	[NT]
Extracted ISTD d_7 N MeFOSE	%		Org-029	96	12	101	95	6	97	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	88	12	96	87	10	94	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	144	12	141	139	1	126	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	103	12	106	102	4	94	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in water TRACE Extended - MeFOSA and EtFOSA Extracted Internal Standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

PAH in Sediment & Organotin Compounds in Soil analysed by MPL Laboratories. Report No. 268678

Organotin Compounds in Soil: Some PQLS have been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

Density in Soils/Solids analysed by Microanalysis Australia. Report No. 21_1501
View attached report

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
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SAMPLE RECEIPT ADVICE

Client Details

Client	AECOM Australia Pty Ltd (Melbourne)
Attention	[redacted]

Sample Login Details

Your reference	60642423 - Viva Energy Gas Terminal
Envirolab Reference	277707
Date Sample Received	10/09/2021
Date Instructions Received	10/09/2021
Date Results Expected to be Reported	15/09/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	9 Soil, 1 Porewater, 2 Water
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	10
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

PSD/Density - extra days

Please direct any queries to:

[redacted]

Analysis Underway, details on the following page:

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

Sample ID	PAH NAGD level in soil	Organotin Compunds in Soil	PFAS in Soils Extended	Total Organic Carbon (Combustion)	Organic Matter (Combustion)	Density in Soils/Solids*	Particle Size Distributionin Soils	Antimony - low level	Arsenic - low level	Cadmium - low level	Copper - low level	Chromium - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	PFAS in Waters Trace Extended	On Hold
BH-SB-36_0.0-0.5_210908																			✓
BH-SB-36_0.5-1.0_210908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-36_1.0-1.5_210908																			✓
BH-SB-36_1.5-2.0_210908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-SB-36_2.0-2.5_210908																			✓
BH-SB-36_2.5-3.0_210908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-BP-22_0.0-0.5_210908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-BP-22_2.0-2.5_210908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
BH-BP-22_2.5-3.0_210908																			✓
PW-SB-36_210908																			✓
QC315 _210908																			✓
QC414 _210908																		✓	

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

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
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Additional Info

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

5 Alvan Street
Mount Lawley, WA 6050
+61 8 9225 5810
ABN 65 133 060 787

Accreditation No. 20283
Site No. 24180
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Client:	Envirolab Services	**Date received:**	14/9/2021
Client Address:	12 Ashley Street CHATSWOOD NSW 2067	**Date analysed:**	23/9/2021
Job number:	21_1501	**Date reported:**	23/9/2021
Analysis:	Absolute density by helium pycnometry following ASTM D5550		

Revision No.: 0
Comments: **None**

Sample preparation
A representative sub-sample was taken and oven dried at 105 °C prior to analysis.

Analysis
The sample was analysed using a Micromeritics Accupyc with helium gas (99.9 %). The instrument was calibrated using a certified standard prior to the analysis. The analysis was conducted 10 times to enable an average value and standard deviation to be quoted. The analyses were conducted at 21 °C.

Summary
The density results are as follows:

Client ID	Lab ID	Density (g/cc)
277707-2	21_1501_01	2.6526 ± 0.010
277707-4	21_1501_02	2.6361 ± 0.006
277707-6	21_1501_03	2.6788 ± 0.001
277707-7	21_1501_04	2.5005 ± 0.002
277707-8	21_1501_05	2.6286 ± 0.001

The results are representative only of the sample/s provided.

Analyst: James Nicolas, B.A.

Reported: James Nicolas, B.A.

Authorised: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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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 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
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☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@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@alsglobal.com

CLIENT: AECOM	**TURNAROUND REQUIREMENTS :** X Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY (Circle)**
OFFICE: Melbourne	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact? Yes / No / N/A
PROJECT: Viva Geelong Offshore	**ALS QUOTE NO.:** ME/386/21 V2	Free ice / frozen ice packs present upon receipt? Yes / No / N/A
ORDER NUMBER:	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: [redacted] **CONTACT PH:**	OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: BC **SAMPLER MOBILE:** [redacted]	**RELINQUISHED BY:**	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):** Esdat				
Email Reports to (will default to PM if no other addresses are listed): [redacted]	DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): [redacted]				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL CONTAINERS	Total Hg EG035T	TBT EP090	Metals EG005T (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn)	TOC EP003	SIM-PAH Only EP075 SIM PAH only	Particle Sizing with Hydrometer + Soil Particle Density EA150H/EA152	PFAS Full Suite EP231		
1	QC202_210819		Sed			x	x	x	x	x	x	x		
2	QC203_210819		Sed			x	x	x	x	x	x	x		
3	QC601_210819		Seawate			x	x	x				x		Total and dissolved metals
4	QC401_210819		Water									x		

Environmental Division
Melbourne
Work Order Reference
EM2116795

Telephone : +61-3-8549 9600

Received: 24/8/16 5:30 Carrier: courier
C/note:
Temp: 1.5 °C Seal: Y / N
Ice / Icebricks / NA
TM

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

CERTIFICATE OF ANALYSIS

Work Order	: **EM2116795**	Page	: 1 of 12
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	[redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 24-Aug-2021 16:50
Order number	: VIVA GEELONG OFFSHORE	Date Analysis Commenced	: 25-Aug-2021
C-O-C number	: ----	Issue Date	: 02-Sep-2021 16:09
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 4		

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, unless the sampling was conducted by ALS. 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*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, 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.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG020-F : EM2116795 #3 dissolved metal required dilution prior analysis due to sample matrix. LORs have been adjusted accordingly.
- EG020-T : EM2116795 #3 total metal required dilution prior analysis due to sample matrix. LORs have been adjusted accordingly.
- EP090 - Organotins: Insufficient sample was provided for extended QC analysis. Matrix spike and duplicate recoveries not determined.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC202_210819	QC203_210819	----	----	----
			Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM2116795-001	EM2116795-002	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	17.6	18.9	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	94	6	----	----	----
+150µm	----	1	%	74	3	----	----	----
+300µm	----	1	%	39	2	----	----	----
+425µm	----	1	%	26	1	----	----	----
+600µm	----	1	%	12	1	----	----	----
+1180µm	----	1	%	2	<1	----	----	----
+2.36mm	----	1	%	<1	<1	----	----	----
+4.75mm	----	1	%	<1	<1	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	6	42	----	----	----
Silt (2-60 µm)	----	1	%	<1	48	----	----	----
Sand (0.06-2.00 mm)	----	1	%	93	10	----	----	----
Gravel (>2mm)	----	1	%	1	<1	----	----	----
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.64	2.64	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	<5	----	----	----
Arsenic	7440-38-2	5	mg/kg	<5	<5	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	5	5	----	----	----
Copper	7440-50-8	5	mg/kg	<5	<5	----	----	----
Lead	7439-92-1	5	mg/kg	<5	<5	----	----	----
Nickel	7440-02-0	2	mg/kg	2	2	----	----	----
Silver	7440-22-4	2	mg/kg	<2	<2	----	----	----
Zinc	7440-66-6	5	mg/kg	7	6	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC202_210819	QC203_210819	----	----	----
			Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM2116795-001	EM2116795-002	--------	--------	--------
				Result	Result	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.10**	**0.74**	----	----	----
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	----	----	----
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**	----	----	----
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC202_210819	QC203_210819	----	----	----
			Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM2116795-001	EM2116795-002	--------	--------	--------
				Result	Result	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC202_210819	QC203_210819	----	----	----
				Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2116795-001	EM2116795-002	--------	--------	--------
					Result	Result	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		<0.0002	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		<0.0002	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**79.2**	**74.3**	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		**81.2**	**76.4**	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		**60.1**	**54.8**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**95.4**	**89.5**	----	----	----
Anthracene-d10	1719-06-8	0.5	%		**110**	**106**	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		**100**	**93.8**	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**87.9**	**95.4**	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**103**	----	----	----	----
13C8-PFOA	----	0.0002	%		**90.1**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC601_210819	QC401_210819	----	----	----
				Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2116795-003	EM2116795-004	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Antimony	7440-36-0	0.001	mg/L		<0.002	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.004**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0002	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.002	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.002	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.002	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.002	----	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.002	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.010	----	----	----	----
EG020T: Total Metals by ICP-MS									
Antimony	7440-36-0	0.001	mg/L		<0.002	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.005**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0002	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.002	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.002	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.002	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.002	----	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.002	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.010	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable 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	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	QC601_210819	QC401_210819	----	----	----
			Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM2116795-003	EM2116795-004	--------	--------	--------
				Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
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	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC601_210819	QC401_210819	----	----	----
				Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2116795-003	EM2116795-004	--------	--------	--------
					Result	Result	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	<0.01	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	<0.01	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC601_210819	QC401_210819	----	----	----
				Sampling date / time	19-Aug-2021 00:00	19-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM2116795-003	EM2116795-004	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1.0	%		**37.9**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**73.7**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**76.7**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**81.0**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**81.3**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**76.5**	----	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	5	%		**100**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**102**	**103**	----	----	----
13C8-PFOA	----	0.02	%		**99.2**	**102**	----	----	----

Surrogate Control Limits

Sub-Matrix: SEDIMENT		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
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	68	136
13C8-PFOA	----	69	133

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	51
2-Chlorophenol-D4	93951-73-6	30	114
2.4.6-Tribromophenol	118-79-6	26	133
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	35	127
Anthracene-d10	1719-06-8	44	122
4-Terphenyl-d14	1718-51-0	44	124
EP090S: Organotin Surrogate			
Tripropyltin	----	24	116
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

(WATER) EP090: Organotin Compounds (Soluble)

(WATER) EP090S: Organotin Surrogate

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA150: Particle Sizing

(SOIL) EA152: Soil Particle Density

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2116795**	Page	: 1 of 17
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	[redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 24-Aug-2021
Order number	: VIVA GEELONG OFFSHORE	Date Analysis Commenced	: 25-Aug-2021
C-O-C number	: ----	Issue Date	: 02-Sep-2021
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 4		

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, unless the sampling was conducted by ALS. 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*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3874943)									
EM2116875-086	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	19	18	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	10	9	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	21	19	9.6	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	39	36	8.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	146	137	6.6	0% - 20%
EM2116990-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	12	13	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	7	8	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	7	7	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	10	10	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3865688)									
EM2116795-001	QC202_210819	EA055: Moisture Content	----	0.1	%	17.6	19.0	7.3	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3874942)									
EM2116875-086	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.4	0.3	0.0	No Limit
EM2116990-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3876766)									
EM2116795-001	QC202_210819	EP003: Total Organic Carbon	----	0.02	%	0.10	0.10	0.0	No Limit
EP2109842-009	Anonymous	EP003: Total Organic Carbon	----	0.02	%	1.91	1.77	7.5	0% - 20%
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3874925)									
EM2116875-086	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3872514)									
EM2116795-001	QC202_210819	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3875932)									
EM2116795-001	QC202_210819	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3875932)									
EM2116795-001	QC202_210819	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3875932) - continued									
EM2116795-001	QC202_210819	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875932)									
EM2116795-001	QC202_210819	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875932) - continued									
EM2117074-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3875932)									
EM2116795-001	QC202_210819	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117074-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3875932)									
EM2116795-001	QC202_210819	EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3875629)									
EM2116940-003	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3875629) - continued									
EM2116940-003	Anonymous	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.015	0.015	0.0	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.012	0.011	0.0	No Limit
EM2116795-003	QC601_210819	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0002	<0.0002	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.003	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.010	<0.010	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3875630)									
EM2116795-003	QC601_210819	EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.002	<0.002	0.0	No Limit
EM2117005-004	Anonymous	EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 3876727)									
EM2116795-003	QC601_210819	EG020B-T: Silver	7440-22-4	0.001	mg/L	<0.002	<0.002	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 3876728)									
EM2116962-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.007	0.008	13.9	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.114	0.112	1.8	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.002	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.011	0.013	19.6	No Limit
EM2116795-003	QC601_210819	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0002	<0.0002	0.0	No Limit
		EG020A-T: Antimony	7440-36-0	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.005	0.004	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.002	<0.002	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.010	<0.010	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3875628)									
EM2116795-003	QC601_210819	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EM2117005-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3875765)									
EM2116795-003	QC601_210819	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EM2116921-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3875986)									
EM2116940-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.09	1.09	0.0	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.08	0.09	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.10	0.09	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.83	0.77	7.4	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.04	0.04	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EM2116940-009	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.07	0.06	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.07	0.07	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3875986)									
EM2116940-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.08	0.08	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.40	0.42	4.4	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.47	0.51	8.8	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.12	0.12	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	0.05	0.05	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	0.1	0.2	0.0	No Limit
EM2116940-009	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.03	0.03	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.12	0.12	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.10	0.09	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.05	0.05	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	0.10	0.09	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875986)									
EM2116940-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875986) - continued									
EM2116940-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EM2116940-009	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3875986)									
EM2116940-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EM2116940-009	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3875986)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231P: PFAS Sums (QC Lot: 3875986) - continued									
EM2116940-001	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	3.36	3.46	2.9	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	1.92	1.86	3.2	0% - 20%
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	3.17	3.28	3.4	0% - 20%
EM2116940-009	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.54	0.53	1.9	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.14	0.13	7.4	0% - 50%
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	0.44	0.44	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (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 Sample (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 (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3874943)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	116	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	99.7	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	66.8	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	102	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	92.5	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	90.0	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	97.4	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	78.1	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	78.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3874942)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	92.2	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3876766)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	9.24 %	105	70.0	130
				<0.02	0.2 %	95.5	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3874925)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	103	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	98.5	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	102	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	90.5	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	96.6	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	103	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	92.8	78.3	124
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	96.3	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	92.4	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	107	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	91.3	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	101	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	106	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	69.0	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	70.3	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	76.5	65.8	127
EP090: Organotin Compounds (QCLot: 3872514)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	118	52.0	139

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875932)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00111 mg/kg	104	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	86.4	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0014 mg/kg	82.4	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	89.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	96.7	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00121 mg/kg	91.1	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875932)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	111	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.2	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.7	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.5	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.7	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00468 mg/kg	106	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875932)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	95.9	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	105	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	103	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	135	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875932)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00117 mg/kg	95.1	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00119 mg/kg	103	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.0012 mg/kg	121	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00121 mg/kg	116	70.0	130
EP231P: PFAS Sums (QCLot: 3875932)								
EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231P: PFAS Sums (QCLot: 3875932) - continued								
EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3875629)								
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	97.8	82.4	109
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	89.0	111
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	83.5	111
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.8	83.2	109
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	98.6	83.1	107
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	84.6	108
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.0	84.3	110
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	102	86.3	112
EG020F: Dissolved Metals by ICP-MS (QCLot: 3875630)								
EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	0.02 mg/L	107	83.2	119
EG020T: Total Metals by ICP-MS (QCLot: 3876727)								
EG020B-T: Silver	7440-22-4	0.001	mg/L	<0.001	0.02 mg/L	106	83.3	117
EG020T: Total Metals by ICP-MS (QCLot: 3876728)								
EG020A-T: Antimony	7440-36-0	0.001	mg/L	<0.001	0.02 mg/L	105	86.9	118
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	112	89.2	115
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	106	86.4	115
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	107	86.9	112
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	107	86.9	111
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	103	88.3	112
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	107	87.9	113
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	86.7	117
EG035F: Dissolved Mercury by FIMS (QCLot: 3875628)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.2	71.6	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3875765)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	85.3	73.4	119
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3865971)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	86.4	42.8	114
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	77.0	48.6	119
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	83.0	47.0	117
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	84.6	49.5	119
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	82.6	49.4	121
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	82.9	48.4	122

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3865971) - continued								
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	84.4	50.3	124
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	81.8	50.0	126
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	82.7	49.4	127
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	82.1	48.7	126
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	81.6	54.5	134
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	79.6	56.1	134
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	79.5	55.6	135
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	82.7	54.4	126
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	82.9	54.5	126
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	83.4	54.4	126
EP090: Organotin Compounds (Soluble) (QCLot: 3869418)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	115	30.7	134
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875986)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.222 µg/L	93.8	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.235 µg/L	83.0	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.228 µg/L	96.5	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	82.1	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.232 µg/L	92.6	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.241 µg/L	82.1	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875986)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	94.4	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	89.6	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	99.9	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	92.3	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	87.2	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	86.0	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	87.7	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	104	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	88.6	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	87.0	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.9375 µg/L	111	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875986)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	85.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	120	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	106	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	99.5	70.0	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	LCS: Spike Recovery (%)	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875986) - continued								
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	82.2	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	116	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	121	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875986)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.234 µg/L	83.0	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.238 µg/L	96.5	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.24 µg/L	109	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.242 µg/L	100	70.0	130
EP231P: PFAS Sums (QCLot: 3875986)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3874943)							
EM2116875-086	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	116	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	102	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	106	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	112	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	102	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	119	78.0	120
		EG005T: Zinc	7440-66-6	250 mg/kg	99.7	80.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3874942)							
EM2116875-086	Anonymous	EG035T: Mercury	7439-97-6	0.5 mg/kg	97.3	76.0	116
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3874925)							
EM2116795-002	QC203_210819	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	93.3	77.2	116
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	92.4	65.5	136
EP090: Organotin Compounds (QCLot: 3872514)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP090: Organotin Compounds (QCLot: 3872514) - continued							
EM2116795-002	QC203_210819	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	107	20.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00111 mg/kg	110	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00118 mg/kg	109	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00114 mg/kg	123	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00119 mg/kg	105	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00116 mg/kg	120	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00121 mg/kg	91.4	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	115	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	117	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	108	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	111	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	94.6	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	103	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	93.4	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	108	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	101	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	97.0	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00468 mg/kg	112	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	106	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	113	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	99.1	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	101	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	99.8	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	114	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	123	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00117 mg/kg	95.9	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00119 mg/kg	103	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0012 mg/kg	115	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00121 mg/kg	111	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3875629)							
EM2116795-003	QC601_210819	EG020A-F: Arsenic	7440-38-2	0.4 mg/L	111	76.6	124
		EG020A-F: Cadmium	7440-43-9	0.1 mg/L	96.9	74.6	118
		EG020A-F: Chromium	7440-47-3	0.4 mg/L	94.2	71.0	135
		EG020A-F: Copper	7440-50-8	0.4 mg/L	98.4	76.0	130
		EG020A-F: Lead	7439-92-1	0.4 mg/L	91.6	75.0	133
		EG020A-F: Nickel	7440-02-0	0.4 mg/L	100	73.0	131
		EG020A-F: Zinc	7440-66-6	0.4 mg/L	96.3	75.0	131
EG020T: Total Metals by ICP-MS (QCLot: 3876728)							
EM2116795-003	QC601_210819	EG020A-T: Arsenic	7440-38-2	1 mg/L	109	82.0	123
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	104	81.8	123
		EG020A-T: Chromium	7440-47-3	1 mg/L	106	78.9	119
		EG020A-T: Copper	7440-50-8	1 mg/L	107	80.4	118
		EG020A-T: Lead	7439-92-1	1 mg/L	109	80.5	121
		EG020A-T: Nickel	7440-02-0	1 mg/L	106	80.0	118
		EG020A-T: Zinc	7440-66-6	1 mg/L	104	74.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 3875628)							
EM2116900-010	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	95.5	70.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3875765)							
EM2116874-001	Anonymous	EG035T: Mercury	7439-97-6	0.1 mg/L	93.8	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875986)							
EM2116940-003	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.222 µg/L	101	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.235 µg/L	120	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.228 µg/L	121	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.238 µg/L	95.1	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.232 µg/L	111	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.241 µg/L	87.9	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875986)							
EM2116940-003	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	111	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	101	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	106	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	102	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	92.5	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	93.4	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	105	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	115	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	98.7	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	96.2	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.9375 µg/L	132	71.0	132

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875986)							
EM2116940-003	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	98.3	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	104	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	110	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	126	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	89.9	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	126	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	127	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875986)							
EM2116940-003	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.234 µg/L	97.9	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.238 µg/L	106	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.24 µg/L	113	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.242 µg/L	73.2	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2116795**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: M[redacted]	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 24-Aug-2021
Site	: ----	Issue Date	: 02-Sep-2021
Sampler	: BC	No. of samples received	: 4
Order number	: VIVA GEELONG OFFSHORE	No. of samples analysed	: 4

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

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP090: Organotin Compounds (Soluble)						
Amber Glass Bottle - Unpreserved						
QC601_210819	27-Aug-2021	26-Aug-2021	**1**	----	----	----

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)					
Organotin Compounds (Soluble)	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	0	14	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Organotin Compounds (Soluble)	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	0	14	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
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
QC202_210819,	QC203_210819	**19-Aug-2021**	**----**	----	----	**25-Aug-2021**	02-Sep-2021	✓
EA150: Particle Sizing								
Snap Lock Bag (EA150H)								
QC202_210819,	QC203_210819	**19-Aug-2021**	**----**	----	----	**31-Aug-2021**	15-Feb-2022	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H)								
QC202_210819,	QC203_210819	**19-Aug-2021**	**----**	----	----	**31-Aug-2021**	15-Feb-2022	✓
EA152: Soil Particle Density								
Snap Lock Bag (EA152)								
QC202_210819,	QC203_210819	**19-Aug-2021**	**----**	----	----	**31-Aug-2021**	15-Feb-2022	✓

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)							
QC202_210819, QC203_210819	**19-Aug-2021**	**01-Sep-2021**	15-Feb-2022	✓	**01-Sep-2021**	15-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
QC202_210819, QC203_210819	**19-Aug-2021**	**01-Sep-2021**	16-Sep-2021	✓	**01-Sep-2021**	16-Sep-2021	✓
EP003: Total Organic Carbon (TOC) in Soil							
Soil Glass Jar - Unpreserved (EP003)							
QC202_210819, QC203_210819	**19-Aug-2021**	**01-Sep-2021**	16-Sep-2021	✓	**01-Sep-2021**	16-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
QC202_210819, QC203_210819	**19-Aug-2021**	**31-Aug-2021**	02-Sep-2021	✓	**31-Aug-2021**	10-Oct-2021	✓
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090)							
QC202_210819, QC203_210819	**19-Aug-2021**	**30-Aug-2021**	02-Sep-2021	✓	**01-Sep-2021**	09-Oct-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
Soil Glass Jar - Unpreserved (EP231X)							
QC202_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
Soil Glass Jar - Unpreserved (EP231X)							
QC202_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
Soil Glass Jar - Unpreserved (EP231X)							
QC202_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
Soil Glass Jar - Unpreserved (EP231X)							
QC202_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231P: PFAS Sums							
Soil Glass Jar - Unpreserved (EP231X)							
QC202_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓

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 - Nitric Acid; Filtered (EG020B-F)							
QC601_210819	**19-Aug-2021**	**----**	----	----	**31-Aug-2021**	15-Feb-2022	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020B-T)							
QC601_210819	**19-Aug-2021**	**01-Sep-2021**	15-Feb-2022	✓	**01-Sep-2021**	15-Feb-2022	✓

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
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
QC601_210819	**19-Aug-2021**	**----**	----	----	**31-Aug-2021**	16-Sep-2021	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
QC601_210819	**19-Aug-2021**	**----**	----	----	**01-Sep-2021**	16-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
QC601_210819	**19-Aug-2021**	**25-Aug-2021**	26-Aug-2021	✓	**26-Aug-2021**	04-Oct-2021	✓
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved (EP090S)							
QC601_210819	**19-Aug-2021**	**27-Aug-2021**	26-Aug-2021	×	**27-Aug-2021**	06-Oct-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC601_210819, QC401_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	15-Feb-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QC601_210819, QC401_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	15-Feb-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
QC601_210819, QC401_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	15-Feb-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC601_210819, QC401_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	15-Feb-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QC601_210819, QC401_210819	**19-Aug-2021**	**31-Aug-2021**	15-Feb-2022	✓	**31-Aug-2021**	15-Feb-2022	✓

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	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	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
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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
Total Organic Carbon	EP003	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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

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	17	11.76	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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	3	66.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	0	3	0.00	10.00	×	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) - Continued							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	14	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**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-MS - Suite A	EG020A-T	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**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-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Compounds (Soluble)	EP090S	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**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-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite B	EG020B-T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**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
Organotin Compounds (Soluble)	EP090S	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	14	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**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-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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 Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
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 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 Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. 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 Schedule B(3)
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite B	EG020B-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.
Total Metals by ICP-MS - Suite B	EG020B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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 Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	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. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered 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 Schedule B(3).
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 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 Schedule B(3)
Organotin Compounds (Soluble)	EP090S	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

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 Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
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.

Preparation Methods	Method	Matrix	Method Descriptions
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Digestion for Total Recoverable Metals	EN25	WATER	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 Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 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 Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Organotin Sample Preparation	ORG34	WATER	In house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivitisated, extracted and the subtitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2116795**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	: [redacted]	Telephone	: [redacted]
Facsimile	: +61 03 9654 7117	Facsimile	: +61-3-8549 9626
Project	: Viva geelong offshore	Page	: 1 of 3
Order number	: ----	Quote number	: EM2021AECOMAU0004 (ME/386/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BC		

Dates

Date Samples Received	: 24-Aug-2021 16:50	Issue Date	: 25-Aug-2021
Client Requested Due Date	: 02-Sep-2021	Scheduled Reporting Date	: **02-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 1.5°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 4 / 4

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, ALS Newcastle and ALS Brisbane**
- **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 laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. 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.

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	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EG035T (solids) Total Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - EP090 (solids) Organotins	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EM2116795-001	19-Aug-2021 00:00	QC202_210819	✓	✓	✓	✓	✓	✓	✓
EM2116795-002	19-Aug-2021 00:00	QC203_210819	✓	✓	✓	✓	✓	✓	

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EG005T (solids) Total Metals by ICP-AES
EM2116795-001	19-Aug-2021 00:00	QC202_210819	✓
EM2116795-002	19-Aug-2021 00:00	QC203_210819	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - EG035F Dissolved Mercury	WATER - EG035T Total Mercury	WATER - EP090S Full Suite Organotins (Soluble) Full Suite	WATER - EP231X PFAS - Full Suite (28 analytes)
EM2116795-003	19-Aug-2021 00:00	QC601_210819	✓	✓	✓	✓	✓	✓
EM2116795-004	19-Aug-2021 00:00	QC401_210819						✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP075 SIM PAH only SIM - PAH only
EM2116795-003	19-Aug-2021 00:00	QC601_210819	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV) — Email — AP_CustomerService.ANZ@aecom.com

[redacted]

- *AU Certificate of Analysis - NATA (COA) — Email
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) — Email
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) — Email
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) — Email
- A4 - AU Tax Invoice (INV) — Email
- Chain of Custody (CoC) (COC) — Email
- EDI Format - ENMRG (ENMRG) — Email
- EDI Format - ESDAT (ESDAT) — Email

[redacted]

- *AU Certificate of Analysis - NATA (COA) — Email
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) — Email
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) — Email
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) — Email
- Chain of Custody (CoC) (COC) — Email
- EDI Format - ENMRG (ENMRG) — Email
- EDI Format - ESDAT (ESDAT) — Email

[redacted]

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 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@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@alsglobal.com

CLIENT: AECOM	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	X Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY: (Circle)** Custody Seal Intact? Yes / No / N/A
OFFICE: Melbourne		☐ Non Standard or urgent TAT **(List due date):**	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
PROJECT: Viva Geelong Offshore	**ALS QUOTE NO.:** ME/386/21 V2	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
ORDER NUMBER:		OF: 1 2 3 4 5 6 7	Other comment:
PROJECT MANAGER: [redacted]	**CONTACT PH:**		
SAMPLER: BC	**SAMPLER MOBILE:** [redacted]	**RELINQUISHED BY:**	**RECEIVED BY:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):** Esdat		
Email Reports to (will default to PM if no other addresses are listed): [redacted]		DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): [redacted]		**RELINQUISHED BY:** DATE/TIME:	**RECEIVED BY:** DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS (MATRIX: SOLID (S) WATER (W))			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Total Hg EG035T	TBT EP090	Metals EG005T (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn)	TOC EP003	SIM-PAH Only EP075 SIM PAH only	Particle Sizing with Hydrometer + Soil Particle Density EA150H/EA152	PFAS Full Suite EP231		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	QC204_210826		Sed			x	x	x	x	x	x	x		
2.	QC403 TRIP BLANK		W		2									

Environmental Division
Melbourne
Work Order Reference
EM2117075

Telephone : + 61-3-8549 9600

Received: 27/8, 12:15 Carrier:
C/note:
Temp: 2.2 °C Seal: Y N
Ice / Icebricks / N/A

ALS

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.

[redacted]

From: [redacted]
Sent: Thursday, 26 August 2021 5:22 PM
To: COC Melbourne
Subject: AECOM - ME/386/21 V2 - Incoming Esky from Geelong - 27/8
Attachments: ALS CoC_Sediment_Sent_26Aug.xls

[redacted]

Client Services – Springvale

Environmental

[redacted]

2-4 Westall Rd
Springvale Vic 3171
Australia

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From: [redacted]
Sent: Thursday, 26 August 2021 5:11 PM
To: [redacted]
Cc: [redacted]
Subject: [EXTERNAL] - RE: ME/386/21 V2: eCOC

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

[redacted]

Please find attached the eCOC for samples to be picked up tomorrow.

Thanks,

[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

Delivering a better world

From: [redacted]
Sent: Thursday, 26 August 2021 3:30 PM
To: [redacted]
Cc: [redacted]
Subject: ME/386/21 V2: Sample Pickup

[redacted]

Will you please arrange for pickup of 1 esky for tomorrow morning?
Admiralty Inn
66 McKillop St, Geelong VIC 3220

I'll send an eCOC separately.

Thanks,

[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

Delivering a better world

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2117075**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 27-Aug-2021 12:15
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 30-Aug-2021
C-O-C number	: ----	Issue Date	: 03-Sep-2021 16:18
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 2		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. 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*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP231X: Sample (EM2117055-013) required dilution due to matrix interferences. LOR values have been adjusted accordingly.
- 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.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- An additional water sample "QC403 TRIP BLANK" was received in non-ALS containers. This sample will be placed on hold until further analysis is received.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC204_210826	----	----	----	----
			Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2117075-001	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**33.2**	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	**10**	----	----	----	----
+150µm	----	1	%	**7**	----	----	----	----
+300µm	----	1	%	**6**	----	----	----	----
+425µm	----	1	%	**5**	----	----	----	----
+600µm	----	1	%	**5**	----	----	----	----
+1180µm	----	1	%	**4**	----	----	----	----
+2.36mm	----	1	%	**3**	----	----	----	----
+4.75mm	----	1	%	**2**	----	----	----	----
+9.5mm	----	1	%	<1	----	----	----	----
+19.0mm	----	1	%	<1	----	----	----	----
+37.5mm	----	1	%	<1	----	----	----	----
+75.0mm	----	1	%	<1	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	**74**	----	----	----	----
Silt (2-60 µm)	----	1	%	**13**	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	**10**	----	----	----	----
Gravel (>2mm)	----	1	%	**3**	----	----	----	----
Cobbles (>6cm)	----	1	%	<1	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	**2.78**	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	**9**	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**36**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**13**	----	----	----	----
Lead	7439-92-1	5	mg/kg	<5	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**38**	----	----	----	----
Silver	7440-22-4	2	mg/kg	<2	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**15**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC204_210826	----	----	----	----
				Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117075-001	--------	--------	--------	--------
					Result	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.15**	----	----	----	----
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	----	----	----	----
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**	----	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	----	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		<1	----	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC204_210826	----	----	----	----
			Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2117075-001	--------	--------	--------	--------
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC204_210826	----	----	----	----
				Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117075-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		<0.0002	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		<0.0002	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**105**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%		**111**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		**118**	----	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**108**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**96.5**	----	----	----	----
13C8-PFOA	----	0.0002	%		**92.2**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC403 TRIP BLANK	----	----	----	----
				Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117075-002	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC403 TRIP BLANK	----	----	----	----
				Sampling date / time	26-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117075-002	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**110**	----	----	----	----
13C8-PFOA	----	0.02	%		**116**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
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
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	68	136
13C8-PFOA	----	69	133

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA150: Particle Sizing

(SOIL) EA152: Soil Particle Density

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2117075**	Page	: 1 of 13
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: M[redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 27-Aug-2021
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 30-Aug-2021
C-O-C number	: ----	Issue Date	: 03-Sep-2021
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 2		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. 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*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3877222)									
EM2117081-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	32	34	6.6	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	18	22	18.9	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	10	12	12.9	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	28	24	14.7	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	25	27	6.5	No Limit
EM2117120-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	37	39	5.6	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	9	10	10.3	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	7	25.3	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	5	6	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	17	17	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	27	28	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3872882)									
EM2117075-001	QC204_210826	EA055: Moisture Content	----	0.1	%	33.2	33.2	0.0	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3877221)									
EM2117081-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EM2117120-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3876903)									
EM2117075-001	QC204_210826	EP003: Total Organic Carbon	----	0.02	%	0.15	0.15	0.0	No Limit
ES2131372-007	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.04	0.03	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3875082)									
EM2117051-027	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EM2117051-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3875878)									
EM2117075-001	QC204_210826	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP090: Organotin Compounds (QC Lot: 3875878) - continued									
EM2117075-001	QC204_210826	EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3875932)									
EM2116795-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3875932)									
EM2116795-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875932)									
EM2116795-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3875932) - continued									
EM2116795-001	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3875932)									
EM2116795-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117074-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3875932) - continued									
EM2117074-001	Anonymous	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3875932)									
EM2116795-001	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EM2117074-001	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3876847)									
EM2117055-012	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3876847)									
EM2117055-012	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3876847)									
EM2117055-012	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3876847) - continued									
EM2117055-012	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3876847)									
EM2117055-012	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3876847)									
EM2117055-012	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (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 (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3877222)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	91.7	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	90.4	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	54.7	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	95.6	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	87.3	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	84.6	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	90.6	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	75.8	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	70.2	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3877221)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	86.7	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3876903)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.11 %	114	70.0	130
				<0.02	0.2 %	101	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3875082)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	94.1	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	93.9	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	94.0	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	85.0	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	89.3	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	95.5	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	90.0	78.3	124
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	92.6	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	89.3	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	96.5	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	93.6	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	84.8	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	99.9	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	78.9	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	82.1	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	85.5	65.8	127
EP090: Organotin Compounds (QCLot: 3875878)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	94.3	36.0	128

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP090: Organotin Compounds (QCLot: 3875878) - continued								
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	86.0	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	105	52.0	139
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875932)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00111 mg/kg	104	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	86.4	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0014 mg/kg	82.4	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	89.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	96.7	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00121 mg/kg	91.1	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875932)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	111	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.2	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.7	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.5	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.7	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00468 mg/kg	106	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875932)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	95.9	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	105	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	103	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	135	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875932)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00117 mg/kg	95.1	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00119 mg/kg	103	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.0012 mg/kg	121	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00121 mg/kg	116	70.0	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231P: PFAS Sums (QCLot: 3875932)								
EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3876847)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.222 µg/L	106	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.235 µg/L	100	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.228 µg/L	104	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	93.2	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.232 µg/L	102	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.241 µg/L	92.5	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3876847)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	100	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	107	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	102	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	99.7	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	94.0	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	93.3	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	96.6	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	102	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	98.9	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	97.3	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.9375 µg/L	106	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3876847)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	95.3	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	123	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	108	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	105	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	103	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	128	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	121	61.0	135

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3876847)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.234 µg/L	97.5	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.238 µg/L	102	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.24 µg/L	109	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.242 µg/L	92.9	70.0	130
EP231P: PFAS Sums (QCLot: 3876847)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3877222)							
EM2117081-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	89.8	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	92.8	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	90.4	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	94.7	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	92.4	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	96.4	78.0	120
		EG005T: Zinc	7440-66-6	250 mg/kg	89.6	80.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3877221)							
EM2117081-001	Anonymous	EG035T: Mercury	7439-97-6	0.5 mg/kg	94.8	76.0	116
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3875082)							
EM2117051-004	Anonymous	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	89.7	77.2	116
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	93.6	65.5	136
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00111 mg/kg	110	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00118 mg/kg	109	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00114 mg/kg	123	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00119 mg/kg	105	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00116 mg/kg	120	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00121 mg/kg	91.4	59.0	134

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	115	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	117	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	108	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	111	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	94.6	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	103	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	93.4	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	108	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	101	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	97.0	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00468 mg/kg	112	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	106	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	113	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	99.1	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	101	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	99.8	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	114	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	123	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3875932)							
EM2116982-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00117 mg/kg	95.9	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00119 mg/kg	103	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0012 mg/kg	115	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00121 mg/kg	111	70.0	130

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3876847)							
EM2117055-013	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.222 µg/L	114	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.235 µg/L	98.3	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.228 µg/L	105	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.238 µg/L	96.0	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.232 µg/L	105	65.0	140

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3876847) - continued							
EM2117055-013	Anonymous	EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.241 µg/L	# 52.4	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3876847)							
EM2117055-013	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	100	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	102	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	102	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	100	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	95.5	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	93.9	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	97.4	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	101	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	95.2	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	112	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.9375 µg/L	108	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3876847)							
EM2117055-013	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	93.4	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	95.9	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	105	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	106	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	98.9	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	135	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	116	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3876847)							
EM2117055-013	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.234 µg/L	94.8	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.238 µg/L	101	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.24 µg/L	109	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.242 µg/L	# 67.6	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2117075**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 27-Aug-2021
Site	: ----	Issue Date	: 03-Sep-2021
Sampler	: BC	No. of samples received	: 2
Order number	: Viva Geelong Offshore	No. of samples analysed	: 2

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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **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.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117055--013	Anonymous	**Perfluorodecane sulfonic acid (PFDS)**	335-77-3	52.4 %	53.0-142%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EM2117055--013	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	67.6 %	70.0-130%	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Organotin Analysis	0	1	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
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
QC204_210826	**26-Aug-2021**	**----**	----	----	**30-Aug-2021**	09-Sep-2021	✓
EA150: Particle Sizing							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
QC204_210826	**26-Aug-2021**	**----**	----	----	**03-Sep-2021**	22-Feb-2022	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
QC204_210826	**26-Aug-2021**	**----**	----	----	**03-Sep-2021**	22-Feb-2022	✓
EA152: Soil Particle Density							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152)							
QC204_210826	**26-Aug-2021**	**----**	----	----	**03-Sep-2021**	22-Feb-2022	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
QC204_210826	**26-Aug-2021**	**02-Sep-2021**	22-Feb-2022	✓	**02-Sep-2021**	22-Feb-2022	✓

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
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
QC204_210826	**26-Aug-2021**	**02-Sep-2021**	23-Sep-2021	✓	**02-Sep-2021**	23-Sep-2021	✓
EP003: Total Organic Carbon (TOC) in Soil							
Soil Glass Jar - Unpreserved (EP003)							
QC204_210826	**26-Aug-2021**	**01-Sep-2021**	23-Sep-2021	✓	**01-Sep-2021**	23-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	09-Sep-2021	✓	**01-Sep-2021**	10-Oct-2021	✓
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090)							
QC204_210826	**26-Aug-2021**	**01-Sep-2021**	09-Sep-2021	✓	**02-Sep-2021**	11-Oct-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	22-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	22-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	22-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	22-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)							
QC204_210826	**26-Aug-2021**	**31-Aug-2021**	22-Feb-2022	✓	**31-Aug-2021**	10-Oct-2021	✓

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
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC403 TRIP BLANK	**26-Aug-2021**	**01-Sep-2021**	22-Feb-2022	✓	**01-Sep-2021**	22-Feb-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QC403 TRIP BLANK	**26-Aug-2021**	**01-Sep-2021**	22-Feb-2022	✓	**01-Sep-2021**	22-Feb-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
QC403 TRIP BLANK	**26-Aug-2021**	**01-Sep-2021**	22-Feb-2022	✓	**01-Sep-2021**	22-Feb-2022	✓

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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC403 TRIP BLANK	**26-Aug-2021**	**01-Sep-2021**	22-Feb-2022	✓	**01-Sep-2021**	22-Feb-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QC403 TRIP BLANK	**26-Aug-2021**	**01-Sep-2021**	22-Feb-2022	✓	**01-Sep-2021**	22-Feb-2022	✓

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	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	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
Total Organic Carbon	EP003	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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
Total Organic Carbon	EP003	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organotin Analysis	EP090	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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
Total Organic Carbon	EP003	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organotin Analysis	EP090	0	1	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	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

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)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

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*	
Method Blanks (MB) - Continued							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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 Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
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 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 Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. 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 Schedule B(3)
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions

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 Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
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.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EM2117075**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	[redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	:	Telephone	:
Facsimile	:	Facsimile	:
Project	: Viva geelong offshore	Page	: 1 of 3
Order number	: ----	Quote number	: EM2021AECOMAU0004 (ME/386/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BC		

Dates

Date Samples Received	: 27-Aug-2021 12:15	Issue Date	: 30-Aug-2021
Client Requested Due Date	: 03-Sep-2021	Scheduled Reporting Date	: **03-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 2.2°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

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 laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- An additional water sample "QC403 TRIP BLANK" was received in non-ALS containers. This sample will be placed on hold until further analysis is received.
- 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.

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	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG035T (solids) Total Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - EP090 (solids) Organotins
EM2117075-001	26-Aug-2021 00:00	QC204_210826	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EM2117075-001	26-Aug-2021 00:00	QC204_210826	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)
EM2117075-002	26-Aug-2021 00:00	QC403 TRIP BLANK	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- A4 - AU Tax Invoice (INV)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	

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 7209 7200 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 24 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
NEWCASTLE 6/468 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@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@alsglobal.com

CLIENT: AECOM	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): 2-day TAT
OFFICE: Melbourne	
PROJECT: Viva Geelong Offshore	ALS QUOTE NO.: ME/386/21 V2
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
PROJECT MANAGER: [redacted]	CONTACT PH:
SAMPLER: BC	SAMPLER MOBILE: [redacted]
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): Esdat
Email Reports to (will default to PM if no other addresses are listed): [redacted]	
Email Invoice to (will default to PM if no other addresses are listed): [redacted]	
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:	

FOR LABORATORY USE ONLY (Circle)			
Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
AECOM Brad Coad			
DATE/TIME: 31/08/21	DATE/TIME:	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	P-30/1 EPA 1828.2 Table 2 Solid Suite							Hold	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	QC207_210830		S	2x Soil Jar 1x PFAS soil	3								Hold	
	QC209_210830		S	" " " "	3								X	
	QC209_210831		S	" " " "	3								X	
	QC407_210930		W	2x PFAS	2								X	
													X	

[redacted]

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.

Environmental Division
Melbourne
Work Order Reference
EM2117375

Telephone : +61-3-8549 9600

Received: 1/9/21 Carrier: Courier
C/note:
Temp: 4.7 °C Seal: Y / N
Ice / Icebricks / NA
Tamra

SAMPLES

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 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@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@alsglobal.com

CLIENT: AECOM	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	X Standard TAT **(List due date):** ☐ Non Standard or urgent TAT **(List due date):**
OFFICE: Melbourne		
PROJECT: Viva Geelong Offshore	**ALS QUOTE NO.:** ME/386/21 V2	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:		
PROJECT MANAGER: [redacted]	**CONTACT PH:**	
SAMPLER: BC	**SAMPLER MOBILE:** [redacted]	
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):** Esdat	
Email Reports to (will default to PM if no other addresses are listed): [redacted]		
Email Invoice to (will default to PM if no other addresses are listed): [redacted]		

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt	°C		
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS (MATRIX: SOLID (S) WATER (W))			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Total Hg EG035T	TBT EP090	Metals EG005T (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn)	TOC EP003	SIM-PAH Only EP075 SIM PAH only	Particle Sizing with Hydrometer + Soil Particle Density EA150H/EA152	PFAS Full Suite EP231		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	QC207_210830		Sed			x	x	x	x	x	x	x		
2	QC208_210830		Sed			x	x	x	x	x	x	x		
3	QC209_210831		Sed			x	x	x	x	x	x	x		
4	QC407_210830		Water									x		
[redacted]														

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.

[redacted]

From: [redacted]
Sent: Thursday, September 2, 2021 9:13 AM
To: [redacted]
Subject: [EXTERNAL] - RE: On Hold - EM2117375 - AECOMAU (Viva Geelong Offshore)
Attachments: ALS CoC_Sediment_Sent_02Sep.xls

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

[redacted]

Please see the attached COC for these samples.

Thanks,

[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

Delivering a better world

From: [redacted]
Sent: Thursday, 2 September 2021 8:38 AM
To: [redacted]
Subject: [EXTERNAL] On Hold - EM2117375 - AECOMAU (Viva Geelong Offshore)

[redacted]

Just confirming that the attached samples are to remain on hold

Thanks

[redacted]

Client Services – Springvale

Environmental

[redacted]

2-4 Westall Rd
Springvale Vic 3171
Australia

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EnviroMail™ 135 – New Analytical Suites to meet EPA Victoria 1828.2 Guideline

ALSCompass
SAMPLING *Intelligence*

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www.alsglobal.com

[redacted]

From: [redacted]
Sent: Thursday, 2 September 2021 1:46 PM
To: [redacted]
Cc:
Subject: RE: [EXTERNAL] SRN for ALS Workorder : EM2117375 | Overall Description: Viva Geelong Offshore

[redacted]

Will you please cancel the particle sizing and density for these samples?
EM2117375-001 (QC207_210830)
EM2117375-002 (QC208_210830)

Thank you.

[redacted]

AECOM
Collins Square, Level 10, Tower Two
727 Collins Street, Melbourne, VIC 3008
T +61 3 9653 1234
aecom.com

Delivering a better world

From: angel-no-reply@alsglobal.com <angel-no-reply@alsglobal.com>
Sent: Thursday, 2 September 2021 12:37 PM
To: [redacted]
Subject: [EXTERNAL] SRN for ALS Workorder : EM2117375 | Overall Description: Viva Geelong Offshore

Deliverables for ALS Workorder EM2117375

Project: Viva geelong offshore

Overall Description: Viva Geelong Offshore

[redacted]

Please find enclosed the following deliverables for **EM2117375**:

- EM2117375_0_SRN_210902123657.pdf
- EM2117375_COC.pdf
- EM2117375_COC_1.pdf

Report Recipients

- [redacted]
  - EM2117375_0_SRN_210902123657.pdf (Email)
  - EM2117375_COC.pdf (Email)
  - EM2117375_COC_1.pdf (Email)
- [redacted]
  - EM2117375_0_SRN_210902123657
  - EM2117375_COC
  - EM2117375_COC_1

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2117375**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 01-Sep-2021 11:25
Order number	: Viva Geelong offshore	Date Analysis Commenced	: 03-Sep-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021 17:34
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 4		

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, unless the sampling was conducted by ALS. 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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Sarah Ashworth	Laboratory Manager - Brisbane	Brisbane Organics, Stafford, QLD
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP090 - Organotins: Sample 'QC208_210830' shows poor matrix spike recovery for MBT due to matrix interference.
- Samples 1 and 2 are high in moisture and require airdrying
- 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.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP231X: Poor matrix spike recovery for sample EM2117173-046 due to sample matrix interference. Confirmed by re-analysis.
- EG005T: EM2117303 #1 Poor duplicate precision for Barium due to sample heterogeneity. Confirmed by re-extraction and re-analysis. The results observed are as follows: 3980 mg/kg, 2390 mg/kg, 2540 mg/kg, and 1930 mg/kg
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC207_210830	QC208_210830	QC209_210831	----	----
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	31-Aug-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117375-001	EM2117375-002	EM2117375-003	--------	--------
				Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	3.4	2.4	32.8	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	31	----	----
+150µm	----	1	%	----	----	27	----	----
+300µm	----	1	%	----	----	22	----	----
+425µm	----	1	%	----	----	18	----	----
+600µm	----	1	%	----	----	14	----	----
+1180µm	----	1	%	----	----	7	----	----
+2.36mm	----	1	%	----	----	3	----	----
+4.75mm	----	1	%	----	----	<1	----	----
+9.5mm	----	1	%	----	----	<1	----	----
+19.0mm	----	1	%	----	----	<1	----	----
+37.5mm	----	1	%	----	----	<1	----	----
+75.0mm	----	1	%	----	----	<1	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	49	----	----
Silt (2-60 µm)	----	1	%	----	----	17	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	30	----	----
Gravel (>2mm)	----	1	%	----	----	4	----	----
Cobbles (>6cm)	----	1	%	----	----	<1	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	2.73	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg	18	17	29	----	----
Cadmium	7440-43-9	1	mg/kg	<1	1	<1	----	----
Chromium	7440-47-3	2	mg/kg	53	55	58	----	----
Copper	7440-50-8	5	mg/kg	12	19	9	----	----
Lead	7439-92-1	5	mg/kg	39	80	9	----	----
Nickel	7440-02-0	2	mg/kg	27	31	39	----	----
Silver	7440-22-4	2	mg/kg	<2	<2	<2	----	----
Zinc	7440-66-6	5	mg/kg	58	88	31	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.1	0.3	<0.1	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC207_210830	QC208_210830	QC209_210831	----	----
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	31-Aug-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117375-001	EM2117375-002	EM2117375-003	--------	--------
				Result	Result	Result	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.84**	**1.12**	**0.20**	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg	<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	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	----	----
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC207_210830	QC208_210830	QC209_210831	----	----
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	31-Aug-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117375-001	EM2117375-002	EM2117375-003	--------	--------
				Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC207_210830	QC208_210830	QC209_210831	----	----
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	31-Aug-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117375-001	EM2117375-002	EM2117375-003	--------	--------
				Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**78.9**	**79.4**	**78.0**	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**75.5**	**77.5**	**83.4**	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**46.7**	**61.3**	**51.1**	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**90.5**	**92.8**	**88.3**	----	----
Anthracene-d10	1719-06-8	0.5	%	**107**	**110**	**122**	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	**95.4**	**91.9**	**100**	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**106**	**91.7**	**108**	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**91.5**	**104**	**87.2**	----	----
13C8-PFOA	----	0.0002	%	**92.2**	**84.0**	**104**	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC407_210830	----	----	----	----
				Sampling date / time	30-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117375-004	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC407_210830	----	----	----	----
				Sampling date / time	30-Aug-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117375-004	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**101**	----	----	----	----
13C8-PFOA	----	0.02	%		**98.8**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: SEDIMENT		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
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	68	136
13C8-PFOA	----	69	133

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA150: Particle Sizing

(SOIL) EA152: Soil Particle Density

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2117375**	Page	: 1 of 16
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 01-Sep-2021
Order number	: Viva Geelong offshore	Date Analysis Commenced	: 03-Sep-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 4		

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, unless the sampling was conducted by ALS. 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.

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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3883722)									
EM2117375-001	QC207_210830	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	53	50	5.0	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	27	26	4.0	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	18	16	9.6	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	12	12	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	39	40	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	58	59	1.8	0% - 50%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3887265)									
EM2117303-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	17	15	10.2	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	22	22	0.0	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	28	16	51.8	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	29	27	6.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	21	22	0.0	No Limit
EM2117497-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	32	32	0.0	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	15	15	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3887265) - continued									
EM2117497-001	Anonymous	EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	17	17	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	90	98	8.8	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3883720)									
EM2117375-001	QC207_210830	EA055: Moisture Content	----	0.1	%	3.4	3.7	8.0	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3885033)									
EM2117366-036	Anonymous	EA055: Moisture Content	----	0.1	%	19.3	20.3	4.7	0% - 20%
EM2117460-001	Anonymous	EA055: Moisture Content	----	0.1	%	17.2	17.0	0.9	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3883721)									
EM2117375-001	QC207_210830	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.1	0.2	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3887266)									
EM2117303-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EM2117497-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3893243)									
EB2124632-003	Anonymous	EP003: Total Organic Carbon	----	0.02	%	2.06	2.06	0.0	0% - 20%
EB2125252-003	Anonymous	EP003: Total Organic Carbon	----	0.02	%	50.2	49.8	0.9	0% - 20%
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3883723)									
EM2117375-001	QC207_210830	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3883884)									
EM2117303-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3883884) - continued									
EM2117303-001	Anonymous	EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3884615)									
EM2117375-001	QC207_210830	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3884058)									
EM2117173-039	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0024	0.0022	12.4	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0015	0.0027	56.3	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0109	0.0130	17.9	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0007	0.0008	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0258	0.0303	16.1	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
EM2117412-004	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0003	0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3884058)									
EM2117173-039	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0014	0.0015	7.3	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0058	0.0062	6.5	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0004	0.0008	52.8	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0008	0.0013	48.6	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3884058) - continued									
EM2117173-039	Anonymous	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0010	<0.0009	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.002	<0.002	0.0	No Limit
EM2117412-004	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3884058)									
EM2117173-039	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0004	<0.0004	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0010	<0.0009	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0010	<0.0009	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0010	<0.0009	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0010	<0.0009	0.0	No Limit
EM2117412-004	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3884058)									
EM2117173-039	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117412-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3884058)									
EM2117173-039	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	0.0497	0.0588	16.8	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0367	0.0433	16.5	0% - 20%
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0475	0.0553	15.2	0% - 20%
EM2117412-004	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	0.0003	0.0002	40.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0003	0.0002	40.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0003	0.0002	40.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3889502)									
EM2117375-004	QC407_210830	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EM2117469-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.04	0.04	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3889502)									
EM2117375-004	QC407_210830	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EM2117469-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.04	0.04	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3889502)									
EM2117375-004	QC407_210830	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EM2117469-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3889502) - continued									
EM2117469-001	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3889502)									
EM2117375-004	QC407_210830	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EM2117469-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3889502)									
EM2117375-004	QC407_210830	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
EM2117469-001	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.08	0.10	22.2	0% - 50%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.04	0.06	40.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	0.08	0.10	22.2	0% - 50%

Method Blank (MB) and Laboratory Control Sample (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 Sample (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 (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3883722)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	70.3	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	101	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	63.1	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	109	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	123	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	93.4	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	101	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	86.2	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	78.9	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3887265)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	89.9	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	95.2	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	65.2	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	113	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	89.8	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	91.4	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	109	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	76.5	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	76.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3883721)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	98.4	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3887266)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	93.8	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3893243)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	1.03 %	98.2	70.0	130
				<0.02	0.2 %	110	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3883723)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	106	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	108	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	111	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	104	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	109	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	109	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	109	78.3	124

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3883723) - continued								
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	109	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	104	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	107	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	104	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	102	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	114	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	103	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	106	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	108	65.8	127
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3883884)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	95.5	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	106	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	103	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	96.2	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	97.7	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	102	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	98.9	78.3	124
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	100	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	94.0	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	102	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	87.3	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	99.7	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	94.7	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	80.5	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	82.0	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	83.8	65.8	127
EP090: Organotin Compounds (QCLot: 3884615)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	73.2	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	76.9	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	107	52.0	139
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3884058)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00111 mg/kg	102	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	74.2	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0014 mg/kg	74.2	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	90.2	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	88.0	68.0	136

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3884058) - continued								
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00121 mg/kg	89.6	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3884058)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	90.0	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.1	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.4	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.2	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.7	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.2	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	86.4	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.7	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	81.4	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00468 mg/kg	94.2	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3884058)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	86.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	92.8	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	83.4	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	83.2	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	89.7	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	115	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	120	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3884058)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00117 mg/kg	88.1	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00119 mg/kg	90.4	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.0012 mg/kg	82.8	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00121 mg/kg	# 67.8	70.0	130
EP231P: PFAS Sums (QCLot: 3884058)								
EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3889502)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.222 µg/L	111	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.235 µg/L	107	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.228 µg/L	109	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	99.1	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.232 µg/L	109	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.241 µg/L	95.1	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3889502)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	113	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	114	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	109	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	98.2	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	102	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	106	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	108	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	103	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	100	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.9375 µg/L	122	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3889502)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	104	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	112	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	116	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	116	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	107	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	129	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	116	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3889502)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.234 µg/L	103	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.238 µg/L	108	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.24 µg/L	119	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.242 µg/L	83.8	70.0	130
EP231P: PFAS Sums (QCLot: 3889502)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231P: PFAS Sums (QCLot: 3889502) - continued								
EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3883722)							
EM2117375-002	QC208_210830	EG005T: Arsenic	7440-38-2	50 mg/kg	98.1	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	96.0	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	93.8	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	102	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	98.9	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	95.8	78.0	120
		EG005T: Zinc	7440-66-6	250 mg/kg	92.7	80.0	120
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3887265)							
EM2117303-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	81.8	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	92.9	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	101	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	94.8	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	91.5	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	90.8	78.0	120
		EG005T: Zinc	7440-66-6	250 mg/kg	88.7	80.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3883721)							
EM2117375-002	QC208_210830	EG035T: Mercury	7439-97-6	0.5 mg/kg	84.2	76.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3887266)							
EM2117303-002	Anonymous	EG035T: Mercury	7439-97-6	0.5 mg/kg	99.6	76.0	116
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3883723)							
EM2117375-002	QC208_210830	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	93.0	77.2	116
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	93.1	65.5	136
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3883884)							
EM2117303-002	Anonymous	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	98.8	77.2	116
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	102	65.5	136
EP090: Organotin Compounds (QCLot: 3884615)							
EM2117375-002	QC208_210830	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 13.0	20.0	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP090: Organotin Compounds (QCLot: 3884615) - continued							
EM2117375-002	QC208_210830	EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	74.1	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	100	20.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3884058)							
EM2117173-046	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00111 mg/kg	74.2	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00118 mg/kg	108	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00114 mg/kg	# 146	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00119 mg/kg	131	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00116 mg/kg	# Not Determined	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00121 mg/kg	# 32.2	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3884058)							
EM2117173-046	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	90.7	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	115	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	118	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	93.4	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	99.4	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	94.2	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	91.6	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	89.4	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# 137	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	# 194	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00468 mg/kg	127	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3884058)							
EM2117173-046	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	# 34.7	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	98.0	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	92.0	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	125	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	85.6	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	78.0	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	# Not Determined	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3884058)							
EM2117173-046	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00117 mg/kg	81.0	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00119 mg/kg	97.3	64.0	140

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3884058) - continued							
EM2117173-046	Anonymous	EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0012 mg/kg	91.2	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00121 mg/kg	# 34.1	70.0	130

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3889502)							
EM2117469-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.222 µg/L	110	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.235 µg/L	101	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.228 µg/L	107	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.238 µg/L	102	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.232 µg/L	102	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.241 µg/L	89.3	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3889502)							
EM2117469-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	117	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	111	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	104	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	109	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	97.4	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	99.3	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	105	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	109	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	104	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	90.7	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.9375 µg/L	122	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3889502)							
EM2117469-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	102	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	113	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	114	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	120	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	112	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	132	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	135	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3889502)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3889502) - continued							
EM2117469-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.234 µg/L	102	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.238 µg/L	112	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.24 µg/L	122	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.242 µg/L	76.8	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2117375**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 01-Sep-2021
Site	: ----	Issue Date	: 13-Sep-2021
Sampler	: BC	No. of samples received	: 4
Order number	: Viva Geelong offshore	No. of samples analysed	: 4

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.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **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.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	QC-3884058-001	----	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	67.8 %	70.0-130%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	EM2117375--002	QC208_210830	**Monobutyltin**	78763-54-9	13.0 %	20.0-130%	**Recovery less than lower data quality objective**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117173--046	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	146 %	67.0-130%	**Recovery greater than upper data quality objective**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117173--046	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117173--046	Anonymous	**Perfluorodecane sulfonic acid (PFDS)**	335-77-3	32.2 %	59.0-134%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117173--046	Anonymous	**Perfluorododecanoic acid (PFDoDA)**	307-55-1	137 %	69.0-135%	**Recovery greater than upper data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117173--046	Anonymous	**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	194 %	66.0-139%	**Recovery greater than upper data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EM2117173--046	Anonymous	**Perfluorooctane sulfonamide (FOSA)**	754-91-6	34.7 %	67.0-137%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EM2117173--046	Anonymous	**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EM2117173--046	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	34.1 %	70.0-130%	**Recovery less than lower data quality objective**

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

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) QC207_210830, QC208_210830	**30-Aug-2021**	**----**	----	----	**03-Sep-2021**	13-Sep-2021	✓
Soil Glass Jar - Unpreserved (EA055) QC209_210831	**31-Aug-2021**	**----**	----	----	**06-Sep-2021**	14-Sep-2021	✓
EA150: Particle Sizing							
Snap Lock Bag (EA150H) QC209_210831	**31-Aug-2021**	**----**	----	----	**10-Sep-2021**	27-Feb-2022	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H) QC209_210831	**31-Aug-2021**	**----**	----	----	**10-Sep-2021**	27-Feb-2022	✓
EA152: Soil Particle Density							
Snap Lock Bag (EA152) QC209_210831	**31-Aug-2021**	**----**	----	----	**10-Sep-2021**	27-Feb-2022	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) QC207_210830, QC208_210830	**30-Aug-2021**	**07-Sep-2021**	26-Feb-2022	✓	**07-Sep-2021**	26-Feb-2022	✓
Soil Glass Jar - Unpreserved (EG005T) QC209_210831	**31-Aug-2021**	**07-Sep-2021**	27-Feb-2022	✓	**07-Sep-2021**	27-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) QC207_210830, QC208_210830	**30-Aug-2021**	**07-Sep-2021**	27-Sep-2021	✓	**07-Sep-2021**	27-Sep-2021	✓
Soil Glass Jar - Unpreserved (EG035T) QC209_210831	**31-Aug-2021**	**07-Sep-2021**	28-Sep-2021	✓	**08-Sep-2021**	28-Sep-2021	✓
EP003: Total Organic Carbon (TOC) in Soil							
Soil Glass Jar - Unpreserved (EP003) QC207_210830, QC208_210830	**30-Aug-2021**	**09-Sep-2021**	27-Sep-2021	✓	**09-Sep-2021**	27-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP003) QC209_210831	**31-Aug-2021**	**09-Sep-2021**	28-Sep-2021	✓	**09-Sep-2021**	28-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) QC207_210830, QC208_210830	**30-Aug-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP075(SIM)) QC209_210831	**31-Aug-2021**	**06-Sep-2021**	14-Sep-2021	✓	**07-Sep-2021**	16-Oct-2021	✓
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090) QC207_210830, QC208_210830	**30-Aug-2021**	**08-Sep-2021**	13-Sep-2021	✓	**10-Sep-2021**	18-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP090) QC209_210831	**31-Aug-2021**	**08-Sep-2021**	14-Sep-2021	✓	**10-Sep-2021**	18-Oct-2021	✓

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
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC207_210830, QC208_210830	**30-Aug-2021**	**04-Sep-2021**	26-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
HDPE Soil Jar (EP231X) QC209_210831	**31-Aug-2021**	**04-Sep-2021**	27-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC207_210830, QC208_210830	**30-Aug-2021**	**04-Sep-2021**	26-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
HDPE Soil Jar (EP231X) QC209_210831	**31-Aug-2021**	**04-Sep-2021**	27-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) QC207_210830, QC208_210830	**30-Aug-2021**	**04-Sep-2021**	26-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
HDPE Soil Jar (EP231X) QC209_210831	**31-Aug-2021**	**04-Sep-2021**	27-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC207_210830, QC208_210830	**30-Aug-2021**	**04-Sep-2021**	26-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
HDPE Soil Jar (EP231X) QC209_210831	**31-Aug-2021**	**04-Sep-2021**	27-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC207_210830, QC208_210830	**30-Aug-2021**	**04-Sep-2021**	26-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓
HDPE Soil Jar (EP231X) QC209_210831	**31-Aug-2021**	**04-Sep-2021**	27-Feb-2022	✓	**04-Sep-2021**	14-Oct-2021	✓

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
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X) QC407_210830	**30-Aug-2021**	**08-Sep-2021**	26-Feb-2022	✓	**08-Sep-2021**	26-Feb-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X) QC407_210830	**30-Aug-2021**	**08-Sep-2021**	26-Feb-2022	✓	**08-Sep-2021**	26-Feb-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X) QC407_210830	**30-Aug-2021**	**08-Sep-2021**	26-Feb-2022	✓	**08-Sep-2021**	26-Feb-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) QC407_210830	**30-Aug-2021**	**08-Sep-2021**	26-Feb-2022	✓	**08-Sep-2021**	26-Feb-2022	✓

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
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QC407_210830	**30-Aug-2021**	**08-Sep-2021**	26-Feb-2022	✓	**08-Sep-2021**	26-Feb-2022	✓

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	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	9	**22.22**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organotin Analysis	EP090	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	9	**22.22**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	9	**22.22**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	22	**9.09**	**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)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

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*	
Method Blanks (MB) - Continued							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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 Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
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 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 Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. 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 Schedule B(3)
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions

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 Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
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.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EM2117375**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	: [redacted]	Telephone	[redacted]
Facsimile	: +61 03 9654 7117	Facsimile	: +61-3-8549 9626
Project	: Viva geelong offshore	Page	: 1 of 3
Order number	: ----	Quote number	: EM2021AECOMAU0004 (ME/386/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BC		

Dates

Date Samples Received	: 01-Sep-2021 11:25	Issue Date	: 02-Sep-2021
Client Requested Due Date	: 14-Sep-2021	Scheduled Reporting Date	: **09-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 4.7°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 4 / 4

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, ALS Newcastle & ALS Brisbane.**
- **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 laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Preliminary results will be available on the scheduled reporting date listed in this report. However the final report with TOC, TBT & PSD analysis will be complete on 14/09/2021.
- 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.

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	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG035T (solids) Total Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - EP090 (solids) Organotins	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EM2117375-001	30-Aug-2021 00:00	QC207_210830	✓	✓	✓	✓	✓	✓	✓
EM2117375-002	30-Aug-2021 00:00	QC208_210830	✓	✓	✓	✓	✓	✓	✓
EM2117375-003	31-Aug-2021 00:00	QC209_210831	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle
EM2117375-003	31-Aug-2021 00:00	QC209_210831	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)
EM2117375-004	30-Aug-2021 00:00	QC407_210830	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com
- Purchase Order Request Letter (PO_Request)	Email	AP_CustomerService.ANZ@aecom.com

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- A4 - AU Tax Invoice (INV)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	
- Purchase Order Request Letter (PO_Request)	Email	

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	

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 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
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☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@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@alsglobal.com

CLIENT: AECOM	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	X Standard TAT (List due date):
OFFICE: Melbourne		☐ Non Standard or urgent TAT (List due date):
PROJECT: Viva Geelong Offshore	ALS QUOTE NO.: ME/386/21 V2	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:		FOR LABORATORY USE ONLY (Circle) Custody seal intact? Yes No N/A Free liquid, frozen ice bricks present on receipt? Yes No N/A Random Sample Temperature on Receipt: °C Other comments:
PROJECT MANAGER: [redacted]	CONTACT PH:	
SAMPLER: BC	SAMPLER MOBILE: [redacted]	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): Esdat	
Email Reports to (will default to PM if no other addresses are listed): [redacted]		
Email Invoice to (will default to PM if no other addresses are listed): [redacted]		

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Total Hg EG035T	TBT EP090	Metals EG005T (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn)	TOC EP003	SIM-PAH Only EP075 SIM PAH only	Particle Sizing with Hydrometer + Soil Particle Density EA150H/EA152	PFAS Full Suite EP231	HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	QC214_210907		Sed										X	
2	QC215_210907		Sed			X	X	X	X	X	X	X		
3	QC216_210907		Sed										X	
UR. A	QC217_210907		PW										X	
5	QC413_210907		W									X		

Environmental Division
Melbourne
Work Order Reference
EM2117925

Telephone : +61-3-8549 9600

Received: 8/9, 10-15 Carrier:
C/note:
Temp: 1.3 °C Seal: Y N
Ice / Icebricks / NA

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.

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT: [redacted]

COMPANY: AECOM Australia Pty Ltd

ADDRESS: Collins Square
Level 10, Tower Two
727 Collins Street Melbourne\R\N

PROJECT: Viva geelong offshore

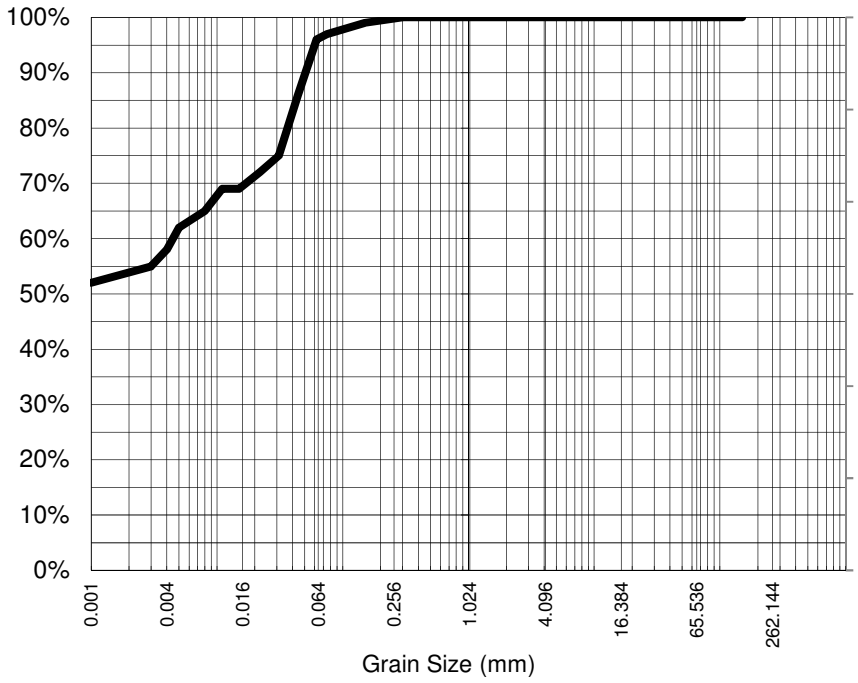
DATE REPORTED: 16-Sep-2021

DATE RECEIVED: 8-Sep-2021

REPORT NO: EM2117925-002 / PSD

SAMPLE ID: QC215_210907

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	97%
Particle Size (microns)	
44	86%
31	75%
22	72%
15	69%
11	69%
8	65%
5	62%
4	58%
1	52%

Median Particle Size (mm)*	<0.005

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 15-Sep-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.68

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

NATA
WORLD RECOGNISED ACCREDITATION

Vincent Emerton-Bell
Laboratory Analyst
Authorised Signatory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2117925**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 08-Sep-2021 10:15
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 10-Sep-2021
C-O-C number	: ----	Issue Date	: 22-Sep-2021 12:20
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. 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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
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
Thomas Donovan	Senior Organic Chemist - PFAS	Brisbane Organics, Stafford, QLD
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP090 Organtins: Sample ES2132764_020 shows poor matrix spike recovery due to matrix interference. Insufficient sample for re-extraction.
- 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.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP231X: Poor matrix spike recovery for sample EM2117937-001 due to sample matrix interference. Confirmed by re-analysis.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	QC215_210907	----	----	----	----
			Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM2117925-002	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**4.8**	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	**4**	----	----	----	----
+150µm	----	1	%	<1	----	----	----	----
+300µm	----	1	%	<1	----	----	----	----
+425µm	----	1	%	<1	----	----	----	----
+600µm	----	1	%	<1	----	----	----	----
+1180µm	----	1	%	<1	----	----	----	----
+2.36mm	----	1	%	<1	----	----	----	----
+4.75mm	----	1	%	<1	----	----	----	----
+9.5mm	----	1	%	<1	----	----	----	----
+19.0mm	----	1	%	<1	----	----	----	----
+37.5mm	----	1	%	<1	----	----	----	----
+75.0mm	----	1	%	<1	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	**53**	----	----	----	----
Silt (2-60 µm)	----	1	%	**42**	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	**5**	----	----	----	----
Gravel (>2mm)	----	1	%	<1	----	----	----	----
Cobbles (>6cm)	----	1	%	<1	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	**2.68**	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	**18**	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	**1**	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**52**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**31**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**70**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**28**	----	----	----	----
Silver	7440-22-4	2	mg/kg	<2	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**112**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	**0.4**	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC215_210907	----	----	----	----
				Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117925-002	--------	--------	--------	--------
					Result	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**1.29**	----	----	----	----
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	----	----	----	----
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**	----	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	----	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		<1	----	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC215_210907	----	----	----	----
				Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117925-002	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0003**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QC215_210907	----	----	----	----
				Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117925-002	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0003**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0003**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0003**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**79.6**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		**78.2**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		**74.3**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**101**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%		**115**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		**104**	----	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**40.5**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**128**	----	----	----	----
13C8-PFOA	----	0.0002	%		**109**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC413_210907	----	----	----	----
				Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117925-005	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC413_210907	----	----	----	----
				Sampling date / time	07-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2117925-005	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**102**	----	----	----	----
13C8-PFOA	----	0.02	%		**102**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: SEDIMENT		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
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	68	136
13C8-PFOA	----	69	133

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	65	140
13C8-PFOA	----	71	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

(SOIL) EP003: Total Organic Carbon (TOC) in Soil

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification based on Particle Size

(SOIL) EA150: Particle Sizing

(SOIL) EA152: Soil Particle Density

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2117925**	Page	: 1 of 10
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	[redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 08-Sep-2021
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 10-Sep-2021
C-O-C number	: ----	Issue Date	: 22-Sep-2021
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 4		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. 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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
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
Thomas Donovan	Senior Organic Chemist - PFAS	Brisbane Organics, Stafford, QLD
Vincent Emerton-Bell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3897818)									
EM2117925-002	QC215_210907	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	52	50	3.3	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	28	28	0.0	0% - 50%
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	18	18	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	31	33	6.1	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	70	76	8.0	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	112	114	1.9	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3895969)									
EM2117862-031	Anonymous	EA055: Moisture Content	----	0.1	%	25.1	24.9	1.0	0% - 20%
EM2117862-046	Anonymous	EA055: Moisture Content	----	0.1	%	21.5	22.3	3.7	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3897817)									
EM2117925-002	QC215_210907	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.4	0.4	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3911085)									
EM2117925-002	QC215_210907	EP003: Total Organic Carbon	----	0.02	%	1.29	1.38	6.5	0% - 20%
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3897809)									
EM2117925-002	QC215_210907	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3897809) - continued									
EM2117925-002	QC215_210907	EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3904645)									
EM2117925-002	QC215_210907	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3896371)									
EM2117925-002	QC215_210907	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0003	<0.0002	45.6	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EM2117966-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3896371)									
EM2117925-002	QC215_210907	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3896371) - continued									
EM2117966-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3896371)									
EM2117925-002	QC215_210907	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117966-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3896371)									
EM2117925-002	QC215_210907	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3896371) - continued									
EM2117925-002	QC215_210907	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EM2117966-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3896371)									
EM2117925-002	QC215_210907	EP231X: Sum of PFAS	----	0.0002	mg/kg	0.0003	<0.0002	40.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0003	<0.0002	40.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0003	<0.0002	40.0	No Limit
EM2117966-001	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (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 (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3897818)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	104	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	123	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	62.4	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	100	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	95.0	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	96.1	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	94.5	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	76.4	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	70.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3897817)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	102	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3911085)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.57 %	98.1	70.0	130
				<0.02	0.48 %	109	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3897809)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	112	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	122	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	119	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	112	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	112	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	126	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	115	78.3	124
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	122	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	114	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	126	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	106	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	106	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	112	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	86.8	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	93.0	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	88.1	65.8	127
EP090: Organotin Compounds (QCLot: 3904645)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	86.9	36.0	128

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP090: Organotin Compounds (QCLot: 3904645) - continued								
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	84.6	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	85.0	52.0	139
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3896371)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00111 mg/kg	102	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	103	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0014 mg/kg	84.9	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	96.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	100	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00121 mg/kg	96.8	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3896371)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	99.8	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	105	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.5	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.0	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.3	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	104	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.0	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.9	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00468 mg/kg	115	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3896371)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	105	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	114	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	109	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	109	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	134	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3896371)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00117 mg/kg	98.8	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00119 mg/kg	110	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.0012 mg/kg	107	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00121 mg/kg	117	70.0	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231P: PFAS Sums (QCLot: 3896371)								
EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3894690)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.222 µg/L	108	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.235 µg/L	85.6	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.228 µg/L	112	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	104	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.232 µg/L	112	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.241 µg/L	97.5	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3894690)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	106	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	100	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	92.7	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	94.8	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	101	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	109	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	98.6	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	92.8	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.9375 µg/L	126	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3894690)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	95.0	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	106	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	96.7	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	129	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	102	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	135	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	124	61.0	135

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3894690)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.234 µg/L	94.7	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.238 µg/L	104	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.24 µg/L	102	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.242 µg/L	83.2	70.0	130
EP231P: PFAS Sums (QCLot: 3894690)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP090: Organotin Compounds (QCLot: 3904645)							
ES2132764-020	Anonymous	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# Not Determined	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	# Not Determined	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# 8.2	20.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3896371)							
EM2117937-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00111 mg/kg	# 65.3	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00118 mg/kg	85.4	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00114 mg/kg	88.4	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00119 mg/kg	82.7	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00116 mg/kg	# Not Determined	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00121 mg/kg	# 55.0	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3896371)							
EM2117937-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	78.3	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	# 39.4	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	# Not Determined	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	# 50.9	71.0	131

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3896371) - continued							
EM2117937-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	# Not Determined	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	75.1	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	# 46.0	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	86.5	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	74.7	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	77.2	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00468 mg/kg	88.1	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3896371)							
EM2117937-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	# 58.0	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	95.8	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	77.2	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	117	70.0	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	81.7	70.0	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	66.8	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	# 53.9	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3896371)							
EM2117937-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00117 mg/kg	74.5	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00119 mg/kg	88.3	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0012 mg/kg	85.1	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00121 mg/kg	# 38.1	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2117925**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	[redacted]	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 08-Sep-2021
Site	: ----	Issue Date	: 22-Sep-2021
Sampler	: BC	No. of samples received	: 4
Order number	: Viva Geelong Offshore	No. of samples analysed	: 2

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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **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.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	ES2132764--020	Anonymous	**Tributyltin**	56573-85-4	8.2 %	20.0-130%	**Recovery less than lower data quality objective**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117937--001	Anonymous	**Perfluorobutane sulfonic acid (PFBS)**	375-73-5	65.3 %	72.0-128%	**Recovery less than lower data quality objective**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117937--001	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EM2117937--001	Anonymous	**Perfluorodecane sulfonic acid (PFDS)**	335-77-3	55.0 %	59.0-134%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117937--001	Anonymous	**Perfluoropentanoic acid (PFPeA)**	2706-90-3	39.4 %	69.0-132%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117937--001	Anonymous	**Perfluorohexanoic acid (PFHxA)**	307-24-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117937--001	Anonymous	**Perfluoroheptanoic acid (PFHpA)**	375-85-9	50.9 %	71.0-131%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117937--001	Anonymous	**Perfluorooctanoic acid (PFOA)**	335-67-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EM2117937--001	Anonymous	**Perfluorodecanoic acid (PFDA)**	335-76-2	46.0 %	69.0-133%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EM2117937--001	Anonymous	**Perfluorooctane sulfonamide (FOSA)**	754-91-6	58.0 %	67.0-137%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EM2117937--001	Anonymous	**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	53.9 %	61.0-139%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EM2117937--001	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	38.1 %	70.0-130%	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
PAH/Phenols (SIM)	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	18	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	18	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*
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
QC215_210907	**07-Sep-2021**	**----**	----	----	**10-Sep-2021**	21-Sep-2021	✓
EA150: Particle Sizing							
Snap Lock Bag (EA150H)							
QC215_210907	**07-Sep-2021**	**----**	----	----	**16-Sep-2021**	06-Mar-2022	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H)							
QC215_210907	**07-Sep-2021**	**----**	----	----	**16-Sep-2021**	06-Mar-2022	✓
EA152: Soil Particle Density							
Snap Lock Bag (EA152)							
QC215_210907	**07-Sep-2021**	**----**	----	----	**16-Sep-2021**	06-Mar-2022	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
QC215_210907	**07-Sep-2021**	**13-Sep-2021**	06-Mar-2022	✓	**14-Sep-2021**	06-Mar-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
QC215_210907	**07-Sep-2021**	**13-Sep-2021**	05-Oct-2021	✓	**14-Sep-2021**	05-Oct-2021	✓
EP003: Total Organic Carbon (TOC) in Soil							
Soil Glass Jar - Unpreserved (EP003)							
QC215_210907	**07-Sep-2021**	**20-Sep-2021**	05-Oct-2021	✓	**20-Sep-2021**	05-Oct-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
QC215_210907	**07-Sep-2021**	**14-Sep-2021**	21-Sep-2021	✓	**14-Sep-2021**	24-Oct-2021	✓

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
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090)							
QC215_210907	**07-Sep-2021**	**16-Sep-2021**	21-Sep-2021	✓	**17-Sep-2021**	26-Oct-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
QC215_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	20-Oct-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
QC215_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	20-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
QC215_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	20-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
QC215_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	20-Oct-2021	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)							
QC215_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	20-Oct-2021	✓

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
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC413_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	06-Mar-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QC413_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	06-Mar-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
QC413_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	06-Mar-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC413_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	06-Mar-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QC413_210907	**07-Sep-2021**	**10-Sep-2021**	06-Mar-2022	✓	**10-Sep-2021**	06-Mar-2022	✓

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
Organotin Analysis	EP090	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	1	200.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	0	1	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	0	1	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	0	1	0.00	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)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	18	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

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*	
Method Blanks (MB) - Continued							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	18	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

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 Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
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 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 Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. 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 Schedule B(3)
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions

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 Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
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.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2117925**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	: [redacted]	Telephone	: [redacted]
Facsimile	: +61 03 9654 7117	Facsimile	: +61-3-8549 9626
Project	: Viva geelong offshore	Page	: 1 of 3
Order number	: ----	Quote number	: EM2021AECOMAU0004 (ME/386/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BC		

Dates

Date Samples Received	: 08-Sep-2021 10:15	Issue Date	: 09-Sep-2021
Client Requested Due Date	: 21-Sep-2021	Scheduled Reporting Date	: **15-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 1.3°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 4 / 2

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, ALS Brisbane and ALS Newcastle.**
- **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 laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Preliminary results will be available on the scheduled reporting date listed in this report. However the final report with TBT and TOC analysis will be completed on 21/09/2021.
- 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.

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	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG035T (solids) Total Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - EP090 (solids) Organotins
EM2117925-001	07-Sep-2021 00:00	QC214_210907	✓						
EM2117925-002	07-Sep-2021 00:00	QC215_210907		✓	✓	✓	✓	✓	✓
EM2117925-003	07-Sep-2021 00:00	QC216_210907	✓						

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EM2117925-002	07-Sep-2021 00:00	QC215_210907	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)
EM2117925-005	07-Sep-2021 00:00	QC413_210907	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- A4 - AU Tax Invoice (INV)	Email	
- Attachment - Report (SUBCO)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	
- Purchase Order Request Letter (PO_Request)	Email	

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- Attachment - Report (SUBCO)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	

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 [illegible] NSW 2304 Ph: 02 4014 [illegible] E: samples.newcastle@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

URGENT

CLIENT: AECOM	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle):
OFFICE: Melbourne		☐ Non Standard or urgent TAT (List due date): 5 day TAT	Custody Seal Intact? Yes / No / N/A
PROJECT: Viva Geelong Offshore	ALS QUOTE NO.: ME/386/21 V2	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
ORDER NUMBER:		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: [redacted]	CONTACT PH:	OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: BC	SAMPLER MOBILE: [redacted]	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): Esdat				
Email Reports to (will default to PM if no other addresses are listed): [redacted]		DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME: 29, 2025
Email Invoice to (will default to PM if no other addresses are listed): [redacted]					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		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).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	P-16 IWRG 621	E231 - PFAS Full Suite	Total Hg EG035T	TBT EP090	Metals EG005T (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag, Zn)	SIM-PAH Only EP075 SIM PAH only		HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	Waste01		Sed					X	X	X	X			
2	Waste02		Sed					X	X	X	X			
3	Waste03		Sed			X	X							
[redacted]														

Environmental Division
Melbourne
Work Order Reference
EM2117682

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

CERTIFICATE OF ANALYSIS

Work Order	: **EM2117682**	Page	: 1 of 11
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 07-Sep-2021 10:25
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 07-Sep-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021 12:53
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 3		
No. of samples analysed	: 3		

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, unless the sampling was conducted by ALS. 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
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP090 - Organotins: The LOR for DBT for sample 'Waste01' has been raised due to matrix interference.
- 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.
- EP074-UT: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP074-WF: Where reported, Sum of trichlorobenzenes is the sum of the reported concentrations of 1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene, and 1,3,5-Trichlorobenzene at or above the LOR.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EA001: pH in soil using 0.01M CaCl extract								
pH (CaCl2)	----	0.1	pH Unit	----	----	**8.6**	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**41.6**	**39.7**	----	----	----
Moisture Content	----	1.0	%	----	----	**45.6**	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Antimony	7440-36-0	5	mg/kg	<5	<5	----	----	----
Arsenic	7440-38-2	5	mg/kg	**15**	**23**	**9**	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg	**46**	**53**	----	----	----
Copper	7440-50-8	5	mg/kg	**10**	**11**	**9**	----	----
Lead	7439-92-1	5	mg/kg	**74**	**25**	**12**	----	----
Molybdenum	7439-98-7	2	mg/kg	----	----	<2	----	----
Nickel	7440-02-0	2	mg/kg	**23**	**30**	**21**	----	----
Selenium	7782-49-2	5	mg/kg	----	----	<5	----	----
Silver	7440-22-4	2	mg/kg	<2	<2	<2	----	----
Tin	7440-31-5	5	mg/kg	----	----	<5	----	----
Zinc	7440-66-6	5	mg/kg	**51**	**42**	**41**	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	**0.2**	<0.1	<0.1	----	----
EG048: Hexavalent Chromium (Alkaline Digest)								
Hexavalent Chromium	18540-29-9	0.5	mg/kg	----	----	<0.5	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	----	----	<1	----	----
EK040T: Fluoride Total								
Fluoride	16984-48-8	40	mg/kg	----	----	**320**	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	----	<0.1	----	----
EP074A: Monocyclic Aromatic Hydrocarbons								
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	----	----
Styrene	100-42-5	0.5	mg/kg	----	----	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	<0.5	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP074A: Monocyclic Aromatic Hydrocarbons - Continued								
^ **Sum of monocyclic aromatic hydrocarbons**	----	0.2	mg/kg	----	----	<0.2	----	----
^ **Total Xylenes**	----	0.5	mg/kg	----	----	<0.5	----	----
EP074H: Naphthalene								
Naphthalene	91-20-3	1	mg/kg	----	----	<1	----	----
EP074I: Volatile Halogenated Compounds								
Vinyl chloride	75-01-4	0.02	mg/kg	----	----	<0.02	----	----
1.1-Dichloroethene	75-35-4	0.01	mg/kg	----	----	<0.01	----	----
Methylene chloride	75-09-2	0.4	mg/kg	----	----	<0.4	----	----
trans-1.2-Dichloroethene	156-60-5	0.02	mg/kg	----	----	<0.02	----	----
cis-1.2-Dichloroethene	156-59-2	0.01	mg/kg	----	----	<0.01	----	----
Chloroform	67-66-3	0.02	mg/kg	----	----	<0.02	----	----
1.1.1-Trichloroethane	71-55-6	0.01	mg/kg	----	----	<0.01	----	----
Carbon Tetrachloride	56-23-5	0.01	mg/kg	----	----	<0.01	----	----
1.2-Dichloroethane	107-06-2	0.02	mg/kg	----	----	<0.02	----	----
Trichloroethene	79-01-6	0.02	mg/kg	----	----	<0.02	----	----
1.1.2-Trichloroethane	79-00-5	0.04	mg/kg	----	----	<0.04	----	----
Tetrachloroethene	127-18-4	0.02	mg/kg	----	----	<0.02	----	----
1.1.1.2-Tetrachloroethane	630-20-6	0.01	mg/kg	----	----	<0.01	----	----
1.1.2.2-Tetrachloroethane	79-34-5	0.02	mg/kg	----	----	<0.02	----	----
Hexachlorobutadiene	87-68-3	0.02	mg/kg	----	----	<0.02	----	----
Chlorobenzene	108-90-7	0.02	mg/kg	----	----	<0.02	----	----
1.4-Dichlorobenzene	106-46-7	0.02	mg/kg	----	----	<0.02	----	----
1.2-Dichlorobenzene	95-50-1	0.02	mg/kg	----	----	<0.02	----	----
1.2.4-Trichlorobenzene	120-82-1	0.01	mg/kg	----	----	<0.01	----	----
^ **Sum of volatile chlorinated hydrocarbons**	----	0.01	mg/kg	----	----	<0.01	----	----
^ **Sum of other chlorinated hydrocarbons**	----	0.01	mg/kg	----	----	<0.01	----	----
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	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
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	----	----	----
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**	----	----	----
EP075A: Phenolic Compounds (Halogenated)								
2-Chlorophenol	95-57-8	0.03	mg/kg	----	----	<0.03	----	----
2.4-Dichlorophenol	120-83-2	0.03	mg/kg	----	----	<0.03	----	----
2.6-Dichlorophenol	87-65-0	0.03	mg/kg	----	----	<0.03	----	----
4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	----	----	<0.03	----	----
2.4.5-Trichlorophenol	95-95-4	0.05	mg/kg	----	----	<0.05	----	----
2.4.6-Trichlorophenol	88-06-2	0.05	mg/kg	----	----	<0.05	----	----
2.3.5.6-Tetrachlorophenol	935-95-5	0.03	mg/kg	----	----	<0.03	----	----
2.3.4.5 & 2.3.4.6-Tetrachlorophenol	4901-51-3/58-90-2	0.05	mg/kg	----	----	<0.05	----	----
Pentachlorophenol	87-86-5	0.2	mg/kg	----	----	<0.2	----	----
^ Sum of Phenols (halogenated)	----	0.03	mg/kg	----	----	<0.03	----	----
EP075A: Phenolic Compounds (Non-halogenated)								
Phenol	108-95-2	1	mg/kg	----	----	<1	----	----
2-Methylphenol	95-48-7	1	mg/kg	----	----	<1	----	----
3- & 4-Methylphenol	1319-77-3	1	mg/kg	----	----	<1	----	----
2-Nitrophenol	88-75-5	1	mg/kg	----	----	<1	----	----
2.4-Dimethylphenol	105-67-9	1	mg/kg	----	----	<1	----	----
2.4-Dinitrophenol	51-28-5	5	mg/kg	----	----	<5	----	----
4-Nitrophenol	100-02-7	5	mg/kg	----	----	<5	----	----
2-Methyl-4.6-dinitrophenol	8071-51-0	5	mg/kg	----	----	<5	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP075A: Phenolic Compounds (Non-halogenated) - Continued								
Dinoseb	88-85-7	5	mg/kg	----	----	<5	----	----
2-Cyclohexyl-4.6-Dinitrophenol	131-89-5	5	mg/kg	----	----	<5	----	----
^ Sum of Phenols (non-halogenated)	----	1	mg/kg	----	----	<1	----	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthylene	208-96-8	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) & Benzo(k)fluoranthene	205-99-2 207-08-9	1.0	mg/kg	----	----	<1.0	----	----
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	----	----
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**	----	----
EP075I: Organochlorine Pesticides								
alpha-BHC	319-84-6	0.03	mg/kg	----	----	<0.03	----	----
Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	----	----	<0.03	----	----
beta-BHC	319-85-7	0.03	mg/kg	----	----	<0.03	----	----
gamma-BHC	58-89-9	0.03	mg/kg	----	----	<0.03	----	----
delta-BHC	319-86-8	0.03	mg/kg	----	----	<0.03	----	----
Heptachlor	76-44-8	0.03	mg/kg	----	----	<0.03	----	----
Aldrin	309-00-2	0.03	mg/kg	----	----	<0.03	----	----
Heptachlor epoxide	1024-57-3	0.03	mg/kg	----	----	<0.03	----	----
cis-Chlordane	5103-71-9	0.03	mg/kg	----	----	<0.03	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP075l: Organochlorine Pesticides - Continued								
trans-Chlordane	5103-74-2	0.03	mg/kg	----	----	<0.03	----	----
Endosulfan 1	959-98-8	0.03	mg/kg	----	----	<0.03	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	<0.05	----	----
Dieldrin	60-57-1	0.03	mg/kg	----	----	<0.03	----	----
Endrin aldehyde	7421-93-4	0.03	mg/kg	----	----	<0.03	----	----
Endrin	72-20-8	0.03	mg/kg	----	----	<0.03	----	----
Endosulfan 2	33213-65-9	0.03	mg/kg	----	----	<0.03	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.03	mg/kg	----	----	<0.03	----	----
4.4`-DDT	50-29-3	0.05	mg/kg	----	----	<0.05	----	----
Methoxychlor	72-43-5	0.03	mg/kg	----	----	<0.03	----	----
^ Sum of organochlorine pesticides	----	0.03	mg/kg	----	----	<0.03	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.03	mg/kg	----	----	<0.03	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	----	----	<0.05	----	----
^ Chlordane	57-74-9	0.03	mg/kg	----	----	<0.03	----	----
^ Sum of other organochlorine pesticides	----	0.03	mg/kg	----	----	<0.03	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	<10	----	----
C10 - C14 Fraction	----	50	mg/kg	----	----	<50	----	----
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	<10	----	----
C15 - C28 Fraction	----	100	mg/kg	----	----	<100	----	----
C29 - C36 Fraction	----	100	mg/kg	----	----	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	----	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	----	----	<50	----	----
>C16 - C34 Fraction	----	100	mg/kg	----	----	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg	----	----	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	----	<50	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	----	<50	----	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	----	<10	----	----
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP090: Organotin Compounds - Continued								
Dibutyltin	1002-53-5	1	µgSn/kg	<3	<1	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	----	----	**0.0005**	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	----	----	<0.0002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	----	----	<0.001	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	----	----	<0.0002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	----	----	<0.0005	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	----	----	<0.0002	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	----	----	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	----	----	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	----	----	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	----	----	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	----	----	<0.0002	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	----	----	<0.0002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	----	----	<0.0005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	----	----	<0.0005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	----	----	<0.0005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	----	----	<0.0005	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	----	----	**0.0005**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	----	----	**0.0005**	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	----	----	**0.0005**	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	**93.1**	----	----
EP074S: VOC Surrogates (Ultra-Trace)								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	**93.1**	----	----
Toluene-D8	2037-26-5	0.1	%	----	----	**93.1**	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	**98.0**	----	----
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	Waste01	Waste02	Waste03	----	----
			Sampling date / time	06-Sep-2021 00:00	06-Sep-2021 00:00	06-Sep-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	EM2117682-001	EM2117682-002	EM2117682-003	--------	--------
				Result	Result	Result	----	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued								
Phenol-d6	13127-88-3	0.5	%	83.8	85.6	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	87.2	88.8	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	80.3	86.9	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	102	105	----	----	----
Anthracene-d10	1719-06-8	0.5	%	110	115	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	93.7	99.7	----	----	----
EP075S: Acid Extractable Surrogates (Waste Classification)								
Phenol-d6	13127-88-3	0.025	%	----	----	105	----	----
2-Chlorophenol-D4	93951-73-6	0.025	%	----	----	94.1	----	----
2.4.6-Tribromophenol	118-79-6	0.025	%	----	----	86.6	----	----
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)								
Nitrobenzene-D5	4165-60-0	0.025	%	----	----	98.5	----	----
1.2-Dichlorobenzene-D4	2199-69-1	0.025	%	----	----	94.4	----	----
2-Fluorobiphenyl	321-60-8	0.025	%	----	----	94.6	----	----
Anthracene-d10	1719-06-8	0.025	%	----	----	104	----	----
4-Terphenyl-d14	1718-51-0	0.025	%	----	----	89.7	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	88.5	73.2	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	----	----	109	----	----
13C8-PFOA	----	0.0002	%	----	----	102	----	----

Surrogate Control Limits

Sub-Matrix: SEDIMENT		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	41	122
EP074S: VOC Surrogates (Ultra-Trace)			
1.2-Dichloroethane-D4	17060-07-0	59	119
Toluene-D8	2037-26-5	55	117
4-Bromofluorobenzene	460-00-4	59	123
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
EP075S: Acid Extractable Surrogates (Waste Classification)			
Phenol-d6	13127-88-3	63	134
2-Chlorophenol-D4	93951-73-6	60	125
2.4.6-Tribromophenol	118-79-6	54	129
EP075T: Base/Neutral Extractable Surrogates (Waste Classification)			
Nitrobenzene-D5	4165-60-0	63	131
1.2-Dichlorobenzene-D4	2199-69-1	61	124
2-Fluorobiphenyl	321-60-8	69	131
Anthracene-d10	1719-06-8	70	133
4-Terphenyl-d14	1718-51-0	59	141
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	68	136
13C8-PFOA	----	69	133

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

ALS Environmental

Automated Guideline Comparison Report

EPA Victoria Publication IWRG 621 (2009) - Table 2: Soil Hazard Categorisation

Work Order	: **EM2117682**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]		
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	: [redacted]	Telephone	: [redacted]
Facsimile	: +61 03 9654 7117	Facsimile	: +61-3-8549 9626
Project	: Viva geelong offshore	Date Received	: 07-Sep-2021 10:25
Order number	: Viva Geelong Offshore	Date Analysed	: 07-Sep-2021
C-O-C number	: ----	Date Issued	: 13-Sep-2021 12:53
No. of samples received	: 3		
No. of samples analysed	: 3	Quote number	: ME/386/21 V2

General Comments

This guideline comparison report **only** provides comparison of total concentration data against upper limit thresholds for the 'Fill Material', 'C', 'B' Categories in Table 2 of EPA Publication IWRG621.
This guideline comparison report is **NOT** a soil classification report. Classification of soils as Fill Material, Category C, Category B or Category A requires consideration of a number of other factors including preliminary site investigation, sampling density and statistical calculations, as set out in EPA Publication IWRG 702 and measurement uncertainty.
This guideline comparison report only provides comparison data for parameters, specifically listed within the IWRG621 (2009) guideline, that are analysed by ALS.
Only results in the 'Analytical Results' section have been compared to the guideline.

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

Summary of Thresholds Reached or Exceeded

Results for all samples detailed in this report are below the upper threshold limits for Fill Material.

Results for all samples detailed in this report are below the upper threshold limits for Fill Material.

Analytical Results

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Category B: Table 2: Soil Hazard Categorisation Thresholds : Category B

Sub-Matrix: **SEDIMENT**

				Sample ID		Waste01	Waste02	Waste03	----	----
				Sampling date/time	Guideline	Guideline	06-Sep-2021 15:00	06-Sep-2021 15:00	06-Sep-2021 15:00	----	----
Compound	*Method*	*LOR*	*Unit*		Lower Limit	Upper Limit	EM2117682-001 MU	EM2117682-002 MU	EM2117682-003 MU		
EA001: pH in soil using 0.01M CaCl extract											
pH (CaCl2)	EA001	0.1	pH Unit		2	12.5	----	----	**8.6** ± 0.2	----	----
EG005(ED093)T: Total Metals by ICP-AES											
Arsenic	EG005T	5	mg/kg		----	2000	----	----	**9** ± 2	----	----
Cadmium	EG005T	1	mg/kg		----	400	----	----	<1 - -	----	----
Copper	EG005T	5	mg/kg		----	20000	----	----	**9** ± 1	----	----
Lead	EG005T	5	mg/kg		----	6000	----	----	**12** ± 2	----	----
Molybdenum	EG005T	2	mg/kg		----	4000	----	----	<2 - -	----	----
Nickel	EG005T	2	mg/kg		----	12000	----	----	**21** ± 2	----	----
Selenium	EG005T	5	mg/kg		----	200	----	----	<5 - -	----	----
Silver	EG005T	2	mg/kg		----	720	----	----	<2 - -	----	----
Zinc	EG005T	5	mg/kg		----	140000	----	----	**41** ± 5	----	----
EG035T: Total Recoverable Mercury by FIMS											
Mercury	EG035T	0.1	mg/kg		----	300	----	----	<0.1 - -	----	----
EG048: Hexavalent Chromium (Alkaline Digest)											
Hexavalent Chromium	EG048G	0.5	mg/kg		----	2000	----	----	<0.5 - -	----	----
EK026SF: Total CN by Segmented Flow Analyser											
Total Cyanide	EK026SF	1	mg/kg		----	10000	----	----	<1 - -	----	----
EK040T: Fluoride Total											
Fluoride	EK040T	40	mg/kg		----	40000	----	----	**320** ± 60	----	----
EP074A: Monocyclic Aromatic Hydrocarbons											
Benzene	EP074-UT	0.2	mg/kg		----	16	----	----	<0.2 - -	----	----
Sum of monocyclic aromatic hydrocarbons	EP074-UT-SUM	0.2	mg/kg		----	240	----	----	<0.2 - -	----	----
EP074I: Volatile Halogenated Compounds											
Vinyl chloride	EP074-UT	0.02	mg/kg		----	4.8	----	----	<0.02 - -	----	----
Hexachlorobutadiene	EP074-UT	0.02	mg/kg		----	11	----	----	<0.02 - -	----	----
Sum of other chlorinated hydrocarbons	EP074-UT-SUM	0.01	mg/kg		----	50	----	----	<0.01 - -	----	----
EP075A: Phenolic Compounds (Halogenated)											
Sum of Phenols (halogenated)	EP075-EM-SUM	0.03	mg/kg		----	320	----	----	<0.03 - -	----	----
EP075A: Phenolic Compounds (Non-halogenated)											
Sum of Phenols (non-halogenated)	EP075-EM-SUM	1	mg/kg		----	2200	----	----	<1 - -	----	----
EP075B: Polynuclear Aromatic Hydrocarbons											
Benzo(a)pyrene	EP075-EM	0.5	mg/kg		----	20	----	----	<0.5 - -	----	----
Sum of polycyclic aromatic hydrocarbons	EP075-EM-SUM	0.5	mg/kg		----	400	----	----	<0.5 - -	----	----

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Category B: Table 2: Soil Hazard Categorisation Thresholds : Category B

Sub-Matrix: **SEDIMENT**

				Sample ID	Guideline	Guideline	**Waste01**	**Waste02**	**Waste03**	**----**	**----**
				Sampling date/time			06-Sep-2021 15:00	06-Sep-2021 15:00	06-Sep-2021 15:00	----	----
Compound	*Method*	*LOR*	*Unit*		Lower Limit	Upper Limit	**EM2117682-001** MU	**EM2117682-002** MU	**EM2117682-003** MU		
EP075l: Organochlorine Pesticides											
Heptachlor	EP075-EM	0.03	mg/kg		----	4.8	**----**	**----**	<0.03 --	**----**	**----**
Sum of Aldrin + Dieldrin	EP075-EM-SUM	0.03	mg/kg		----	4.8	**----**	**----**	<0.03 --	**----**	**----**
Sum of DDD + DDE + DDT	EP075-EM-SUM	0.05	mg/kg		----	50	**----**	**----**	<0.05 --	**----**	**----**
Chlordane	EP075-EM-SUM	0.03	mg/kg		----	16	**----**	**----**	<0.03 --	**----**	**----**
Sum of other organochlorine pesticides	EP075-EM-SUM	0.03	mg/kg		----	50	**----**	**----**	<0.03 --	**----**	**----**
EP080/071: Total Petroleum Hydrocarbons											
C6 - C9 Fraction	EP074-UT	10	mg/kg		----	2600	**----**	**----**	<10 --	**----**	**----**
C10 - C36 Fraction (sum)	EP071-EM	50	mg/kg		----	40000	**----**	**----**	<50 --	**----**	**----**

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Category C: Table 2: Soil Hazard Categorisation Thresholds : Category C

Sub-Matrix: **SEDIMENT**

Compound	*Method*	*LOR*	*Unit*	Guideline Lower Limit	Guideline Upper Limit	**Waste01** 06-Sep-2021 15:00 **EM2117682-001** MU	**Waste02** 06-Sep-2021 15:00 **EM2117682-002** MU	**Waste03** 06-Sep-2021 15:00 **EM2117682-003** MU	---- ----	---- ----
EA001: pH in soil using 0.01M CaCl extract										
pH (CaCl2)	EA001	0.1	pH Unit	4	9	----	----	**8.6** ± 0.2	----	----
EG005(ED093)T: Total Metals by ICP-AES										
Arsenic	EG005T	5	mg/kg	----	500	----	----	**9** ± 2	----	----
Cadmium	EG005T	1	mg/kg	----	100	----	----	<1 --	----	----
Copper	EG005T	5	mg/kg	----	5000	----	----	**9** ± 1	----	----
Lead	EG005T	5	mg/kg	----	1500	----	----	**12** ± 2	----	----
Molybdenum	EG005T	2	mg/kg	----	1000	----	----	<2 --	----	----
Nickel	EG005T	2	mg/kg	----	3000	----	----	**21** ± 2	----	----
Selenium	EG005T	5	mg/kg	----	50	----	----	<5 --	----	----
Silver	EG005T	2	mg/kg	----	180	----	----	<2 --	----	----
Tin	EG005T	5	mg/kg	----	500	----	----	<5 --	----	----
Zinc	EG005T	5	mg/kg	----	35000	----	----	**41** ± 5	----	----
EG035T: Total Recoverable Mercury by FIMS										
Mercury	EG035T	0.1	mg/kg	----	75	----	----	<0.1 --	----	----
EG048: Hexavalent Chromium (Alkaline Digest)										
Hexavalent Chromium	EG048G	0.5	mg/kg	----	500	----	----	<0.5 --	----	----
EK026SF: Total CN by Segmented Flow Analyser										
Total Cyanide	EK026SF	1	mg/kg	----	2500	----	----	<1 --	----	----
EK040T: Fluoride Total										
Fluoride	EK040T	40	mg/kg	----	10000	----	----	**320** ± 60	----	----
EP074A: Monocyclic Aromatic Hydrocarbons										
Benzene	EP074-UT	0.2	mg/kg	----	4	----	----	<0.2 --	----	----
Sum of monocyclic aromatic hydrocarbons	EP074-UT-SUM	0.2	mg/kg	----	70	----	----	<0.2 --	----	----
EP074I: Volatile Halogenated Compounds										
Vinyl chloride	EP074-UT	0.02	mg/kg	----	1.2	----	----	<0.02 --	----	----
Hexachlorobutadiene	EP074-UT	0.02	mg/kg	----	2.8	----	----	<0.02 --	----	----
Sum of other chlorinated hydrocarbons	EP074-UT-SUM	0.01	mg/kg	----	10	----	----	<0.01 --	----	----
EP075A: Phenolic Compounds (Halogenated)										
Sum of Phenols (halogenated)	EP075-EM-SUM	0.03	mg/kg	----	10	----	----	<0.03 --	----	----
EP075A: Phenolic Compounds (Non-halogenated)										
Sum of Phenols (non-halogenated)	EP075-EM-SUM	1	mg/kg	----	560	----	----	<1 --	----	----
EP075B: Polynuclear Aromatic Hydrocarbons										
Benzo(a)pyrene	EP075-EM	0.5	mg/kg	----	5	----	----	<0.5 --	----	----
Sum of polycyclic aromatic hydrocarbons	EP075-EM-SUM	0.5	mg/kg	----	100	----	----	<0.5 --	----	----

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Category C: Table 2: Soil Hazard Categorisation Thresholds : Category C

Sub-Matrix: **SEDIMENT**

				Sample ID	Guideline	Guideline	**Waste01**	**Waste02**	**Waste03**	**----**	**----**
				Sampling date/time			06-Sep-2021 15:00	06-Sep-2021 15:00	06-Sep-2021 15:00	----	----
Compound	*Method*	*LOR*	*Unit*		Lower Limit	Upper Limit	**EM2117682-001** MU	**EM2117682-002** MU	**EM2117682-003** MU		
EP075l: Organochlorine Pesticides											
Heptachlor	EP075-EM	0.03	mg/kg		----	1.2	**----**	**----**	<0.03 --	**----**	**----**
Sum of Aldrin + Dieldrin	EP075-EM-SUM	0.03	mg/kg		----	1.2	**----**	**----**	<0.03 --	**----**	**----**
Sum of DDD + DDE + DDT	EP075-EM-SUM	0.05	mg/kg		----	50	**----**	**----**	<0.05 --	**----**	**----**
Chlordane	EP075-EM-SUM	0.03	mg/kg		----	4	**----**	**----**	<0.03 --	**----**	**----**
Sum of other organochlorine pesticides	EP075-EM-SUM	0.03	mg/kg		----	10	**----**	**----**	<0.03 --	**----**	**----**
EP080/071: Total Petroleum Hydrocarbons											
C6 - C9 Fraction	EP074-UT	10	mg/kg		----	650	**----**	**----**	<10 --	**----**	**----**
C10 - C36 Fraction (sum)	EP071-EM	50	mg/kg		----	10000	**----**	**----**	<50 --	**----**	**----**

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Fill Material: Table 2: Soil Hazard Categorisation Thresholds : Fill Material

Sub-Matrix: **SEDIMENT**

Compound	*Method*	*LOR*	*Unit*	*Sample ID* / *Sampling date/time* / Guideline Lower Limit	Guideline Upper Limit	**Waste01** 06-Sep-2021 15:00 **EM2117682-001** MU	**Waste02** 06-Sep-2021 15:00 **EM2117682-002** MU	**Waste03** 06-Sep-2021 15:00 **EM2117682-003** MU	---- ----	---- ----
EA001: pH in soil using 0.01M CaCl extract										
pH (CaCl2)	EA001	0.1	pH Unit	4	9	----	----	**8.6** ± 0.2	----	----
EG005(ED093)T: Total Metals by ICP-AES										
Arsenic	EG005T	5	mg/kg	----	20	----	----	**9** ± 2	----	----
Cadmium	EG005T	1	mg/kg	----	3	----	----	<1 --	----	----
Copper	EG005T	5	mg/kg	----	100	----	----	**9** ± 1	----	----
Lead	EG005T	5	mg/kg	----	300	----	----	**12** ± 2	----	----
Molybdenum	EG005T	2	mg/kg	----	40	----	----	<2 --	----	----
Nickel	EG005T	2	mg/kg	----	60	----	----	**21** ± 2	----	----
Selenium	EG005T	5	mg/kg	----	10	----	----	<5 --	----	----
Silver	EG005T	2	mg/kg	----	10	----	----	<2 --	----	----
Tin	EG005T	5	mg/kg	----	50	----	----	<5 --	----	----
Zinc	EG005T	5	mg/kg	----	200	----	----	**41** ± 5	----	----
EG035T: Total Recoverable Mercury by FIMS										
Mercury	EG035T	0.1	mg/kg	----	1	----	----	<0.1 --	----	----
EG048: Hexavalent Chromium (Alkaline Digest)										
Hexavalent Chromium	EG048G	0.5	mg/kg	----	1	----	----	<0.5 --	----	----
EK026SF: Total CN by Segmented Flow Analyser										
Total Cyanide	EK026SF	1	mg/kg	----	50	----	----	<1 --	----	----
EK040T: Fluoride Total										
Fluoride	EK040T	40	mg/kg	----	450	----	----	**320** ± 60	----	----
EP066: Polychlorinated Biphenyls (PCB)										
Total Polychlorinated biphenyls	EP066-EM	0.1	mg/kg	----	2	----	----	<0.1 --	----	----
EP074A: Monocyclic Aromatic Hydrocarbons										
Benzene	EP074-UT	0.2	mg/kg	----	1	----	----	<0.2 --	----	----
Sum of monocyclic aromatic hydrocarbons	EP074-UT-SUM	0.2	mg/kg	----	7	----	----	<0.2 --	----	----
EP074I: Volatile Halogenated Compounds										
Sum of volatile chlorinated hydrocarbons	EP074-UT-SUM	0.01	mg/kg	----	1	----	----	<0.01 --	----	----
EP075A: Phenolic Compounds (Halogenated)										
Sum of Phenols (halogenated)	EP075-EM-SUM	0.03	mg/kg	----	1	----	----	<0.03 --	----	----
EP075A: Phenolic Compounds (Non-halogenated)										
Sum of Phenols (non-halogenated)	EP075-EM-SUM	1	mg/kg	----	60	----	----	<1 --	----	----
EP075B: Polynuclear Aromatic Hydrocarbons										
Benzo(a)pyrene	EP075-EM	0.5	mg/kg	----	1	----	----	<0.5 --	----	----
Sum of polycyclic aromatic hydrocarbons	EP075-EM-SUM	0.5	mg/kg	----	20	----	----	<0.5 --	----	----

Soil Hazard Categorisation and Management

Table 2: Soil Hazard Categorisation Thresholds : Fill Material: Table 2: Soil Hazard Categorisation Thresholds : Fill Material

Sub-Matrix: **SEDIMENT**

Compound	*Method*	*LOR*	*Unit*	*Sample ID* / *Sampling date/time*	Guideline Lower Limit	Guideline Upper Limit	**Waste01** 06-Sep-2021 15:00 **EM2117682-001** MU	**Waste02** 06-Sep-2021 15:00 **EM2117682-002** MU	**Waste03** 06-Sep-2021 15:00 **EM2117682-003** MU	**----** ----	**----** ----
EP075I: Organochlorine Pesticides											
Sum of organochlorine pesticides	EP075-EM-SUM	0.03	mg/kg		----	1	**----**	**----**	<0.03 --	**----**	**----**
EP080/071: Total Petroleum Hydrocarbons											
C6 - C9 Fraction	EP074-UT	10	mg/kg		----	100	**----**	**----**	<10 --	**----**	**----**
C10 - C36 Fraction (sum)	EP071-EM	50	mg/kg		----	1000	**----**	**----**	<50 --	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM2117682**	Page	: 1 of 13
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 9653 1234	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 07-Sep-2021
Order number	: Viva Geelong Offshore	Date Analysis Commenced	: 07-Sep-2021
C-O-C number	: ----	Issue Date	: 13-Sep-2021
Sampler	: BC		
Site	: ----		
Quote number	: ME/386/21 V2		
No. of samples received	: 3		
No. of samples analysed	: 3		

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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, unless the sampling was conducted by ALS. 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
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Morgan Lennox	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3888059)									
EM2117687-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	9	8	0.0	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	7	6	0.0	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	8	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	6	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	14	15	0.0	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	23	16	33.3	No Limit
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 3888056)									
EM2117682-003	Waste03	EA001: pH (CaCl2)	----	0.1	pH Unit	8.6	8.6	0.0	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3888078)									
EM2117687-004	Anonymous	EA055: Moisture Content	----	0.1	%	7.0	6.6	6.1	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3888058)									
EM2117687-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 3888061)									
EM2117682-003	Waste03	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 3888568)									
EM2117516-042	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
EK040T: Fluoride Total (QC Lot: 3888060)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK040T: Fluoride Total (QC Lot: 3888060) - continued									
EM2117682-003	Waste03	EK040T: Fluoride	16984-48-8	40	mg/kg	320	240	30.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3888070)									
EM2117682-003	Waste03	EP066-EM: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 3888064)									
EM2117682-003	Waste03	EP074-UT: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP074-UT: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: Styrene	100-42-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP074-UT: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP074H: Naphthalene (QC Lot: 3888064)									
EM2117682-003	Waste03	EP074-UT: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP074I: Volatile Halogenated Compounds (QC Lot: 3888064)									
EM2117682-003	Waste03	EP074-UT: 1.1-Dichloroethene	75-35-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: cis-1.2-Dichloroethene	156-59-2	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: 1.1.1-Trichloroethane	71-55-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: Carbon Tetrachloride	56-23-5	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: 1.1.1.2-Tetrachloroethane	630-20-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: 1.2.4-Trichlorobenzene	120-82-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EP074-UT: Vinyl chloride	75-01-4	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: trans-1.2-Dichloroethene	156-60-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: Chloroform	67-66-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: 1.2-Dichloroethane	107-06-2	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: Trichloroethene	79-01-6	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: Tetrachloroethene	127-18-4	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: 1.1.2.2-Tetrachloroethane	79-34-5	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: Hexachlorobutadiene	87-68-3	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: Chlorobenzene	108-90-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: 1.4-Dichlorobenzene	106-46-7	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: 1.2-Dichlorobenzene	95-50-1	0.02	mg/kg	<0.02	<0.02	0.0	No Limit
		EP074-UT: 1.1.2-Trichloroethane	79-00-5	0.04	mg/kg	<0.04	<0.04	0.0	No Limit
		EP074-UT: Methylene chloride	75-09-2	0.4	mg/kg	<0.4	<0.4	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3888066)									
EM2117687-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3888066) - continued									
EM2117687-001	Anonymous	EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075A: Phenolic Compounds (Halogenated) (QC Lot: 3888068)									
EM2117682-003	Waste03	EP075-EM: 2-Chlorophenol	95-57-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2.4-Dichlorophenol	120-83-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2.6-Dichlorophenol	87-65-0	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2.3.5.6-Tetrachlorophenol	935-95-5	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 2.4.5-Trichlorophenol	95-95-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 2.4.6-Trichlorophenol	88-06-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 2.3.4.5 & 2.3.4.6-Tetrachlorophenol	4901-51-3/58-90-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: Pentachlorophenol	87-86-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075A: Phenolic Compounds (Non-halogenated) (QC Lot: 3888068)									
EM2117682-003	Waste03	EP075-EM: Phenol	108-95-2	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2-Methylphenol	95-48-7	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2-Nitrophenol	88-75-5	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2.4-Dimethylphenol	105-67-9	1	mg/kg	<1	<1	0.0	No Limit
		EP075-EM: 2.4-Dinitrophenol	51-28-5	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 4-Nitrophenol	100-02-7	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 2-Methyl-4.6-dinitrophenol	8071-51-0	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: Dinoseb	88-85-7	5	mg/kg	<5	<5	0.0	No Limit
		EP075-EM: 2-Cyclohexyl-4.6-Dinitrophenol	131-89-5	5	mg/kg	<5	<5	0.0	No Limit
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3888068)									
EM2117682-003	Waste03	EP075-EM: Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3888068) - continued									
EM2117682-003	Waste03	EP075-EM: Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075-EM: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1.0	<1.0	0.0	No Limit
EP075I: Organochlorine Pesticides (QC Lot: 3888068)									
EM2117682-003	Waste03	EP075-EM: alpha-BHC	319-84-6	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: beta-BHC	319-85-7	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: gamma-BHC	58-89-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: delta-BHC	319-86-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Heptachlor	76-44-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Aldrin	309-00-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Dieldrin	60-57-1	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endrin	72-20-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: Methoxychlor	72-43-5	0.03	mg/kg	<0.03	<0.03	0.0	No Limit
		EP075-EM: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP075-EM: 4.4`-DDT	50-29-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3888064)									
EM2117682-003	Waste03	EP074-UT: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3888069)									
EM2117682-003	Waste03	EP071-EM: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3888064)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3888064) - continued									
EM2117682-003	Waste03	EP074-UT: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
		EP074-UT: C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3888069)									
EM2117682-003	Waste03	EP071-EM: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071-EM: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3893684)									
EM2117682-001	Waste01	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<3	<3	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3888569)									
EM2117682-003	Waste03	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0005	0.0005	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3888569)									
EM2117682-003	Waste03	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3888569)									
EM2117682-003	Waste03	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3888569) - continued									
EM2117682-003	Waste03	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3888569)									
EM2117682-003	Waste03	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 3888569)									
EM2117682-003	Waste03	EP231X: Sum of PFAS	----	0.0002	mg/kg	0.0005	0.0005	0.0	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0005	0.0005	0.0	No Limit
		EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0005	0.0005	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (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 (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3888059)								
EG005T: Antimony	7440-36-0	5	mg/kg	<5	2.57 mg/kg	87.9	70.0	130
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	123 mg/kg	104	70.0	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.23 mg/kg	67.9	50.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	108	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	55.9 mg/kg	98.2	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.4 mg/kg	99.1	70.0	130
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	2.19 mg/kg	82.5	70.0	130
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	99.6	70.0	130
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.9 mg/kg	82.4	70.0	130
EG005T: Tin	7440-31-5	5	mg/kg	<5	5.33 mg/kg	93.6	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	79.4	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3888058)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.64 mg/kg	93.8	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 3888061)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	20 mg/kg	75.6	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3888568)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	20 mg/kg	86.6	70.0	130
EK040T: Fluoride Total (QCLot: 3888060)								
EK040T: Fluoride	16984-48-8	40	mg/kg	<40	400 mg/kg	90.0	75.2	110
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3888070)								
EP066-EM: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	105	67.4	136
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 3888064)								
EP074-UT: Benzene	71-43-2	0.2	mg/kg	<0.2	2.1 mg/kg	94.1	69.2	116
EP074-UT: Toluene	108-88-3	0.5	mg/kg	<0.5	2.1 mg/kg	96.7	67.7	116
EP074-UT: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2.1 mg/kg	94.7	66.6	115
EP074-UT: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4.2 mg/kg	93.5	65.2	112
EP074-UT: Styrene	100-42-5	0.5	mg/kg	<0.5	2.1 mg/kg	93.4	69.4	111
EP074-UT: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2.1 mg/kg	93.5	68.4	110
EP074H: Naphthalene (QCLot: 3888064)								
EP074-UT: Naphthalene	91-20-3	1	mg/kg	<1	0.6 mg/kg	98.0	72.3	114
EP074I: Volatile Halogenated Compounds (QCLot: 3888064)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP074I: Volatile Halogenated Compounds (QCLot: 3888064) - continued								
EP074-UT: Vinyl chloride	75-01-4	0.02	mg/kg	<0.02	0.1 mg/kg	87.6	47.0	138
EP074-UT: 1.1-Dichloroethene	75-35-4	0.01	mg/kg	<0.01	0.1 mg/kg	90.6	57.6	125
EP074-UT: Methylene chloride	75-09-2	0.4	mg/kg	<0.4	2.1 mg/kg	87.7	72.3	115
EP074-UT: trans-1.2-Dichloroethene	156-60-5	0.02	mg/kg	<0.02	0.1 mg/kg	94.2	60.5	122
EP074-UT: cis-1.2-Dichloroethene	156-59-2	0.01	mg/kg	<0.01	0.1 mg/kg	92.8	70.3	112
EP074-UT: Chloroform	67-66-3	0.02	mg/kg	<0.02	0.1 mg/kg	93.0	66.6	115
EP074-UT: 1.1.1-Trichloroethane	71-55-6	0.01	mg/kg	<0.01	0.1 mg/kg	93.2	64.4	122
EP074-UT: Carbon Tetrachloride	56-23-5	0.01	mg/kg	<0.01	0.1 mg/kg	96.2	58.4	127
EP074-UT: 1.2-Dichloroethane	107-06-2	0.02	mg/kg	<0.02	0.1 mg/kg	89.9	72.9	114
EP074-UT: Trichloroethene	79-01-6	0.02	mg/kg	<0.02	0.1 mg/kg	96.4	64.7	115
EP074-UT: 1.1.2-Trichloroethane	79-00-5	0.04	mg/kg	<0.04	0.1 mg/kg	99.6	72.6	116
EP074-UT: Tetrachloroethene	127-18-4	0.02	mg/kg	<0.02	0.1 mg/kg	95.7	60.0	119
EP074-UT: 1.1.1.2-Tetrachloroethane	630-20-6	0.01	mg/kg	<0.01	0.1 mg/kg	105	71.8	116
EP074-UT: 1.1.2.2-Tetrachloroethane	79-34-5	0.02	mg/kg	<0.02	0.1 mg/kg	92.7	66.1	116
EP074-UT: Hexachlorobutadiene	87-68-3	0.02	mg/kg	<0.02	0.1 mg/kg	101	39.8	128
EP074-UT: Chlorobenzene	108-90-7	0.02	mg/kg	<0.02	0.1 mg/kg	94.8	70.3	113
EP074-UT: 1.4-Dichlorobenzene	106-46-7	0.02	mg/kg	<0.02	0.1 mg/kg	90.3	62.6	113
EP074-UT: 1.2-Dichlorobenzene	95-50-1	0.02	mg/kg	<0.02	0.1 mg/kg	91.4	70.8	110
EP074-UT: 1.2.4-Trichlorobenzene	120-82-1	0.01	mg/kg	<0.01	0.1 mg/kg	102	48.4	120
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3888066)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	104	85.7	123
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	106	81.0	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	105	83.6	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	102	81.3	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	103	79.4	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	98.4	81.7	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	103	78.3	124
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	102	79.9	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	94.8	76.9	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	96.7	80.9	130
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	96.0	70.0	121
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	95.4	80.4	130
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	102	70.2	123
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	95.5	67.9	122
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	97.1	65.8	123
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	95.8	65.8	127
EP075A: Phenolic Compounds (Halogenated) (QCLot: 3888068)								
EP075-EM: 2-Chlorophenol	95-57-8	0.03	mg/kg	<0.03	2 mg/kg	92.1	74.5	126

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075A: Phenolic Compounds (Halogenated) (QCLot: 3888068) - continued								
EP075-EM: 2.4-Dichlorophenol	120-83-2	0.03	mg/kg	<0.03	2 mg/kg	85.5	72.7	126
EP075-EM: 2.6-Dichlorophenol	87-65-0	0.03	mg/kg	<0.03	2 mg/kg	87.7	73.5	132
EP075-EM: 4-Chloro-3-methylphenol	59-50-7	0.03	mg/kg	<0.03	2 mg/kg	87.4	72.8	128
EP075-EM: 2.4.5-Trichlorophenol	95-95-4	0.05	mg/kg	<0.05	2 mg/kg	88.2	73.3	134
EP075-EM: 2.4.6-Trichlorophenol	88-06-2	0.05	mg/kg	<0.05	2 mg/kg	87.0	72.4	128
EP075-EM: 2.3.5.6-Tetrachlorophenol	935-95-5	0.03	mg/kg	<0.03	2 mg/kg	83.6	69.4	126
EP075-EM: 2.3.4.5 & 2.3.4.6-Tetrachlorophenol	4901-51-3/5 8-90-2	0.05	mg/kg	<0.05	4 mg/kg	85.4	71.9	128
EP075-EM: Pentachlorophenol	87-86-5	0.2	mg/kg	<0.2	4 mg/kg	66.8	54.4	135
EP075A: Phenolic Compounds (Non-halogenated) (QCLot: 3888068)								
EP075-EM: Phenol	108-95-2	1	mg/kg	<1	2 mg/kg	93.7	71.5	130
EP075-EM: 2-Methylphenol	95-48-7	1	mg/kg	<1	2 mg/kg	90.8	73.4	129
EP075-EM: 3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	4 mg/kg	89.1	74.3	129
EP075-EM: 2-Nitrophenol	88-75-5	1	mg/kg	<1	2 mg/kg	85.5	70.9	133
EP075-EM: 2.4-Dimethylphenol	105-67-9	1	mg/kg	<1	2 mg/kg	88.1	71.8	132
EP075-EM: 2.4-Dinitrophenol	51-28-5	5	mg/kg	<5	10 mg/kg	56.8	41.0	156
EP075-EM: 4-Nitrophenol	100-02-7	5	mg/kg	<5	10 mg/kg	87.5	65.3	134
EP075-EM: 2-Methyl-4.6-dinitrophenol	8071-51-0	5	mg/kg	<5	10 mg/kg	66.4	43.6	128
EP075-EM: Dinoseb	88-85-7	5	mg/kg	<5	10 mg/kg	70.3	62.0	128
EP075-EM: 2-Cyclohexyl-4.6-Dinitrophenol	131-89-5	5	mg/kg	<5	10 mg/kg	44.5	34.5	137
EP075B: Polynuclear Aromatic Hydrocarbons (QCLot: 3888068)								
EP075-EM: Naphthalene	91-20-3	0.5	mg/kg	<0.5	2 mg/kg	86.7	73.0	131
EP075-EM: Acenaphthene	83-32-9	0.5	mg/kg	<0.5	2 mg/kg	90.9	76.3	130
EP075-EM: Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	2 mg/kg	91.8	72.0	135
EP075-EM: Fluorene	86-73-7	0.5	mg/kg	<0.5	2 mg/kg	87.8	74.4	131
EP075-EM: Phenanthrene	85-01-8	0.5	mg/kg	<0.5	2 mg/kg	88.3	73.3	130
EP075-EM: Anthracene	120-12-7	0.5	mg/kg	<0.5	2 mg/kg	88.3	78.4	127
EP075-EM: Fluoranthene	206-44-0	0.5	mg/kg	<0.5	2 mg/kg	88.3	75.3	132
EP075-EM: Pyrene	129-00-0	0.5	mg/kg	<0.5	2 mg/kg	89.2	75.4	130
EP075-EM: Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	2 mg/kg	89.0	69.6	133
EP075-EM: Chrysene	218-01-9	0.5	mg/kg	<0.5	2 mg/kg	92.1	75.0	133
EP075-EM: Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	1	mg/kg	<1.0	4 mg/kg	95.6	75.8	133
EP075-EM: Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	2 mg/kg	107	65.1	130
EP075-EM: Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	2 mg/kg	88.1	72.1	134
EP075-EM: Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	2 mg/kg	91.3	72.9	135
EP075-EM: Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	2 mg/kg	92.1	71.3	134
EP075I: Organochlorine Pesticides (QCLot: 3888068)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075I: Organochlorine Pesticides (QCLot: 3888068) - continued								
EP075-EM: alpha-BHC	319-84-6	0.03	mg/kg	<0.03	2 mg/kg	90.6	71.0	129
EP075-EM: Hexachlorobenzene (HCB)	118-74-1	0.03	mg/kg	<0.03	2 mg/kg	87.1	74.8	126
EP075-EM: beta-BHC	319-85-7	0.03	mg/kg	<0.03	2 mg/kg	90.0	75.7	130
EP075-EM: gamma-BHC	58-89-9	0.03	mg/kg	<0.03	2 mg/kg	92.5	70.8	130
EP075-EM: delta-BHC	319-86-8	0.03	mg/kg	<0.03	2 mg/kg	95.2	76.5	134
EP075-EM: Heptachlor	76-44-8	0.03	mg/kg	<0.03	2 mg/kg	85.9	75.5	131
EP075-EM: Aldrin	309-00-2	0.03	mg/kg	<0.03	2 mg/kg	88.7	76.8	130
EP075-EM: Heptachlor epoxide	1024-57-3	0.03	mg/kg	<0.03	2 mg/kg	88.8	73.6	130
EP075-EM: cis-Chlordane	5103-71-9	0.03	mg/kg	<0.03	2 mg/kg	86.6	75.0	133
EP075-EM: trans-Chlordane	5103-74-2	0.03	mg/kg	<0.03	2 mg/kg	86.0	75.3	131
EP075-EM: Endosulfan 1	959-98-8	0.03	mg/kg	<0.03	2 mg/kg	109	69.4	134
EP075-EM: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	2 mg/kg	86.0	71.0	132
EP075-EM: Dieldrin	60-57-1	0.03	mg/kg	<0.03	2 mg/kg	91.4	78.0	133
EP075-EM: Endrin aldehyde	7421-93-4	0.03	mg/kg	<0.03	2 mg/kg	88.7	69.0	143
EP075-EM: Endrin	72-20-8	0.03	mg/kg	<0.03	2 mg/kg	142	55.7	145
EP075-EM: Endosulfan 2	33213-65-9	0.03	mg/kg	<0.03	2 mg/kg	95.9	71.4	135
EP075-EM: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	2 mg/kg	90.9	74.8	134
EP075-EM: Endosulfan sulfate	1031-07-8	0.03	mg/kg	<0.03	2 mg/kg	100	70.2	135
EP075-EM: 4.4`-DDT	50-29-3	0.05	mg/kg	<0.05	2 mg/kg	89.7	77.7	133
EP075-EM: Methoxychlor	72-43-5	0.03	mg/kg	<0.03	2 mg/kg	97.3	63.6	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3888064)								
EP074-UT: C6 - C9 Fraction	----	10	mg/kg	<10	39.6 mg/kg	89.1	61.1	119
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3888069)								
EP071-EM: C10 - C14 Fraction	----	50	mg/kg	<50	840 mg/kg	101	74.4	129
EP071-EM: C15 - C28 Fraction	----	100	mg/kg	<100	2900 mg/kg	99.9	81.0	123
EP071-EM: C29 - C36 Fraction	----	100	mg/kg	<100	1490 mg/kg	99.2	81.8	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3888064)								
EP074-UT: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	48.9 mg/kg	91.8	59.9	119
EP074-UT: C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3888069)								
EP071-EM: >C10 - C16 Fraction	----	50	mg/kg	<50	1110 mg/kg	98.6	75.4	132
EP071-EM: >C16 - C34 Fraction	----	100	mg/kg	<100	3900 mg/kg	99.3	80.8	120
EP071-EM: >C34 - C40 Fraction	----	100	mg/kg	<100	290 mg/kg	99.9	73.3	136
EP090: Organotin Compounds (QCLot: 3893684)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	128	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	99.4	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	99.3	52.0	139

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3888569)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00111 mg/kg	95.6	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	94.2	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0014 mg/kg	83.1	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	93.9	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	94.6	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00121 mg/kg	93.8	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3888569)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	92.3	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.4	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.6	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.0	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.4	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	90.3	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.7	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.2	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00468 mg/kg	109	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3888569)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.0	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	104	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	99.7	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	107	70.0	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	95.2	70.0	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	126	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3888569)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00117 mg/kg	89.0	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00119 mg/kg	87.9	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.0012 mg/kg	109	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00121 mg/kg	105	70.0	130
EP231P: PFAS Sums (QCLot: 3888569)								
EP231X: Sum of PFAS	----	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	mg/kg	<0.0002	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231P: PFAS Sums (QCLot: 3888569) - continued								
EP231X: Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<0.0002	----	----	----	----

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3888059)							
EM2117687-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	106	78.0	124
		EG005T: Cadmium	7440-43-9	50 mg/kg	91.3	79.7	116
		EG005T: Chromium	7440-47-3	50 mg/kg	95.0	79.0	121
		EG005T: Copper	7440-50-8	250 mg/kg	101	80.0	120
		EG005T: Lead	7439-92-1	250 mg/kg	94.8	80.0	120
		EG005T: Nickel	7440-02-0	50 mg/kg	91.6	78.0	120
		EG005T: Zinc	7440-66-6	250 mg/kg	85.0	80.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3888058)							
EM2117687-001	Anonymous	EG035T: Mercury	7439-97-6	0.5 mg/kg	107	76.0	116
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3888568)							
EM2117682-003	Waste03	EK026SF: Total Cyanide	57-12-5	20 mg/kg	104	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3888066)							
EM2117687-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	91.8	77.2	116
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	98.4	65.5	136
EP090: Organotin Compounds (QCLot: 3893684)							
EM2117682-002	Waste02	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	22.4	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	62.8	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	71.3	20.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2117682**	Page	: 1 of 9
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	[redacted]	Telephone	: +6138549 9645
Project	: Viva geelong offshore	Date Samples Received	: 07-Sep-2021
Site	: ----	Issue Date	: 13-Sep-2021
Sampler	: BC	No. of samples received	: 3
Order number	: Viva Geelong Offshore	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

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

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Hexavalent Chromium by Alkaline Digestion and DA Finish	0	1	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	0	1	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)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	07-Sep-2021	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
Waste01, Waste02, Waste03	**06-Sep-2021**	**----**	----	----	**07-Sep-2021**	20-Sep-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
Waste01, Waste02, Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	05-Mar-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
Waste01, Waste02, Waste03	**06-Sep-2021**	**07-Sep-2021**	04-Oct-2021	✓	**08-Sep-2021**	04-Oct-2021	✓
EG048: Hexavalent Chromium (Alkaline Digest)							
Soil Glass Jar - Unpreserved (EG048G)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	04-Oct-2021	✓	**07-Sep-2021**	14-Sep-2021	✓

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
EK026SF: Total CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK026SF)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**08-Sep-2021**	21-Sep-2021	✓
EK040T: Fluoride Total							
Soil Glass Jar - Unpreserved (EK040T)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	04-Oct-2021	✓	**07-Sep-2021**	04-Oct-2021	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066-EM)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074-UT)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	13-Sep-2021	✓
EP074H: Naphthalene							
Soil Glass Jar - Unpreserved (EP074-UT)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	13-Sep-2021	✓
EP074I: Volatile Halogenated Compounds							
Soil Glass Jar - Unpreserved (EP074-UT)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	13-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
Waste01, Waste02	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP075A: Phenolic Compounds (Halogenated)							
Soil Glass Jar - Unpreserved (EP075-EM)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP075A: Phenolic Compounds (Non-halogenated)							
Soil Glass Jar - Unpreserved (EP075-EM)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP075B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075-EM)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP075I: Organochlorine Pesticides							
Soil Glass Jar - Unpreserved (EP075-EM)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	20-Sep-2021	✓	**07-Sep-2021**	17-Oct-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074-UT)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	13-Sep-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP074-UT)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	13-Sep-2021	✓	**07-Sep-2021**	13-Sep-2021	✓

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
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090)							
Waste01, Waste02	**06-Sep-2021**	**10-Sep-2021**	20-Sep-2021	✓	**10-Sep-2021**	20-Oct-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	17-Oct-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	17-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	17-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	17-Oct-2021	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)							
Waste03	**06-Sep-2021**	**07-Sep-2021**	05-Mar-2022	✓	**07-Sep-2021**	17-Oct-2021	✓

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)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	1	**200.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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*	
Method Blanks (MB) - Continued							
Total Mercury by FIMS	EG035T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	0	1	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB - VIC EPA 448.3 Screen	EP066-EM	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Semivolatile Organic Compounds - Waste Classification	EP075-EM	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fluoride	EK040T	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071-EM	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds - Ultra-trace	EP074-UT	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

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 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 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 Schedule B(3).
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 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 Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511 / ISO 14403. 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 Schedule B(3).
Total Fluoride	EK040T	SOIL	(In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.
PCB - VIC EPA 448.3 Screen	EP066-EM	SOIL	In house: Referenced to USEPA SW 846 - 8270 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 Schedule B(3).
TRH - Semivolatile Fraction	EP071-EM	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.
Volatile Organic Compounds - Ultra-trace	EP074-UT	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS in partial SIM/Scan mode. Quantification is by comparison against an established multi-point calibration curves. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Volatile Organic Compounds - Ultra-trace - Summations	EP074-UT-SUM	SOIL	Summation of MAHs and VHCs
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. 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 Schedule B(3)
Semivolatile Organic Compounds - Waste Classification	EP075-EM	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
SVOC - Waste Classification (Sums)	EP075-EM-SUM	SOIL	Summations for EP075 (EM variation)
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

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.
pH in soil using a 0.01M CaCl2 extract	EA001-PR	SOIL	In house: Referenced to Rayment and Lyons 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 Schedule B(3).
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Total Fluoride	EK040T-PR	SOIL	In house: Samples are fused with Sodium Carbonate / Potassium Carbonate flux.
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 Schedule B(3).
Methanolic Extraction of Soils - Ultra-trace.	ORG16-UT	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.
Tumbler Extraction of Solids - VIC EPA Screen	ORG17-EM	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.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Preparation Methods	Method	Matrix	Method Descriptions
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2117682**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: [redacted]	Contact	: [redacted]
Address	: COLLINS SQUARE LEVEL 10, TOWER TWO 727 COLLINS STREET MELBOURNE VIC, AUSTRALIA 3004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: [redacted]	E-mail	: [redacted]
Telephone	: [redacted]	Telephone	: [redacted]5
Facsimile	: +61 03 9654 7117	Facsimile	: +61-3-8549 9626
Project	: Viva geelong offshore	Page	: 1 of 2
Order number	: ----	Quote number	: EM2021AECOMAU0004 (ME/386/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BC		

Dates

Date Samples Received	: 07-Sep-2021 10:25	Issue Date	: 07-Sep-2021
Client Requested Due Date	: 14-Sep-2021	Scheduled Reporting Date	: **08-Sep-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 1.8°C - Ice present
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
- **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 and ALS Brisbane.**
- **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 laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Preliminary results will be available on the scheduled reporting date listed in this report. However the final report with TBT analysis will be complete on 14/09/2021.
- 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.

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	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG035T (solids) Total Mercury by FIMS	SOIL - EP075 SIM PAH only SIM - PAH only	SOIL - EP090 (solids) Organotins	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)	SOIL - P-16 IWRG 621
EM2117682-001	06-Sep-2021 00:00	Waste01	✓	✓	✓	✓	✓		
EM2117682-002	06-Sep-2021 00:00	Waste02	✓	✓	✓	✓	✓		
EM2117682-003	06-Sep-2021 00:00	Waste03	✓					✓	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- A4 - AU Tax Invoice (INV)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	
- EPA Waste Classification & Categorisation Guideline Report (COA_GL_EPA_WASTE)	Email	
- Purchase Order Request Letter (PO_Request)	Email	

[redacted]

- *AU Certificate of Analysis - NATA (COA)	Email	[redacted]
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	
- Chain of Custody (CoC) (COC)	Email	
- EDI Format - ENMRG (ENMRG)	Email	
- EDI Format - ESDAT (ESDAT)	Email	
- EPA Waste Classification & Categorisation Guideline Report (COA_GL_EPA_WASTE)	Email	

Appendix H

Data Validation

DATA VALIDATION REPORT

Project #:	60642423	**Validation by:**	[redacted]	**Date:**	20/09/2021
Client:	VIVA	**Data verified by:**	[redacted]	**Date:**	20/09/2021
Site:	Geelong Refinery	**Matrix type:**	Sediment		
Project Manager	[redacted]	**Primary samples:**	66 – Sediment 2 - Pore water 3 - Seawater 25 - Elutriate		
Laboratory:	Envirolab (Primary), ALS Environmental (Secondary)				
Lab reference:	*Sediment:* 276460, 276673, 276959, 277161, 277486, 277569, 277707, EM2116795, EM2117075, EM2117375, EM2117682, EM2117925 *Pore Water:* 277569-B, 277486-B *Elutriate:* 276673-A, 276959-A, 277161-A, 277486-A, 277569-A, 277707-A *Sea Water:* 276460				
Key Issues:	No QA/QC issues were identified in the field or laboratory datasets that could have a material implication to decision-making on the project.				

Field Quality Assurance and Quality Control

Sample Density/ Adherence to SAQP	13 Loading Site sediment sampling locations were investigated in accordance with the SAQP to compliment the pre-existing Coffey data locations. 14 ambient sediment sampling locations were investigated in accordance with the SAQP. 6 Disposal Ground sediment sampling locations were investigated in accordance with the SAQP. 3 seawater samples were taken in accordance with the SAQP 2 porewater samples were recovered which is not in accordance with SAQP (7 samples proposed). This was due to the clayey nature of the material and the significance is discussed in the main report. 25 elutriate samples taken from selected sediment samples (based on sediment sample results). NAGD guidelines specify a minimum of 7 samples. Seven additional samples were taken along the SWTP in accordance with the SAQP addendum.

DATA VALIDATION REPORT	
Sample Depth	Samples could not be collected at 0.5 m intervals within the first 2 m for the following samples: BH-BP-20 (0.0-1) BH-BP-21 (0.0-1) BH-SB-32 (0.0-1) The bore logs indicate similar lithology and therefore the samples which could be collected are considered representative of Domain 1a layer. Sample locations at the Loading Site were completed to the proposed depth of dredging at a particular location. The maximum investigated depth was 7 m. Sample depths at the Disposal Ground and Ambient Site were 0.5 m which was suitable to investigate the surface quality for placement of dredged material.
Sampling personnel	Sampling was conducted between 19 August and 8 September 2021 during the dredge material assessment was completed by [redacted].
Sampling Methodology	Sediment samples were either collected by diver-assisted hand held polycarbonate corer, barge-mounted drill rigs, Vibracoring or Piston sampling techniques. Seawater samples were collected by grab sampler.
Chain of Custody (COC)	Chain of custody (COC) documents were completed by Brad Coad.
Analysis Request	The laboratory analysis request and sample receipt notification were reviewed by [redacted] and [redacted].
Rinsate Blank	Rinsate blank samples were collected for every ten primary samples collected with the remaining samples placed on hold. Eleven (11) in total were analysed where all concentrations were reported below the laboratory limit of reporting (LOR) with the following exceptions; - QC300_210819: Monobutyltin 0.02 mg/L. - QC301_210819: Zinc 0.002 mg/L and Monobutyltin 0.02 mg/L. - QC302_210819: Monobutyltin 0.04 mg/L. - QC303_210819: 6:2 FTS 0.0006 µg/L and 8:2 FTS 0.0005 µg/L. - QC304_210819: Chromium 0.002 mg/L, Lead 0.02 mg/ L, Zinc 0.022 mg/L and Monobutyltin 0.04 mg/L. - QC306_210826: Zinc 0.002 mg/L and PFOS 0.0005 µg/L. - QC314_210907: Zinc 0.003 mg/L The rinsate sample QC303 was taken from the seawater tube. The results are one order of magnitude lower than the seawater results and therefore would not impact the interpretation of the results. FTS compounds were not detected in seawater and therefore it is likely that they have come from the seawater sampling equipment. The rinsate sample QC306 was taken from a glove prior to being used on the 26/8/2021. The sample taken that day was BH-BP-19 which did not report detections of PFOS concentrations above the LOR and therefore does not appear to have been impacted the results of BH-BP-19. The concentrations of zinc, monobutyltin and/or chromium detected in the six rinsates are low concentrations which do not impact the results as they were taken during sediment sampling where the sediment concentrations were all below their respective criteria. The metals may be due to concentrations in the rinsate water.

DATA VALIDATION REPORT	
	The origin of the of the detectable lead concentration in the rinsate sample taken during soil sampling is unknown. However the sediments all reported lead concentrations below the respective criteria and therefore the result does not impact the interpretation of the results.
Trip Blank	Trip blank sample were collected at a frequency of one per day of sampling, nine (9) in total. Trip blanks were analysed for PFAS compounds only as the most likely for of cross contamination at low levels during transit would be from PFAS compounds. All PFAS compound concentrations were reported below the laboratory LOR for all analytes tested. This indicates low potential for cross contamination to have occurred due to sample transport.
Frequency of field QC	Field duplicate and triplicates (inter-laboratory duplicates) were collected at a frequency of one in ten primary samples per analysis suite for seawater and sediment. Field duplicates were collected at a frequency of one in twenty primary samples per analysis suite for elutriate samples which were primarily for the analysis of metals and therefore the frequency of one in twenty is considered acceptable. Triplicate samples were not taken for elutriate samples due to the nature of the elutriate sampling methodology which would not allow a meaningful comparison between sediment elutriate data from different laboratories.
Handling and preservation	Primary and duplicate groundwater samples were received preserved and chilled at the laboratory. Sample receipt temperatures were within the recommended range (≤6°C) in 3 out of 7 sample batches. The three sample batches outside of the recommended range of 6°C ranged from 10 to 15°C in reports 277707, 277486, 276460 and 277569. This is likely due to the transit of the samples to Sydney. Triplicate groundwater samples were received preserved and chilled at the laboratory. Sample receipt temperatures were within the recommended range (≤6°C) with the exception of one batch which recorded a receipt temperature of 6.2°C, this is not expected to influence the analysis of the samples. All samples were received at the laboratory in appropriate sample containers. The COPCs analysed for in these batches (metals) are not volatile and therefore the temperature outside the required range is not likely to affect the results.
Laboratory QA/QC	
Tests requested/reported	Samples were analysed and reported as requested on the COC.
Holding time compliance	Samples were extracted and analysed within recommended holding times with the exception of triplicate sample QC601_210819 which was 1 day overdue for organotin compound analysis.
Laboratory Accreditation	The laboratory analysis was conducted by Envirolab Services Pty Ltd (Melbourne) a National Association of Testing Authorities (NATA) accredited laboratory. The triplicate samples were analysed at ALS Environmental Pty Ltd (Melbourne), also a NATA accredited laboratory.

DATA VALIDATION REPORT	
Envirolab Quality Control Summary	
Report Comments	277161, 277569, 277707, 277486: - For some PFAS analytes practical quantitation limits (PQLs) raised to accommodate the outliers. - PAH in Sediment – PQL raised fur to interference from analytes in the sample/s. - Organotin in Soil – Some PQLs raised due to decreased internal standard efficiency due to sample matrix interferences.
	277569, 277707, 277486, 276460, 276673: - PFAS in water trace level: MeFOSA and EtFOSA extracted internal standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria. 277161, 277569, 276460: - All metals in soil – where low spike recovery obtained for the sample it was re-digested and re-spiked and the ow recovery was confirmed, due to matric interferences. However an acceptable recovery was obtained for LCS. 276673, 277569: - PAHs in Sediment – some samples percent recovery not possible to report as the analytes in the sample/s have caused interference and RPD for duplicate results is accepted due to the non-homogenous nature of the sample/s. 277569, 277707, 277486, 276673: - Organotin Compounds in Soil – some PQLs have been raised due to decreased internal standard efficiency, due to sample matrix interferences. 277569: - Organotin Compounds in Water – PQL has been raised due to insufficient sample provided and requiring dilution. 276673: - Total Metals – no unfiltered, preserved sample were received, therefore analysis was conducted from the unpreserved sample bottle, possibility some elements may be underestimated. 276460: - All metals in water-dissolved and total – PQL has been raised due to the sample matric requiring dilution. 277161-A, 277569-A, 277707-A, 277486-A, 276959-A, 276673-A, 277486-B, 277569-B: - For some PFAS analytes practical quantitation limits (PQLs) raised to accommodate the outliers. - PFBA, MeFOSA and EtFOSA extracted internal standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria. 277486-B, 277569-B: - MeFOSA, EtFOSA, MeFOSE, EtFOSE extracted internal standard is outside of global acceptance criteria (50-150%) for (LCS and/or MB) but within analyte specific acceptance criteria.

DATA VALIDATION REPORT

ALS Quality Control Summary	
Frequency of laboratory QC	The laboratory reported a sufficient frequency of quality control samples to assess whether the results have been reported to an acceptable accuracy and precision, with the exception of: - PAH/Phenols (SIM), Total Mercury by FIMS, Total Metals by ICP-AES for Matrix Spikes (EM2117925) - Organotin Analysis for Matrix Spikes (EM2117075) - Hexavalent Chromium by Alkaline Digestion and DA finish, PCB, PFAS, Semivolatile Organic Compounds, Total Fluoride, TRH – Semi fraction and Volatile Organic Compounds – Ultra-trace for Matrix Spikes (EM2117682) - Organotin compounds, PASH/Phenols for Laboratory Duplicates and Matrix Spikes (EM2116795) The Frequency of laboratory QC are presented in the laboratory Quality Control Report.
Method Blank	Method blank concentrations were not detected above the laboratory LOR for all analytes tested.
Laboratory duplicate RPDs (DUP)	Laboratory duplicate Relative Percentage Differences (RPD) were within control limits.
Laboratory control spike recovery (LCS)	Laboratory Control Spikes (LCS) recoveries were within control limits with the exception of: - EM2117375: 10:2 FTS where *recovery less than lower control limit.*
Matrix spike recovery (MS)	All Matrix Spike (MS) recoveries (where reported) were within control limits with the exception of: - EM2117925: PFOS, PSHxA, PFOA where *MS recovery not determined, background level greater than or equal to 4x spike level* and Tributyltin, PFBS, PFDS, PFPeA, PFHpA, PFDA, FOSA, EtFOSAA, 10:2 FTS where *recovery less than lower data quality objective.* - EM2117375: Monobutyltin, PFDS, FOSA, 10:2 FTS where *recovery less than lower data quality objective* and PFHxS, PFDoDA, PFTrDA where *recovery greater than lower data quality objective* and PFOS where *MS recovery not determined, background level greater than or equal to 4x spike level.* - EM2117075: PFDS 10:2 FTS where *recovery less than lower data quality objective*
Surrogate spike recovery	Surrogate spike recoveries were within control limits.
QA/QC Data Evaluation	
Comparison of Field Observations and Laboratory Results	All field observations were consistent with laboratory results.
Data transcription	A random 10% check of the laboratory results identified no anomalies within the electronic data, the laboratory reports, and tables generated by AECOM.

DATA VALIDATION REPORT	
Limits of reporting	Laboratory LORs were generally low to enable assessment against adopted guideline criteria. Where a result is <LOR but the LOR is greater than the criteria (copper and silver in water), the result is assumed to be below the adopted criteria as exact concentrations were not determined for those particular analytes.
Field intra-laboratory duplicate RPDs	RPDs exceeded control limits for the following sample analysis. (Samples with higher reported concentrations are in bold). ***Sediment*** • **BH-BP-19_2.5-3.0** and QC104 for Fines (<75 µm) (109%) • BH-BP-19_2.5-3.0 and **QC104** for Arsenic (120%) • **BH-BP-19_2.5-3.0** and QC104 for Chromium (89%) • **BH-BP-19_2.5-3.0** and QC104 for Lead (67%) • **BH-BP-19_2.5-3.0** and QC104 for Mercury (67%) • **BH-BP-19_2.5-3.0** and QC104 for Zinc (48%) • **BH-SB-33_1.5-2.0** and QC107 for Benzo(b+j) & Benzo(k)fluoranthene (40%) • **BH-SB-33_1.5-2.0** and QC107 for Arsenic (45%) • **BH-SB-33_1.5-2.0** and QC107 for Cadmium (100%) • **BH-SB-33_1.5-2.0** and QC107 for Copper (52%) • **BH-SB-33_1.5-2.0** and QC107 for Lead (99%) • **BH-SB-33_1.5-2.0** and QC107 for Mercury (123%) • **BH-SB-33_1.5-2.0** and QC107 for Zinc (52%) • **BH-SB-32_0.0-1.0** and QC108 for Sum (PFHxS + PFOS) (100%)PSH • **BH-SB-32_0.0-1.0** and QC108 for PFOS (100%) • **BH-SB-32_0.0-1.0** and QC108 for Sum of PFAS (100%) • **BH-SB-32_0.0-1.0** and QC108 for Sum of US EPA PFAS (PFOS + PFOA) (100%) • BH-SB-32_0.0-1.0 and **QC108** for Antimony (67%) • BH-SB-32_0.0-1.0 and **QC108** for Cadmium (77%) • BH-SB-32_0.0-1.0 and **QC108** for Chromium (46%) • BH-SB-32_0.0-1.0 and **QC108** for Copper (40%) • **BH-SB-32_0.0-1.0** and QC108 for Lead (42%) • BH-SWTP-02_0.0-1.5 and **QC115** for Fines (<75 µm) (100%) • BH-SWTP-02_0.0-1.5 and **QC115** for Anthracene (33%) • BH-SWTP-02_0.0-1.5 and **QC115** for Phenanthrene (86%) • BH-SWTP-02_0.0-1.5 and **QC115** for Fluoranthene (86%) • BH-SWTP-02_0.0-1.5 and **QC115** for Benz(a)anthracene (100%) • BH-SWTP-02_0.0-1.5 and **QC115** for Benzo(b+j) & Benzo(k)fluoranthene (67%) • BH-SWTP-02_0.0-1.5 and **QC115** for Benzo(a)pyrene (86%) • BH-SWTP-02_0.0-1.5 and **QC115** for Benzo(e)pyrene (74%) • BH-SWTP-02_0.0-1.5 and **QC115** for Chrysene (100%) • BH-SWTP-02_0.0-1.5 and **QC115** for Pyrene (76%)

DATA VALIDATION REPORT	
	• BH-SWTP-02_0.0-1.5 and **QC115** for Benzo(g,h,i)perylene (67%) • BH-SWTP-02_0.0-1.5 and **QC115** for Indeno(1,2,3-cd)pyrene (67%) • BH-SWTP-02_0.0-1.5 and **QC115** for Perylene (67%) • BH-SWTP-02_0.0-1.5 and **QC115** for Antimony (67%) • BH-SWTP-02_0.0-1.5 and **QC115** for Cadmium (103%) • BH-SWTP-02_0.0-1.5 and **QC115** for Chromium (70% • BH-SWTP-02_0.0-1.5 and **QC115** for Lead (45%) • BH-SWTP-02_0.0-1.5 and **QC115** for Mercury (57%) • BH-SWTP-02_0.0-1.5 and **QC115** for Nickel (62%) • BH-SWTP-02_0.0-1.5 and **QC115** For Zinc (33%) Where the primary sample is not the highest value this is considered to not impact the interpretation of the results for the following reasons: • BH-BP-19 – arsenic did not exceed criteria in either sample • BH-SB-32 – cadmium, chromium and copper did not exceed criteria in either sample and antimony only marginally exceeded in the duplicate sample • BH-SWTP-02 – PAH, antimony, chromium, cadmium and zinc in primary and secondary samples were all below criteria. Lead, mercury and nickel were higher in the duplicate sample but the order of magnitude was the same The differences in concentrations is likely to be associated with the heterogeneity of the sediments.
	Elutriate • **BH-SB-32_0.0-1.0** and QC108 for PFOS (36%) • **BH-SWTP-02_0.0-1.5** and QC115 for PFHxS (67%) • **BH-SWTP-02_0.0-1.5** and QC115 for PFOA (67%) • **BH-SWTP-02_0.0-1.5** and QC115 for Sum of PFAS (33%) • **BH-SWTP-02_0.0-1.5** and QC115 for Sum of US EPA PFAS (PFOS + PFOA) (33%) • BH-SWTP-02_0.0-1.5 and **QC115** for Mercury (67%) ***Sea Water*** • **SW-DG-03** and QC501 for Monobutyltin (67%) • SW-DG-03 and **QC501** for Arsenic (filtered) (40%) Both primary and duplicate seawater arsenic and monobutylin results were below criteria and therefore this does not impact the interpretation of the results.
Field inter-laboratory Triplicate RPDs	RPDs exceeded control limits for the following sample analysis. (Samples with higher reported concentrations are in bold). ***Sediment*** • BH-OH-13_0.0-0.5 and **QC202** for Clay (<2 µm) (143%) • **BH-OH-13_0.0-0.5** and QC202 for Total Organic Carbon (40%) • **BH-OH-06_0.0-0.5** and QC203 for Nickel (40%) • BH-OH-06_0.0-0.5 and **QC203** for Clay (<2 µm) (182%) • BH-OH-06_0.0-0.5 and **QC203** for Total Organic Carbon (115%) • **BH-BP-19_2.5-3.0** and QC204 for Arsenic (160%)

DATA VALIDATION REPORT	
	• **BH-BP-19_2.5-3.0** and QC204 for Chromium (53%) • **BH-BP-19_2.5-3.0** and QC204 for Copper (83%) • **BH-BP-19_2.5-3.0** and QC204 for Nickel (87%) • **BH-BP-19_2.5-3.0** and QC204 for Zinc (59%) • **BH-BP-19_2.5-3.0** and QC204 for Clay (<2 µm) (47%) • **BH-BP-19_2.5-3.0** and QC204 for Density (200%) • BH-SB-33_1.5-2.0 and **QC207** for Arsenic (75%) • BH-SB-33_1.5-2.0 and **QC207** for Chromium (72%) • BH-SB-33_1.5-2.0 and **QC207** for Lead (36%) • **BH-SB-33_1.5-2.0** and QC207 for Mercury (86%) • BH-SB-33_1.5-2.0 and **QC207** for Nickel (51%) • **BH-SB-32_0.0-1.0** and QC208 for Sum (PFHxS + PFOS) (40%) • **BH-SB-32_0.0-1.0** and QC208 for PFOS (40%) • **BH-SB-32_0.0-1.0** and QC208 for Sum of PFAS (40%) • BH-SB-32_0.0-1.0 and **QC208** for Arsenic (60%) • BH-SB-32_0.0-1.0 and **QC208** for Cadmium (86%) • BH-SB-32_0.0-1.0 and **QC208** for Chromium (86%) • BH-SB-32_0.0-1.0 and **QC208** for Copper (62%) • BH-SB-32_0.0-1.0 and **QC208** for Mercury (40%) • BH-SB-32_0.0-1.0 and **QC208** for Nickel (82%) • BH-SB-32_0.0-1.0 and **QC208** for Zinc (75%) • **BH-SB-32_0.0-1.0** and QC208 for Total Organic Carbon (41%) • BH-BP-22_4.0-5.0 and **QC209** for Arsenic (133%) • BH-BP-22_4.0-5.0 and **QC209** for Chromium (73%) • BH-BP-22_4.0-5.0 and **QC209** for Lead (32%) • BH-BP-22_4.0-5.0 and **QC209** for Nickel (64%) • BH-BP-22_4.0-5.0 and **QC209** for Zinc (64%) • **BH-SWTP-02_0.0-1.5** and QC215 for Sum (PFHxS + PFOS) (67%) • **BH-SWTP-02_0.0-1.5** and QC215 for PFOS (67%) • **BH-SWTP-02_0.0-1.5** and QC215 for Sum of PFAS (67%) • BH-SWTP-02_0.0-1.5 and **QC215** for Chromium (57%) • BH-SWTP-02_0.0-1.5 and **QC215** for Nickel (43%) • BH-SWTP-02_0.0-1.5 and **QC215** for Clay (<2 µm) (43%) • BH-SWTP-02_0.0-1.5 and **QC215** for Density (200%) In the case of PAHs and some metals the concentrations of both primary triplicate results are below the criteria and therefore this does not impact the interpretation of the results. The differences in concentrations is likely to be associated with the heterogeneity of the sediments. ***Sea Water*** • SW-DG-03 and **QC601** for Arsenic (50%) • SW-DG-03 and **QC601** for Arsenic (filtered) (67%) Both primary and triplicate seawater arsenic results were below criteria and therefore this does not impact the interpretation of the results.

Table H1- Sediment RPD Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Duplicates (Sediment)		SDG	ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ENVIROLAB 2021	
		Field ID	BH-OH-13 0.0-0.5	QC102 210819	RPD	BH-DG-06 0.0-0.5	QC103 210819	RPD	BH-BP-19 2.5-3.0	QC104 210826	RPD	BH-SB-33 1.5-2.0	QC107 210830	RPD	BH-BP-22 4.0-5.0	QC109 210831	RPD	BH-SB-32 0.0-1.0	QC108 210830	RPD	BH-SWTP-02 0.0-1.5	QC115 210907	RPD
		Sampled Date	19/08/2021	19/08/2021		19/08/2021	19/08/2021		26/08/2021	26/08/2021		30/08/2021	30/08/2021		31/08/2021	31/08/2021		30/08/2021	30/08/2021		7/09/2021	7/09/2021	
		Sample Type	Primary	Duplicate		Primary	Duplicate		Primary	Duplicate		Primary	Duplicate		Primary	Duplicate		Primary	Duplicate		Primary	Duplicate	
ChemName	**Units**	**LOR**																					
Organotin Compounds																							
Monobutyltin	µg/kg	0.5 : 1 (Interlab)	<0.5	<0.5	0				<3.3	<3.3	0	<2.7	<1.7	0	<1.7	<1.7	0	<1.7	<1.7	0	<4.9	<2.4	0
Tributyltin (as Sn)	µg/kg	0.5	<0.5	<0.5	0				<2	<2	0	<1	<1	0	<1	<1	0	<1	<1	0	<1	<1	0
Particle Size																							
Coarse Gravel 26.5-37.5mm	%	1	<1	<1	0	<1	<1	0	<1	<1	0				<1	<1	0				<1	<1	0
Medium Gravel 13.2-19mm	%	1	<1	<1	0	<1	<1	0	<1	<1	0				<1	<1	0				<1	<1	0
Medium Gravel 6.7-9.5mm	%	1	<1	<1	0	<1	<1	0	<1	<1	0				<1	<1	0				<1	<1	0
+75.0mm	%	1	<1	<1	0	<1	<1	0	<1	<1	0				<1	<1	0				<1	<1	0
Fines (<75 µm)	%	1	50	48	4	10	10	0	**17**	**5**	**109**				7	7	0				**2**	**6**	**100**
Particle Size Analysis by Hydr																							
Cobbles (>64cm)	%	1	<1	<1	0	<1	<1	0	<1	<1	0				<1	<1	0				<1	<1	0
Per- and Poly-fluoroalkyl Substances																							
Sum (PFHxS + PFOS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	0.0001	<0.0001	0	<0.0001	<0.0001	0	**0.0003**	**<0.0001**	**100**	0.0006	0.0005	18
Perfluorobutane sulfonic acid (PFBS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluorohexane sulfonic acid (PFHxS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	0.0001	<0.0001	0	<0.0001	<0.0001	0	**0.0003**	**<0.0001**	**100**	0.0006	0.0005	18
Perfluorodecane sulfonic acid (PFDS)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorobutanoic acid (PFBA)	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorohexanoic acid (PFHxA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluorooctanoic acid (PFOA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluorononanoic acid (PFNA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Perfluorodecanoic acid (PFDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0005	0				<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0
Perfluoroundecanoic acid (PFUnDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0005	0				<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0
Perfluorododecanoic acid (PFDoDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0005	0				<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0
Perfluorotridecanoic acid (PFTrDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0005	0				<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0	<0.0005	<0.0005	0
Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.005 : 0.0005 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0001 : 0.0005 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	mg/kg	0.0001 : 0.0005 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	mg/kg	0.0002 : 0.0005 (Interlab)	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0002 : 0.0005 (Interlab)	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorooctane sulfonamide (FOSA)	mg/kg	0.001 : 0.0002 (Interlab)	<0.001	<0.001	0				<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.001	0				<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.001	0				<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.005 : 0.0005 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.001	0				<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
Sum of PFAS	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0001	0				<0.0001	<0.0001	0	0.0001	<0.0001	0	<0.0001	<0.0001	0	**0.0003**	**<0.0001**	**100**	0.0006	0.0005	18
Sum of US EPA PFAS (PFOS + PFOA)	UG/KG	0.1	<0.1	<0.1	0				<0.1	<0.1	0	0.1	<0.1	0	<0.1	<0.1	0	**0.3**	**<0.1**	**100**	0.6	0.5	18
Polynuclear Aromatic Hydrocarbons																							
Naphthalene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
2-Methylnaphthalene	mg/kg	0.005	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Acenaphthylene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Acenaphthene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	**<0.005**	**0.007**	**33**
Fluorene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Phenanthrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.006	0.005	18	<0.005	<0.005	0	0.006	0.007	15	**0.02**	**0.05**	**86**
Fluoranthene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.02	0.02	0	<0.005	<0.005	0	0.02	0.02	0	**0.03**	**0.075**	**86**
Benz(a)anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.01	0.008	22	<0.005	<0.005	0	0.009	0.01	11	**0.01**	**0.03**	**100**
Benzo(b+j) & Benzo(k)fluoranthene	mg/kg	0.01	<0.01	<0.01	0				<0.01	<0.01	0	**0.03**	**0.02**	**40**	<0.01	<0.01	0	0.02	0.02	0	**0.03**	**0.06**	**67**
Benzo(a)pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.02	0.02	0	<0.005	<0.005	0	0.02	0.02	0	**0.02**	**0.05**	**86**
Benzo(e)pyrene	mg/kg	0.005	<0.005	<0.005	0				<0.005	<0.005	0	0.01	0.009	11	<0.005	<0.005	0	0.009	0.01	11	**0.011**	**0.024**	**74**
Chrysene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.009	0.007	25	<0.005	<0.005	0	0.008	0.008	0	**0.01**	**0.03**	**100**
Pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.02	0.02	0	<0.005	<0.005	0	0.02	0.02	0	**0.03**	**0.067**	**76**
Benzo(g,h,i)perylene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.01	0.008	22	<0.005	<0.005	0	0.008	0.01	22	**0.01**	**0.02**	**67**
Dibenz(a,h)anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Indeno(1,2,3-cd)pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.005	0				<0.005	<0.005	0	0.01	0.01	0	<0.005	<0.005	0	0.01	0.01	0	**0.01**	**0.02**	**67**
Coronene	mg/kg	0.005	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0
Perylene	mg/kg	0.005	<0.005	<0.005	0				<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	<0.005	<0.005	0	**<0.005**	**0.007**	**33**
Metals																							
Antimony	mg/kg	1 : 5 (Interlab)	<1	<1	0				<1	<1	0	<1	1	0	2	2	0	**<1**	**2**	**67**	**<1**	**2**	**67**
Arsenic	mg/kg	0.5 : 5 (Interlab)	4	3	29				**4**	**4**	**120**	**8.2**	**13**	**45**	5.8	6.2	7	9.2	10	8	15	17	13
Cadmium	mg/kg	0.1 : 1 (Interlab)	<0.1	<0.1	0				<0.1	<0.1	0	**0.9**	**0.3**	**100**	<0.1	0.1	0	**0.4**	**0.9**	**77**	**0.9**	**2.8**	**103**
Chromium	mg/kg	0.5 : 2 (Interlab)	5	4	22				**21**	**8.1**	**89**	25	31	21	27	33	20	**22**	**35**	**46**	**29**	**60**	**70**
Copper	mg/kg	0.5 : 5 (Interlab)	1	0.9	11				5.4	4	30	**14**	**8.2**	**52**	10	9.3	7	**10**	**15**	**40**	34	45	28
Lead	mg/kg	0.5 : 5 (Interlab)	2	2	0				**4**	**2**	**67**	**56**	**19**	**99**	6.5	7.4	13	**63**	**41**	**42**	**58**	**92**	**45**
Mercury	mg/kg	0.01 : 0.1 (Interlab)	<0.01	<0.01	0				**0.02**	**<0.01**	**67**	**0.25**	**0.06**	**123**	0.01	0.01	0	0.2	0.23	14	**0.31**	**0.56**	**57**
Nickel	mg/kg	0.5 : 2 (Interlab)	2	2	0				15	12	22	16	16	0	20	24	18	**13**	**20**	**42**	**18**	**34**	**62**
Silver	mg/kg	0.5 : 2 (Interlab)	<0.5	<0.5	0				<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
Zinc	mg/kg	0.5 : 5 (Interlab)	5.3	5	6				**8.2**	**5**	**48**	**51**	**30**	**52**	16	18	12	40	49	20	**100**	**140**	**33**
Physico-Chemical Parameters																							
Clay (<2 µm)	%	1	1	1	0	30	26	14	46	57	21				53	50	6						
Moisture Content (dried @ 103°C)	%	0.1	19	19	0				37	33	11	54	53	2	30	33	10	53	54	2	58	61	5
Total Organic Carbon	mg/kg	100 : 200 (Interlab)	1500	1500	0	7900	7900	0	1900	2100	10	7200	6900	4	2000	1700	16	17000	17000	0			
Density	kg/m3								0.0E0	0.0E0	0												
Organic Matter	%	0.1	0.3	0.3	0	1.4	1.4	0	0.3	0.4	29	1.2	1.2	0	0.3	0.3	0	2.9	2.9	0			
Organotins																							
Dibutyltin as Sn	µg/kg	0.5 : 1 (Interlab)	<0.5	<0.5	0				<2.6	<2.6	0	<3	<1.3	0	<1.3	<1.3	0	<1.3	<1.3	0	<2.6	<3.2	0

*RPDs have only been considered where a concentration is greater than 1 times the LOR.
**High RPDs are in bold (Acceptable RPDs for each LOR multiplier range are: 30 (1-10 x LOR); 30 (10-20 x LOR); 30 (> 20 x LOR))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table H1- Sediment RPD Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Duplicates (Sediment)		SDG	ENVIROLAB 2021	ALSE-Melb		ENVIROLAB 2021	ALSE-Melb		ENVIROLAB 2021	ALSE-Melb		ENVIROLAB 2021	ALSE-Melb		ENVIROLAB 2021	ALSE-Melb		ENVIROLAB 2021	ALSE-Melb		277569	EM2117925	
		Field ID	BH-OH-13 0.0-0.5	QC202 210819	RPD	BH-OH-06 0.0-0.5	QC203 210819	RPD	BH-BP-19 2.5-3.0	QC204 210826	RPD	BH-SB-33 1.5-2.0	QC207 210830	RPD	BH-SB-32 0.0-1.0	QC208 210830	RPD	BH-BP-22 4.0-5.0	QC209 210831	RPD	BH-SWTP-02 0.0-1.5	QC215 210907	RPD
		Sampled Date	19/08/2021	19/08/2021		19/08/2021	19/08/2021		26/08/2021	26/08/2021		30/08/2021	30/08/2021		30/08/2021	30/08/2021		31/08/2021	31/08/2021		7/09/2021	7/09/2021	
		Sample Type	Primary	Triplicate		Primary	Triplicate		Primary	Triplicate		Primary	Triplicate		Primary	Triplicate		Primary	Triplicate		Primary	Triplicate	
ChemName	**Units**	**LOR**																				
Organotin Compounds																						
Monobutyltin	µg/kg	0.5 : 1 (Interlab)	<0.5						<3.3	<1	0	<2.7	<1	0	<1.7	<1	0	<1.7	<1	0	<4.9	<1	0
Tributyltin (as Sn)	µg/kg	0.5	<0.5						<2			<1			<1			<1			<1		
Particle Size																						
Coarse Gravel 26.5-37.5mm	%	1	<1			<1			<1									<1			<1		
Medium Gravel 13.2-19mm	%	1	<1			<1			<1									<1			<1		
Medium Gravel 6.7-9.5mm	%	1	<1			<1			<1									<1			<1		
+75.0mm	%	1	<1	<1	0	<1	<1	0	<1	<1	0							<1	<1	0	<1	<1	0
Fines (<75 µm)	%	1	50			50			17									7			2		
Particle Size Analysis by Hydr																						
Cobbles (>64cm)	%	1	<1	<1	0	<1	<1	0	<1	<1	0							<1	<1	0	<1	<1	0
Per- and Poly-fluoroalkyl Substances																						
Sum (PFHxS + PFOS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	0.0001	<0.0002	0	**0.0003**	**<0.0002**	**40**	<0.0001	<0.0002	0	**0.0006**	**0.0003**	**67**
Perfluorobutane sulfonic acid (PFBS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluorohexane sulfonic acid (PFHxS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	0.0001	<0.0002	0	**0.0003**	**<0.0002**	**40**	<0.0001	<0.0002	0	**0.0006**	**0.0003**	**67**
Perfluorodecane sulfonic acid (PFDS)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorobutanoic acid (PFBA)	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.001	0				<0.0002	<0.001	0	<0.0002	<0.001	0	<0.0002	<0.001	0	<0.0002	<0.001	0	<0.0002	<0.001	0
Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorohexanoic acid (PFHxA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluorooctanoic acid (PFOA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluorononanoic acid (PFNA)	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0	<0.0001	<0.0002	0
Perfluorodecanoic acid (PFDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0002	0				<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0
Perfluoroundecanoic acid (PFUnDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0002	0				<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0
Perfluorododecanoic acid (PFDoDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0002	0				<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0
Perfluorotridecanoic acid (PFTrDA)	mg/kg	0.0005 : 0.0002 (Interlab)	<0.0005	<0.0002	0				<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0	<0.0005	<0.0002	0
Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.005 : 0.0005 (Interlab)	<0.005	<0.0005	0				<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0001 : 0.0005 (Interlab)	<0.0001	<0.0005	0				<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	mg/kg	0.0001 : 0.0005 (Interlab)	<0.0001	<0.0005	0				<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0	<0.0001	<0.0005	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	mg/kg	0.0002 : 0.0005 (Interlab)	<0.0002	<0.0005	0				<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0002 : 0.0005 (Interlab)	<0.0002	<0.0005	0				<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0	<0.0002	<0.0005	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	mg/kg	0.0002	<0.0002	<0.0002	0				<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Perfluorooctane sulfonamide (FOSA)	mg/kg	0.001 : 0.0002 (Interlab)	<0.001	<0.0002	0				<0.001	<0.0002	0	<0.001	<0.0002	0	<0.001	<0.0002	0	<0.001	<0.0002	0	<0.001	<0.0002	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.0005	0				<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.0005	0				<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.005 : 0.0005 (Interlab)	<0.005	<0.0005	0				<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0	<0.005	<0.0005	0
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	mg/kg	0.001 : 0.0005 (Interlab)	<0.001	<0.0005	0				<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0	<0.001	<0.0005	0
Sum of PFAS	mg/kg	0.0001 : 0.0002 (Interlab)	<0.0001	<0.0002	0				<0.0001	<0.0002	0	0.0001	<0.0002	0	**0.0003**	**<0.0002**	**40**	<0.0001	<0.0002	0	**0.0006**	**0.0003**	**67**
Sum of US EPA PFAS (PFOS + PFOA)	UG/KG	0.1	<0.1						<0.1			0.1			0.3			<0.1			0.6		
Polynuclear Aromatic Hydrocarbons																						
Naphthalene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
2-Methylnaphthalene	mg/kg	0.005	<0.005						<0.005			<0.005			<0.005			<0.005			<0.005		
Acenaphthylene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
Acenaphthene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
Anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
Fluorene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
Phenanthrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.006	<0.5	0	0.006	<0.5	0	<0.005	<0.5	0	0.02	<0.5	0
Fluoranthene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.02	<0.5	0	0.02	<0.5	0	<0.005	<0.5	0	0.03	<0.5	0
Benz(a)anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0	0.009	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0
Benzo(b+j) & Benzo(k)fluoranthene	mg/kg	0.01	<0.01						<0.01			0.03			0.02			<0.01			0.03		
Benzo(a)pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.02	<0.5	0	0.02	<0.5	0	<0.005	<0.5	0	0.02	<0.5	0
Benzo(e)pyrene	mg/kg	0.005	<0.005						<0.005			0.01			0.009			<0.005			0.011		
Chrysene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.009	<0.5	0	0.008	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0
Pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.02	<0.5	0	0.02	<0.5	0	<0.005	<0.5	0	0.03	<0.5	0
Benzo(g,h,i)perylene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0	0.008	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0
Dibenz(a,h)anthracene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0
Indeno(1,2,3-cd)pyrene	mg/kg	0.005 : 0.5 (Interlab)	<0.005	<0.5	0	<0.005	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0	0.01	<0.5	0	<0.005	<0.5	0	0.01	<0.5	0
Coronene	mg/kg	0.005	<0.005						<0.005			<0.005			<0.005			<0.005			<0.005		
Perylene	mg/kg	0.005	<0.005						<0.005			<0.005			<0.005			<0.005			<0.005		
Metals																						
Antimony	mg/kg	1 : 5 (Interlab)	<1	<5	0	<1	<5	0	<1	<5	0	<1	<5	0	<1	<5	0	2	<5	0	<1	<5	0
Arsenic	mg/kg	0.5 : 5 (Interlab)	4	<5	0	4	<5	0	**1**	**9**	**160**	**8.2**	**18**	**75**	**9.2**	**17**	**60**	**5.8**	**29**	**133**	15	18	18
Cadmium	mg/kg	0.1 : 1 (Interlab)	<0.1	<1	0	<0.1	<1	0	<0.1	<1	0	0.9	<1	0	**0.4**	**1**	**86**	<0.1	<1	0	0.9	1	11
Chromium	mg/kg	0.5 : 2 (Interlab)	5	5	0	6.1	5	20	**21**	**36**	**53**	**25**	**53**	**72**	**22**	**55**	**86**	**27**	**58**	**73**	**29**	**52**	**57**
Copper	mg/kg	0.5 : 5 (Interlab)	1	<5	0	2	<5	0	**5.4**	**13**	**83**	14	12	15	**10**	**19**	**62**	10	9	11	34	31	9
Lead	mg/kg	0.5 : 5 (Interlab)	2	<5	0	3	<5	0	4	<5	0	**56**	**39**	**36**	63	80	24	**6.5**	**9**	**32**	58	70	19
Mercury	mg/kg	0.01 : 0.1 (Interlab)	<0.01	<0.1	0	0.01	<0.1	0	0.02	<0.1	0	**0.25**	**0.1**	**86**	**0.2**	**0.3**	**40**	0.01	<0.1	0	0.31	0.4	25
Nickel	mg/kg	0.5 : 2 (Interlab)	2	2	0	**3**	**2**	**40**	**15**	**38**	**87**	**16**	**27**	**51**	**13**	**31**	**82**	**20**	**39**	**64**	**18**	**28**	**43**
Silver	mg/kg	0.5 : 2 (Interlab)	<0.5	<2	0	<0.5	<2	0	<0.5	<2	0	<0.5	<2	0	<0.5	<2	0	<0.5	<2	0	<0.5	<2	0
Zinc	mg/kg	0.5 : 5 (Interlab)	5.3	7	28	8.1	6	30	**8.2**	**15**	**59**	51	58	13	**40**	**88**	**75**	**16**	**31**	**64**	100	112	11
Physico-Chemical Parameters																						
Clay (<2 µm)	%	1	**1**	**6**	**143**	**2**	**42**	**182**	**46**	**74**	**47**							53	49	8	**34**	**53**	**44**
Moisture Content (dried @ 103°C)	%	0.1	19						37			54			53			30			58		
Total Organic Carbon	mg/kg	100 : 200 (Interlab)	**1500**	**1000**	**40**	**2000**	**7400**	**115**	1900	1500	24	7200	8400	15	**17000**	**11200**	**41**	2000	2000	0	15000	12900	15
Density	kg/m3								**0.0E0**	**0.00278**	**200**										**0**	**0.00268**	**200**
Organic Matter	%	0.1	0.3			0.3			0.3			1.2			2.9			0.3			2.5		
Organotins																						
Dibutyltin as Sn	µg/kg	0.5 : 1 (Interlab)	<0.5						<2.6	<1	0	<3	<1	0	<1.3	<1	0	<1.3	<1	0	<2.6	<1	0

*RPDs have only been considered where a concentration is greater than 1 times the LOR.
**High RPDs are in bold (Acceptable RPDs for each LOR multiplier range are: 30 (1-10 x LOR); 30 (10-20 x LO
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methc

Table H2 - Elutriate RPD Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Duplicates (Elutriate)

		Lab Report No.	276959-A	276959-A		277569-A	277569-A	
		Field ID	BH-SB-32_0.0-1.0	QC108_210830	RPD	BH-SWTP-02_0.0-1.5	QC115 _210907	RPD
		Sampled Date	30/08/2021	30/08/2021		7/09/2021	7/09/2021	
		Sample Type	Primary	Duplicate		Primary	Duplicate	
ChemName	**Units**	**LOR**						
Per- and Poly-fluoroalkyl Substances								
Sum (PFHxS + PFOS)	µg/L	0.0002	0.0042	0.0033	24	0.01	0.0082	20
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0004	<0.0004	<0.0004	0	<0.0004	<0.0004	0
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0002	0.0009	0.001	11	**0.002**	**0.001**	**67**
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	**0.0033**	**0.0023**	**36**	0.0089	0.0067	28
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluoropentanoic acid (PFPeA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluorohexanoic acid (PFHxA)	µg/L	0.0004	0.001	0.0009	11	0.001	0.001	0
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0004	<0.0004	<0.0004	0	0.0004	<0.0004	0
Perfluorooctanoic acid (PFOA)	µg/L	0.0002	0.0009	0.0009	0	**0.002**	**0.001**	**67**
Perfluorononanoic acid (PFNA)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Perfluorodecanoic acid (PFDA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluorododecanoic acid (PFDoDA)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	0	<0.0004	<0.0004	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	0	<0.0004	<0.0004	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
Perfluorooctane sulfonamide (FOSA)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
Sum of PFAS	µg/L	0.0002	0.0061	0.0052	16	**0.014**	**0.01**	**33**
Sum of US EPA PFAS (PFOS + PFOA)	µg/L	0.0002	0.0042	0.0032	27	**0.011**	**0.0079**	**33**
Metals								
Antimony	mg/L	0.001	0.004	0.003	29	0.003	0.003	0
Arsenic	mg/L	0.001	<0.001	<0.001	0	0.001	<0.001	0
Cadmium	mg/L	0.0001				<0.0001	<0.0001	0
Lead	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Mercury	mg/L	5e-005	<0.00005	<0.00005	0	<0.00005	<0.00005	0
Nickel	mg/L	0.001	0.001	0.001	0	**0.001**	**0.002**	**67**
Un-assigned								
Solids Leachate pH (post rolling)	pH Units	0.1	8.2	8.2	0	8.1	8.2	1
pH of Leaching Fluid	pH Units	0.1	7.9	7.9	0	7.9	7.9	0

*RPDs have only been considered where a concentration is greater than 1 times the LOR.

**High RPDs are in bold (Acceptable RPDs for each LOR multiplier range are: 30 (1-10 x LOR); 30 (10-20 x LOR); 30 (> 20 x LOR))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table H3 - Elutriate RPD Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Duplicates (WATER)		SDG	ENVIROLAB 2021	ENVIROLAB 2021		ENVIROLAB 2021	ALSE-Melb	
		Field ID	SW-DG-03 210819	QC501 210819	RPD	SW-DG-03 210819	QC601 210819	RPD
		Sampled Date	19/08/2021	19/08/2021		19/08/2021	19/08/2021	
		Sample Type	Primary	Duplicate		Primary	Triplicate	
ChemName	**Units**	**LOR**						
Organotin Compounds								
Monobutyltin	µg/L	0.005	**0.04**	**0.02**	**67**	0.04		
Tributyltin (as Sn)	µg/L	0.002	<0.002	<0.002	0	<0.002		
Per- and Poly-fluoroalkyl Substances								
Sum (PFHxS + PFOS)	µg/L	0.0002 : 0.01 (Interlab)	0.0026	0.0028	7	0.0026	<0.01	0
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0004 : 0.02 (Interlab)	<0.0004	<0.0004	0	<0.0004	<0.02	0
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.001 : 0.02 (Interlab)	<0.001	<0.001	0	<0.001	<0.02	0
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0002 : 0.02 (Interlab)	0.0008	0.0009	12	0.0008	<0.02	0
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.001 : 0.02 (Interlab)	<0.001	<0.001	0	<0.001	<0.02	0
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002 : 0.01 (Interlab)	0.002	0.002	0	0.002	<0.01	0
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
Perfluorobutanoic acid (PFBA)	µg/L	0.002 : 0.1 (Interlab)	<0.002	<0.002	0	<0.002	<0.1	0
Perfluoropentanoic acid (PFPeA)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
Perfluorohexanoic acid (PFHxA)	µg/L	0.0004 : 0.02 (Interlab)	0.0008	0.0007	13	0.0008	<0.02	0
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0004 : 0.02 (Interlab)	0.0004	0.0004	0	0.0004	<0.02	0
Perfluorooctanoic acid (PFOA)	µg/L	0.0002 : 0.01 (Interlab)	0.0009	0.0008	12	0.0009	<0.01	0
Perfluorononanoic acid (PFNA)	µg/L	0.001 : 0.02 (Interlab)	<0.001	<0.001	0	<0.001	<0.02	0
Perfluorodecanoic acid (PFDA)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
Perfluorododecanoic acid (PFDoDA)	µg/L	0.005 : 0.02 (Interlab)	<0.005	<0.005	0	<0.005	<0.02	0
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.01 : 0.02 (Interlab)	<0.01	<0.01	0	<0.01	<0.02	0
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001 : 0.05 (Interlab)	<0.001	<0.001	0	<0.001	<0.05	0
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0004 : 0.05 (Interlab)	<0.0004	<0.0004	0	<0.0004	<0.05	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0004 : 0.05 (Interlab)	<0.0004	<0.0004	0	<0.0004	<0.05	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.002 : 0.05 (Interlab)	<0.002	<0.002	0	<0.002	<0.05	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.002 : 0.02 (Interlab)	<0.002	<0.002	0	<0.002	<0.02	0
Perfluorooctane sulfonamide (FOSA)	µg/L	0.01 : 0.02 (Interlab)	<0.01	<0.01	0	<0.01	<0.02	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.01 : 0.05 (Interlab)	<0.01	<0.01	0	<0.01	<0.05	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.005 : 0.05 (Interlab)	<0.005	<0.005	0	<0.005	<0.05	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	µg/L	0.005 : 0.05 (Interlab)	<0.005	<0.005	0	<0.005	<0.05	0
Sum of PFAS	µg/L	0.0002 : 0.01 (Interlab)	0.0048	0.0047	2	0.0048	<0.01	0
Sum of US EPA PFAS (PFOS + PFOA)	µg/L	0.0002	0.0028	0.0027	4	0.0028		
Polynuclear Aromatic Hydrocarbons								
Naphthalene	µg/L	0.2 : 1 (Interlab)	<0.2	<0.2	0	<0.2	<1	0
Acenaphthylene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Acenaphthene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Anthracene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Fluorene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Phenanthrene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Fluoranthene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Benz(a)anthracene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	0.2	<0.2	<0.2	0	<0.2		
Benzo(a)pyrene	µg/L	0.1 : 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.5	0
Chrysene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Pyrene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Benzo(g,h,i)perylene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Dibenz(a,h)anthracene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Indeno(1,2,3-cd)pyrene	µg/L	0.1 : 1 (Interlab)	<0.1	<0.1	0	<0.1	<1	0
Metals								
Antimony	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Antimony (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Arsenic	mg/L	0.001	0.003	0.003	0	**0.003**	**0.005**	**50**
Arsenic (Filtered)	mg/L	0.001	**0.002**	**0.003**	**40**	**0.002**	**0.004**	**67**
Cadmium	mg/L	0.0001	<0.002	<0.002	0	<0.002	<0.0002	0
Cadmium (Filtered)	mg/L	0.0001	<0.0002	<0.0002	0	<0.0002	<0.0002	0
Chromium	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Chromium (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Copper	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Copper (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Lead	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Lead (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Mercury	mg/L	5e-005 : 0.0001 (Interlab	<0.00005	<0.00005	0	<0.00005	<0.0001	0
Mercury (Filtered)	mg/L	5e-005 : 0.0001 (Interlab	<0.00005	<0.00005	0	<0.00005	<0.0001	0
Nickel	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Nickel (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Silver	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Silver (Filtered)	mg/L	0.001	<0.002	<0.002	0	<0.002	<0.002	0
Zinc	mg/L	0.001 : 0.005 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
Zinc (Filtered)	mg/L	0.001 : 0.005 (Interlab)	0.002	0.002	0	0.002	<0.01	0
PAH								
Benzo(a)pyrene TEQ_	mg/L	0.0005	<0.0005	<0.0005	0	<0.0005		

*RPDs have only been considered where a concentration is greater than 1 times the LOR.
**High RPDs are in bold (Acceptable RPDs for each LOR multiplier range are: 30 (1-10 x LOR); 30 (10-20 x LOR); 30 (> 20 x LOR))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table H4 - Field Blank Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Blanks (WATER)

Lab Report No.		276460	276460	276460	276460	276460	276460	276673	276673	277569	276673	277161	276460	276673	276959
Field ID		QC300_210819	QC301_210819	QC302_210819	QC303_210819	QC304_210819	QC305_210819	QC306_210826	QC307_210827	QC314_210907	QC404_210827	QC408_210901	QC400_210819	QC402_210826	QC406_210830
Sampled Date		19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021	19/08/2021	26/08/2021	27/08/2021	7/09/2021	27/08/2021	1/09/2021	19/08/2021	26/08/2021	30/08/2021
Sample Type		Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank
Taken From		Bowl after decon Prior to use	Bowl after use	Glove	Seawater tube	Glove diver after last sample	Jerry can	Glove prior to use	Trowel post use	Liner					
ChemName	**Units**	**LOR**													
Metals															
Antimony	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	**0.002**	<0.001	<0.001	<0.001					
Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	**0.02**	<0.001	<0.001	<0.001					
Mercury	mg/L	0.00005	<5e-005	<5e-005	<5e-005	<5e-005	<5e-005	<5e-005	<5e-005	<5e-005					
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Zinc	mg/L	0.001	<0.001	**0.002**	<0.001	<0.001	**0.022**	<0.001	**0.002**	<0.001	**0.003**				
Organotin Compounds															
Monobutyltin	µg/L	0.005	**0.02**	**0.02**	**0.04**	<0.005	**0.04**	<0.005	<0.005	<0.005	<0.04				
Tributyltin (as Sn)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				
Organotins															
Tributyltin as SN	mg/L	0.000002													
PAH															
Benzo(a)pyrene TEQ	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005					
Per- and Poly-fluoroalkyl Substances															
Sum (PFHxS + PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	**0.0005**	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	**0.0005**	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid (PFHxA)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid (PFOA)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.0005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	**0.0006**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	**0.0005**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide (FOSA)	µg/L	0.0005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Polynuclear Aromatic Hydrocarbons															
Benzo(a)pyrene TEQ calc (Zero)	µg/L	0.5													
Naphthalene	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Acenaphthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Fluorene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Phenanthrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Benz(a)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Benzo(k)fluoranthene	µg/L	1													
Benzo(b&j)fluoranthene	µg/L	1													
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Chrysene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Benzo(g,h,i)perylene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Dibenz(a,h)anthracene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					
Sum of PAHs	µg/L	0.5													

Table H4 - Field Blank Results

Technical Report B: Dredging and offshore contamination assessment
Viva Energy Gas Terminal Project Environment Effects Statement
Viva Energy Gas Australia Pty Ltd

Field Blanks (WATER)

Lab Report No.	277486	277569	277707	EM2116795	EM2117075	EM2117375
Field ID	QC410_210906	QC412_210907	QC414 _210908	QC401_210819	QC403 TRIP BLANK	QC407_210830
Sampled Date	6/09/2021	7/09/2021	8/09/2021	19/08/2021	26/08/2021	30/08/2021
Sample Type	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank
Taken From						

ChemName	Units	LOR						
Metals								
Antimony	mg/L	0.001						
Arsenic	mg/L	0.001						
Cadmium	mg/L	0.0001						
Chromium	mg/L	0.001						
Copper	mg/L	0.001						
Lead	mg/L	0.001						
Mercury	mg/L	0.00005						
Nickel	mg/L	0.001						
Silver	mg/L	0.001						
Zinc	mg/L	0.001						
Organotin Compounds								
Monobutyltin	µg/L	0.005						
Tributyltin (as Sn)	µg/L	0.002						
Organotins								
Tributyltin as SN	mg/L	0.000002						
PAH								
Benzo(a)pyrene TEQ	mg/L	0.0005						
Per- and Poly-fluoroalkyl Substances								
Sum (PFHxS + PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.01	<0.01	<0.01
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.02	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.02	<0.02	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.02	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.01	<0.01	<0.01
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.1	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
Perfluorohexanoic acid (PFHxA)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.02	<0.02	<0.02
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.02	<0.02	<0.02
Perfluorooctanoic acid (PFOA)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.01	<0.01	<0.01
Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.001	<0.001	<0.001	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0005	<0.005	<0.005	<0.005	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.0005	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0004	<0.0004	<0.0004	<0.0004	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.002	<0.002	<0.002	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.0005	<0.002	<0.002	<0.002	<0.02	<0.02	<0.02
Perfluorooctane sulfonamide (FOSA)	µg/L	0.0005	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
Polynuclear Aromatic Hydrocarbons								
Benzo(a)pyrene TEQ calc (Zero)	µg/L	0.5						
Naphthalene	µg/L	0.2						
Acenaphthylene	µg/L	0.1						
Acenaphthene	µg/L	0.1						
Anthracene	µg/L	0.1						
Fluorene	µg/L	0.1						
Phenanthrene	µg/L	0.1						
Fluoranthene	µg/L	0.1						
Benz(a)anthracene	µg/L	0.1						
Benzo(k)fluoranthene	µg/L	1						
Benzo(b&j)fluoranthene	µg/L	1						
Benzo(b+j) & Benzo(k)fluoranthene	µg/L	0.2						
Benzo(a)pyrene	µg/L	0.1						
Chrysene	µg/L	0.1						
Pyrene	µg/L	0.1						
Benzo(g,h,i)perylene	µg/L	0.1						
Dibenz(a,h)anthracene	µg/L	0.1						
Indeno(1,2,3-cd)pyrene	µg/L	0.1						
Sum of PAHs	µg/L	0.5						

Appendix I

ProUCL

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.110/1/2021 13:23:22								
5	From File			Sediment_ProUCLinput_01Oct21xls.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**Conc (|antimony|ambient|aecom|)**											
11												
12	**General Statistics**											
13	Total Number of Observations					14	)bservations					1
14	Number of Detects					0	Non-Detects					14
15	Number of Distinct Detects					0	Non-Detects					1
16												
17	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
18	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
19	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
20												
21	**The data set for variable Conc (|antimony|ambient|aecom|) was not processed!**											
22												
23												
24	**Conc (|antimony|domain 1a|aecom|)**											
25												
26	**General Statistics**											
27	Total Number of Observations					26	)bservations					3
28	Number of Detects					14	Non-Detects					12
29	Number of Distinct Detects					3	Non-Detects					1
30	**Minimum Detect**					**1**	**mum Non-Detect**					**1**
31	**Maximum Detect**					**3**	**mum Non-Detect**					**1**
32	**Variance Detects**					**0.44**	**ent Non-Detects**					**46.15%**
33	**Mean Detects**					**1.857**	**SD Detects**					**0.663**
34	**Median Detects**					**2**	**CV Detects**					**0.357**
35	**Skewness Detects**					**0.151**	**urtosis Detects**					**-0.31**
36	**Mean of Logged Detects**					**0.553**	**f Logged Detects**					**0.39**
37												
38	**Normal GOF Test on Detects Only**											
39	**Shapiro Wilk Test Statistic**					**0.801**	**iro Wilk GOF Test**					
40	**5% Shapiro Wilk Critical Value**					**0.874**	**Normal at 5% Significance Level**					
41	Lilliefors Test Statistic					0.3	rs GOF Test					
42	5% Lilliefors Critical Value					0.226	icance Level					
43	Detected Data Not Normal at 5% Significance Level											
44												
45	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
46	KM Mean					1.462	rror of Mean					12.90%
47	KM SD					0.634	l (BCA) UCL					N/A
48	95% KM (t) UCL					1.682	otstrap) UCL					N/A
49	95% KM (z) UCL					1.674	otstrap t UCL					N/A
50	90% KM Chebyshev UCL					1.849	byshev UCL					2.024
51	**97.5% KM Chebyshev UCL**					**2.268**	**M Chebyshev UCL**					**2.746**
52												
53	**Gamma GOF Tests on Detected Observations Only**											
54	**A-D Test Statistic**					**1.562**	**on-Darling GOF Test**					
55	**5% A-D Critical Value**					**0.736**	**a Distributed at 5% Significance Level**					
56	**K-S Test Statistic**					**0.343**	**gorov-Smirnov GOF**					
57	**5% K-S Critical Value**					**0.229**	**a Distributed at 5% Significance Level**					
58	Detected Data Not Gamma Distributed at 5% Significance Level											
59												
60	Gamma Statistics on Detected Data Only											
61	k hat (MLE)					7.737	bias corrected MLE)					6.127
62	**Theta hat (MLE)**					**0.24**	**r (bias corrected MLE)**					**0.303**
63	**nu hat (MLE)**					**216.6**	**ar (bias corrected)**					**171.6**

	A	B	C	D	E	F	G	H	I	J	K	L
64	**Mean (detects)**					**1.857**						
65												
66	Gamma ROS Statistics using Imputed Non-Detects											
67	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
68	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
69	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
70	This is especially true when the sample size is small.											
71	**For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates**											
72	**Minimum**					**0.01**	**Mean**					**1.241**
73	Maximum					3	**Median**					**1**
74	SD					0.858	CV					0.692
75	k hat (MLE)					1.322	**ias corrected MLE)**					**1.195**
76	Theta hat (MLE)					0.939	r (bias corrected MLE)					1.038
77	**nu hat (MLE)**					**68.73**	**ar (bias corrected)**					**62.14**
78	**Adjusted Level of Significance (β)**					**0.0398**						
79	**Approximate Chi Square Value (62.14, α)**					**45.01**	**i Square Value (62.14, β)**					**44.04**
80	95% Gamma Approximate UCL (use when n>=50)					1.713	when n<50)					1.75
81												
82	Estimates of Gamma Parameters using KM Estimates											
83	Mean (KM)					1.462	SD (KM)					0.634
84	**Variance (KM)**					**0.402**	**E of Mean (KM)**					**0.129**
85	**k hat (KM)**					**5.309**	**k star (KM)**					**4.722**
86	nu hat (KM)					276.1	nu star (KM)					245.5
87	theta hat (KM)					0.275	heta star (KM)					0.31
88	80% gamma percentile (KM)					1.977	mma percentile (KM)					2.362
89	95% gamma percentile (KM)					2.714	mma percentile (KM)					3.46
90												
91	Gamma Kaplan-Meier (KM) Statistics											
92	Approximate Chi Square Value (245.54, α)					210.3	e (245.54, β)					208.1
93	95% Gamma Approximate KM-UCL (use when n>=50)					1.707	when n<50)					1.724
94												
95	Lognormal GOF Test on Detected Observations Only											
96	Shapiro Wilk Test Statistic					0.774	ilk GOF Test					
97	5% Shapiro Wilk Critical Value					0.874	icance Level					
98	Lilliefors Test Statistic					0.355	rs GOF Test					
99	5% Lilliefors Critical Value					0.226	icance Level					
100	**Detected Data Not Lognormal at 5% Significance Level**											
101												
102	Lognormal ROS Statistics Using Imputed Non-Detects											
103	Mean in Original Scale					1.327	in Log Scale					0.12
104	SD in Original Scale					0.766	in Log Scale					0.59
105	95% t UCL (assumes normality of ROS data)					1.584	ootstrap UCL					1.571
106	95% BCA Bootstrap UCL					1.592	otstrap t UCL					1.604
107	95% H-UCL (Log ROS)					1.708						
108												
109	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
110	**KM Mean (logged)**					**0.298**	**KM Geo Mean**					**1.347**
111	KM SD (logged)					0.39	ue (KM-Log)					1.878
112	KM Standard Error of Mean (logged)					0.0793	CL (KM -Log)					1.682
113	**KM SD (logged)**					**0.39**	**tical H Value (KM-Log)**					**1.878**
114	**KM Standard Error of Mean (logged)**					**0.0793**						
115												
116	DL/2 Statistics											
117	DL/2 Normal						**DL/2 Log-Transformed**					
118	Mean in Original Scale					1.231	ean in Log Scale					-0.0221
119	**SD in Original Scale**					**0.839**	**D in Log Scale**					**0.693**
120	**95% t UCL (Assumes normality)**					**1.512**	**5% H-Stat UCL**					**1.675**
121	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
122												
123	Nonparametric Distribution Free UCL Statistics											
124	Data do not follow a Discernible Distribution at 5% Significance Level											
125												
126	Suggested UCL to Use											

ProUCL Output

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	A	B	C	D	E	F	G	H	I	J	K	L
127	**95% KM (t) UCL**					**1.682**	**KM H-UCL**					**1.682**
128	**95% KM (BCA) UCL**					**N/A**						
129	Warning: One or more Recommended UCL(s) not available!											
130												
131	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
132	Recommendations are based upon data size, data distribution, and skewness.											
133	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
134	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
135												
136	**Conc (|antimony|domain 1a|all|)**											
137												
138	General Statistics											
139	Total Number of Observations					60	)bservations					11
140	**Number of Detects**					**38**	**)er of Non-Detects**					**22**
141	**Number of Distinct Detects**					**11**	**f Distinct Non-Detects**					**2**
142	**Minimum Detect**					**0.5**	**mum Non-Detect**					**0.5**
143	**Maximum Detect**					**5.4**	**mum Non-Detect**					**1**
144	**Variance Detects**					**1.121**	**:ent Non-Detects**					**36.67%**
145	**Mean Detects**					**1.318**	**SD Detects**					**1.059**
146	Median Detects					0.8	CV Detects					0.803
147	**Skewness Detects**					**2.09**	**urtosis Detects**					**5.14**
148	Mean of Logged Detects					0.0491	of Logged Detects					0.64
149												
150	Normal GOF Test on Detects Only											
151	Shapiro Wilk Test Statistic					0.73	iro Wilk GOF Test					
152	**5% Shapiro Wilk Critical Value**					**0.938**	**Normal at 5% Significance Level**					
153	**Lilliefors Test Statistic**					**0.276**	**Lilliefors GOF Test**					
154	**5% Lilliefors Critical Value**					**0.142**	**Normal at 5% Significance Level**					
155	**Detected Data Not Normal at 5% Significance Level**											
156												
157	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
158	KM Mean					1.04	:rror of Mean					11.90%
159	KM SD					0.91	l (BCA) UCL					1.253
160	95% KM (t) UCL					1.24	otstrap) UCL					1.243
161	95% KM (z) UCL					1.237	otstrap t UCL					1.319
162	90% KM Chebyshev UCL					1.398	byshev UCL					1.561
163	97.5% KM Chebyshev UCL					1.786	byshev UCL					2.228
164												
165	Gamma GOF Tests on Detected Observations Only											
166	**A-D Test Statistic**					**2.435**	**on-Darling GOF Test**					
167	**5% A-D Critical Value**					**0.758**	**a Distributed at 5% Significance Level**					
168	**K-S Test Statistic**					**0.23**	**gorov-Smirnov GOF**					
169	**5% K-S Critical Value**					**0.145**	**a Distributed at 5% Significance Level**					
170	**Detected Data Not Gamma Distributed at 5% Significance Level**											
171												
172	**Gamma Statistics on Detected Data Only**											
173	**k hat (MLE)**					**2.352**	**)ias corrected MLE)**					**2.184**
174	**Theta hat (MLE)**					**0.56**	**r (bias corrected MLE)**					**0.604**
175	**nu hat (MLE)**					**178.8**	**ar (bias corrected)**					**166**
176	**Mean (detects)**					**1.318**						
177												
178	**Gamma ROS Statistics using Imputed Non-Detects**											
179	**GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs**											
180	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
181	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
182	This is especially true when the sample size is small.											
183	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
184	Minimum					0.01	Mean					0.914
185	Maximum					5.4	Median					0.612
186	**SD**					**1.016**	**CV**					**1.111**
187	**k hat (MLE)**					**0.587**	**)ias corrected MLE)**					**0.569**
188	**Theta hat (MLE)**					**1.557**	**r (bias corrected MLE)**					**1.607**
189	**nu hat (MLE)**					**70.47**	**ar (bias corrected)**					**68.28**

	A	B	C	D	E	F	G	H	I	J	K	L
190	**Adjusted Level of Significance (β)**					**0.046**						
191	Approximate Chi Square Value (68.28, α)					50.26	ue (68.28, β)					49.88
192	95% Gamma Approximate UCL (use when n>=50)					1.242	when n<50)					1.251
193												
194	Estimates of Gamma Parameters using KM Estimates											
195	**Mean (KM)**					**1.04**	**SD (KM)**					**0.91**
196	**Variance (KM)**					**0.829**	**E of Mean (KM)**					**0.119**
197	k hat (KM)					1.306	k star (KM)					1.251
198	nu hat (KM)					156.7	nu star (KM)					150.2
199	theta hat (KM)					0.797	eta star (KM)					0.831
200	80% gamma percentile (KM)					1.64	rcentile (KM)					2.266
201	95% gamma percentile (KM)					2.882	rcentile (KM)					4.288
202												
203	Gamma Kaplan-Meier (KM) Statistics											
204	**Approximate Chi Square Value (150.16, α)**					**122.8**	**Square Value (150.16, β)**					**122.2**
205	**95% Gamma Approximate KM-UCL (use when n>=50)**					**1.272**	**usted KM-UCL (use when n<50)**					**1.278**
206												
207	Lognormal GOF Test on Detected Observations Only											
208	Shapiro Wilk Test Statistic					0.868	ilk GOF Test					
209	**5% Shapiro Wilk Critical Value**					**0.938**	**gnormal at 5% Significance Level**					
210	**Lilliefors Test Statistic**					**0.191**	**iefors GOF Test**					
211	**5% Lilliefors Critical Value**					**0.142**	**gnormal at 5% Significance Level**					
212	**Detected Data Not Lognormal at 5% Significance Level**											
213												
214	Lognormal ROS Statistics Using Imputed Non-Detects											
215	Mean in Original Scale					0.986	in Log Scale					-0.352
216	SD in Original Scale					0.958	in Log Scale					0.808
217	95% t UCL (assumes normality of ROS data)					1.192	otstrap UCL					1.198
218	95% BCA Bootstrap UCL					1.224	otstrap t UCL					1.265
219	**95% H-UCL (Log ROS)**					**1.221**						
220												
221	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
222	KM Mean (logged)					-0.187	M Geo Mean					0.829
223	KM SD (logged)					0.599	ue (KM-Log)					1.961
224	KM Standard Error of Mean (logged)					0.0794	CL (KM -Log)					1.156
225	KM SD (logged)					0.599	ue (KM-Log)					1.961
226	**KM Standard Error of Mean (logged)**					**0.0794**						
227												
228	**DL/2 Statistics**											
229	DL/2 Normal						DL/2 Log-Transformed					
230	Mean in Original Scale					0.977	in Log Scale					-0.339
231	SD in Original Scale					0.956	in Log Scale					0.752
232	**95% t UCL (Assumes normality)**					**1.183**	**5% H-Stat UCL**					**1.16**
233	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
234												
235	**Nonparametric Distribution Free UCL Statistics**											
236	**Data do not follow a Discernible Distribution at 5% Significance Level**											
237												
238	Suggested UCL to Use											
239	95% KM (Chebyshev) UCL					1.561						
240												
241	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
242	Recommendations are based upon data size, data distribution, and skewness.											
243	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
244	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
245												
246	**Conc (|antimony|domain 1b|aecom|)**											
247												
248	**General Statistics**											
249	**Total Number of Observations**					**14**	**f Distinct Observations**					**3**
250	Number of Detects					8	Non-Detects					6
251	Number of Distinct Detects					3	Non-Detects					1
252	Minimum Detect					1	n Non-Detect					1

ProUCL Output

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	A	B	C	D	E	F	G	H	I	J	K	L
253	**Maximum Detect**					**3**	**mum Non-Detect**					**1**
254	**Variance Detects**					**0.286**	**ent Non-Detects**					**42.86%**
255	**Mean Detects**					**2**	**SD Detects**					**0.535**
256	**Median Detects**					**2**	**CV Detects**					**26.70%**
257	**Skewness Detects**					**0**	**urtosis Detects**					**3.5**
258	**Mean of Logged Detects**					**0.657**	**f Logged Detects**					**0.301**
259												
260	**Normal GOF Test on Detects Only**											
261	**Shapiro Wilk Test Statistic**					**0.733**	**Shapiro Wilk GOF Test**					
262	**5% Shapiro Wilk Critical Value**					**0.818**	**Normal at 5% Significance Level**					
263	**Lilliefors Test Statistic**					**0.375**	**iefors GOF Test**					
264	5% Lilliefors Critical Value					0.283	icance Level					
265	Detected Data Not Normal at 5% Significance Level											
266												
267	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
268	**KM Mean**					**1.571**	**ndard Error of Mean**					**17.80%**
269	**KM SD**					**0.623**	**% KM (BCA) UCL**					**N/A**
270	**95% KM (t) UCL**					**1.887**	**ercentile Bootstrap) UCL**					**N/A**
271	**95% KM (z) UCL**					**1.864**	**KM Bootstrap t UCL**					**N/A**
272	**90% KM Chebyshev UCL**					**2.105**	**M Chebyshev UCL**					**2.347**
273	**97.5% KM Chebyshev UCL**					**2.683**	**M Chebyshev UCL**					**3.342**
274												
275	**Gamma GOF Tests on Detected Observations Only**											
276	**A-D Test Statistic**					**1.394**	**on-Darling GOF Test**					
277	**5% A-D Critical Value**					**0.715**	**a Distributed at 5% Significance Level**					
278	K-S Test Statistic					0.41	mirnov GOF					
279	5% K-S Critical Value					0.294	icance Level					
280	Detected Data Not Gamma Distributed at 5% Significance Level											
281												
282	Gamma Statistics on Detected Data Only											
283	k hat (MLE)					14.07	rrected MLE)					8.876
284	Theta hat (MLE)					0.142	rrected MLE)					0.225
285	nu hat (MLE)					225.1	as corrected)					142
286	Mean (detects)					2						
287												
288	**Gamma ROS Statistics using Imputed Non-Detects**											
289	**GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs**											
290	**GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)**											
291	**For such situations, GROS method may yield incorrect values of UCLs and BTVs**											
292	**This is especially true when the sample size is small.**											
293	**For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates**											
294	**Minimum**					**0.557**	**Mean**					**1.551**
295	Maximum					3	**Median**					**1.636**
296	SD					0.685	CV					0.442
297	k hat (MLE)					5.177	**ias corrected MLE)**					**4.116**
298	Theta hat (MLE)					0.3	r (bias corrected MLE)					0.377
299	**nu hat (MLE)**					**145**	**ar (bias corrected)**					**115.2**
300	**Adjusted Level of Significance (β)**					**0.0312**						
301	**Approximate Chi Square Value (115.24, α)**					**91.45**	**Square Value (115.24, β)**					**88.65**
302	95% Gamma Approximate UCL (use when n>=50)					1.955	when n<50)					2.017
303												
304	Estimates of Gamma Parameters using KM Estimates											
305	Mean (KM)					1.571	SD (KM)					0.623
306	Variance (KM)					0.388	f Mean (KM)					0.178
307	k hat (KM)					6.368	k star (KM)					5.051
308	**nu hat (KM)**					**178.3**	**nu star (KM)**					**141.4**
309	**theta hat (KM)**					**0.247**	**heta star (KM)**					**0.311**
310	80% gamma percentile (KM)					2.11	**mma percentile (KM)**					**2.507**
311	95% gamma percentile (KM)					2.87	mma percentile (KM)					3.634
312												
313	Gamma Kaplan-Meier (KM) Statistics											
314	**Approximate Chi Square Value (141.44, α)**					**115**	**Square Value (141.44, β)**					**111.8**
315	**95% Gamma Approximate KM-UCL (use when n>=50)**					**1.933**	**usted KM-UCL (use when n<50)**					**1.988**

	A	B	C	D	E	F	G	H	I	J	K	L
316												
317	Lognormal GOF Test on Detected Observations Only											
318	Shapiro Wilk Test Statistic					0.697	ilk GOF Test					
319	5% Shapiro Wilk Critical Value					0.818	icance Level					
320	Lilliefors Test Statistic					0.423	rs GOF Test					
321	**5% Lilliefors Critical Value**					**0.283**	**gnormal at 5% Significance Level**					
322	**Detected Data Not Lognormal at 5% Significance Level**											
323												
324	Lognormal ROS Statistics Using Imputed Non-Detects											
325	Mean in Original Scale					1.587	ean in Log Scale					0.385
326	SD in Original Scale					0.642	D in Log Scale					0.411
327	95% t UCL (assumes normality of ROS data)					1.891	rcentile Bootstrap UCL					1.867
328	95% BCA Bootstrap UCL					1.883	otstrap t UCL					1.926
329	95% H-UCL (Log ROS)					2.006						
330												
331	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
332	KM Mean (logged)					0.376	M Geo Mean					1.456
333	KM SD (logged)					0.389	ue (KM-Log)					1.973
334	KM Standard Error of Mean (logged)					0.111	CL (KM -Log)					1.942
335	KM SD (logged)					0.389	ue (KM-Log)					1.973
336	KM Standard Error of Mean (logged)					0.111						
337												
338	**DL/2 Statistics**											
339	DL/2 Normal						DL/2 Log-Transformed					
340	Mean in Original Scale					1.357	in Log Scale					0.0785
341	SD in Original Scale					0.864	in Log Scale					0.728
342	95% t UCL (Assumes normality)					1.766	H-Stat UCL					2.276
343	DL/2 is not a recommended method, provided for comparisons and historical reasons											
344												
345	Nonparametric Distribution Free UCL Statistics											
346	**Data do not follow a Discernible Distribution at 5% Significance Level**											
347												
348	Suggested UCL to Use											
349	95% KM (t) UCL					1.887	KM H-UCL					1.942
350	**95% KM (BCA) UCL**					**N/A**						
351	**Warning: One or more Recommended UCL(s) not available!**											
352												
353	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
354	Recommendations are based upon data size, data distribution, and skewness.											
355	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
356	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
357												
358	**Conc (|antimony|domain 1b|all|)**											
359												
360	General Statistics											
361	Total Number of Observations					24	Observations					6
362	Number of Detects					11	Non-Detects					13
363	Number of Distinct Detects					5	Non-Detects					2
364	**Minimum Detect**					**0.6**	**mum Non-Detect**					**0.5**
365	**Maximum Detect**					**3**	**mum Non-Detect**					**1**
366	Variance Detects					0.591	Non-Detects					54.17%
367	Mean Detects					1.636	SD Detects					0.768
368	Median Detects					2	CV Detects					0.47
369	Skewness Detects					-0.0659	tosis Detects					-0.737
370	Mean of Logged Detects					0.365	gged Detects					0.565
371												
372	**Normal GOF Test on Detects Only**											
373	**Shapiro Wilk Test Statistic**					**0.836**	**iro Wilk GOF Test**					
374	5% Shapiro Wilk Critical Value					0.85	icance Level					
375	Lilliefors Test Statistic					0.318	rs GOF Test					
376	5% Lilliefors Critical Value					0.251	icance Level					
377	**Detected Data Not Normal at 5% Significance Level**											
378												

	A	B	C	D	E	F	G	H	I	J	K	L
379	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
380	**KM Mean**					**1.033**	**ndard Error of Mean**					**16.00%**
381	**KM SD**					**0.746**	**% KM (BCA) UCL**					**1.3**
382	**95% KM (t) UCL**					**1.308**	**'ercentile Bootstrap) UCL**					**1.283**
383	95% KM (z) UCL					1.297	)tstrap t UCL					1.346
384	**90% KM Chebyshev UCL**					**1.514**	**M Chebyshev UCL**					**1.731**
385	97.5% KM Chebyshev UCL					2.033	KM Chebyshev UCL					2.627
386												
387	Gamma GOF Tests on Detected Observations Only											
388	A-D Test Statistic					1.122	on-Darling GOF Test					
389	**5% A-D Critical Value**					**0.733**	**a Distributed at 5% Significance Level**					
390	**K-S Test Statistic**					**0.356**	**Kolmogorov-Smirnov GOF**					
391	**5% K-S Critical Value**					**0.256**	**a Distributed at 5% Significance Level**					
392	**Detected Data Not Gamma Distributed at 5% Significance Level**											
393												
394	Gamma Statistics on Detected Data Only											
395	k hat (MLE)					4.075	rrected MLE)					3.024
396	Theta hat (MLE)					0.402	rrected MLE)					0.541
397	nu hat (MLE)					89.65	as corrected)					66.53
398	Mean (detects)					1.636						
399												
400	Gamma ROS Statistics using Imputed Non-Detects											
401	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
402	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
403	**For such situations, GROS method may yield incorrect values of UCLs and BTVs**											
404	**This is especially true when the sample size is small.**											
405	**For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates**											
406	**Minimum**					**0.01**	**Mean**					**0.892**
407	**Maximum**					**3**	**Median**					**0.6**
408	**SD**					**0.888**	**CV**					**0.996**
409	**k hat (MLE)**					**0.598**	**bias corrected MLE)**					**0.551**
410	**Theta hat (MLE)**					**1.49**	**r (bias corrected MLE)**					**1.617**
411	**nu hat (MLE)**					**28.72**	**ar (bias corrected)**					**26.46**
412	**Adjusted Level of Significance (β)**					**0.0392**						
413	**Approximate Chi Square Value (26.46, α)**					**15.73**	**i Square Value (26.46, β)**					**15.15**
414	95% Gamma Approximate UCL (use when n>=50)					1.499	**justed UCL (use when n<50)**					**1.557**
415												
416	Estimates of Gamma Parameters using KM Estimates											
417	Mean (KM)					1.033	SD (KM)					0.746
418	**Variance (KM)**					**0.556**	**E of Mean (KM)**					**0.16**
419	**k hat (KM)**					**1.92**	**k star (KM)**					**1.708**
420	**nu hat (KM)**					**92.15**	**nu star (KM)**					**81.96**
421	theta hat (KM)					0.538	eta star (KM)					0.605
422	80% gamma percentile (KM)					1.576	rcentile (KM)					2.087
423	95% gamma percentile (KM)					2.579	rcentile (KM)					3.681
424												
425	Gamma Kaplan-Meier (KM) Statistics											
426	Approximate Chi Square Value (81.96, α)					62.1	ue (81.96, β)					60.88
427	**95% Gamma Approximate KM-UCL (use when n>=50)**					**1.364**	**usted KM-UCL (use when n<50)**					**1.391**
428												
429	**Lognormal GOF Test on Detected Observations Only**											
430	**Shapiro Wilk Test Statistic**					**0.807**	**iro Wilk GOF Test**					
431	**5% Shapiro Wilk Critical Value**					**0.85**	**gnormal at 5% Significance Level**					
432	Lilliefors Test Statistic					0.356	rs GOF Test					
433	5% Lilliefors Critical Value					0.251	icance Level					
434	Detected Data Not Lognormal at 5% Significance Level											
435												
436	**Lognormal ROS Statistics Using Imputed Non-Detects**											
437	**Mean in Original Scale**					**0.974**	**an in Log Scale**					**-0.366**
438	SD in Original Scale					0.814	D in Log Scale					0.852
439	95% t UCL (assumes normality of ROS data)					1.258	rcentile Bootstrap UCL					1.245
440	95% BCA Bootstrap UCL					1.283	% Bootstrap t UCL					1.3
441	95% H-UCL (Log ROS)					1.515						

	A	B	C	D	E	F	G	H	I	J	K	L
442												
443	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
444	KM Mean (logged)					-0.187	M Geo Mean					0.829
445	KM SD (logged)					0.631	ue (KM-Log)					2.104
446	KM Standard Error of Mean (logged)					0.136	CL (KM -Log)					1.334
447	KM SD (logged)					0.631	ue (KM-Log)					2.104
448	KM Standard Error of Mean (logged)					0.136						
449												
450	DL/2 Statistics											
451	DL/2 Normal					DL/2 Log-Transformed						
452	**Mean in Original Scale**					**0.948**	**an in Log Scale**					**-0.41**
453	**SD in Original Scale**					**0.827**	**D in Log Scale**					**0.859**
454	95% t UCL (Assumes normality)					1.237	H-Stat UCL					1.464
455	DL/2 is not a recommended method, provided for comparisons and historical reasons											
456												
457	Nonparametric Distribution Free UCL Statistics											
458	Data do not follow a Discernible Distribution at 5% Significance Level											
459												
460	Suggested UCL to Use											
461	**95% KM (Chebyshev) UCL**					**1.731**						
462												
463	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
464	Recommendations are based upon data size, data distribution, and skewness.											
465	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
466	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
467												
468	Conc (|antimony|domain 2 |all|)											
469												
470	General Statistics											
471	**Total Number of Observations**					**6**	**f Distinct Observations**					**2**
472	**Number of Detects**					**1**	**er of Non-Detects**					**5**
473	**Number of Distinct Detects**					**1**	**f Distinct Non-Detects**					**1**
474												
475	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
476	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
477												
478	The data set for variable Conc (|antimony|domain 2 |all|) was not processed!											
479												
480												
481	Conc (|antimony|domain 2|aecom|)											
482												
483	General Statistics											
484	Total Number of Observations					5	Observations					2
485	Number of Detects					2	Non-Detects					3
486	**Number of Distinct Detects**					**1**	**f Distinct Non-Detects**					**1**
487												
488	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
489	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
490												
491	The data set for variable Conc (|antimony|domain 2|aecom|) was not processed!											
492												
493												
494	**Conc (|antimony|domain 2|all|)**											
495												
496	**General Statistics**											
497	**Total Number of Observations**					**5**	**f Distinct Observations**					**2**
498	Number of Detects					2	Non-Detects					3
499	**Number of Distinct Detects**					**1**	**f Distinct Non-Detects**					**1**
500												
501	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
502	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
503												
504	**The data set for variable Conc (|antimony|domain 2|all|) was not processed!**											

	A	B	C	D	E	F	G	H	I	J	K	L
505												
506												
507												
508	Conc (|arsenic|ambient|aecom|)											
509												
510	General Statistics											
511	**Total Number of Observations**					**14**	**f Distinct Observations**					**6**
512						**Number of Missing Observations**							**0**
513	**Minimum**					**1**	**Mean**					**3.536**
514	**Maximum**					**5.5**	**Median**					**3.5**
515	**SD**					**1.216**	**l. Error of Mean**					**0.325**
516	**Coefficient of Variation**					**0.344**	**Skewness**					**-0.321**
517												
518	**Normal GOF Test**											
519	**Shapiro Wilk Test Statistic**					**0.94**	**Shapiro Wilk GOF Test**					
520	**5% Shapiro Wilk Critical Value**					**0.874**	**mal at 5% Significance Level**					
521	**Lilliefors Test Statistic**					**0.187**	**iefors GOF Test**					
522	5% Lilliefors Critical Value					0.226	icance Level					
523	Data appear Normal at 5% Significance Level											
524												
525	**Assuming Normal Distribution**											
526	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
527	**95% Student's-t UCL**					**4.111**	**ed-CLT UCL (Chen-1995)**					**4.041**
528						**95% Modified-t UCL (Johnson-1978)**						**4.107**
529												
530	**Gamma GOF Test**											
531	**A-D Test Statistic**					**0.664**	**arling Gamma GOF Test**					
532	**5% A-D Critical Value**					**0.737**	**ma Distributed at 5% Significance Level**					
533	**K-S Test Statistic**					**0.241**	**Kolmogorov-Smirnov Gamma GOF Test**					
534	**5% K-S Critical Value**					**0.229**	**tributed at 5% Significance Level**					
535	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
536												
537	Gamma Statistics											
538	k hat (MLE)					6.986	rected MLE)					5.537
539	**Theta hat (MLE)**					**0.506**	**r (bias corrected MLE)**					**0.639**
540	**nu hat (MLE)**					**195.6**	**ar (bias corrected)**					**155**
541	**MLE Mean (bias corrected)**					**3.536**	**Sd (bias corrected)**					**1.503**
542						**Approximate Chi Square Value (0.05)**						**127.3**
543	**Adjusted Level of Significance**					**0.0312**	**d Chi Square Value**					**123.9**
544												
545	**Assuming Gamma Distribution**											
546	**95% Approximate Gamma UCL (use when n>=50))**					**4.308**	**Gamma UCL (use when n<50)**					**4.424**
547												
548	**Lognormal GOF Test**											
549	**Shapiro Wilk Test Statistic**					**0.838**	**lk Lognormal GOF Test**					
550	5% Shapiro Wilk Critical Value					0.874	icance Level					
551	Lilliefors Test Statistic					0.275	al GOF Test					
552	5% Lilliefors Critical Value					0.226	icance Level					
553	**Data Not Lognormal at 5% Significance Level**											
554												
555	**Lognormal Statistics**											
556	**Minimum of Logged Data**					**0**	**n of logged Data**					**1.19**
557	**Maximum of Logged Data**					**1.705**	**of logged Data**					**0.436**
558												
559	**Assuming Lognormal Distribution**											
560	**95% H-UCL**					**4.604**	**ebyshev (MVUE) UCL**					**4.871**
561	**95% Chebyshev (MVUE) UCL**					**5.452**	**97.5% Chebyshev (MVUE) UCL**					**6.258**
562	**99% Chebyshev (MVUE) UCL**					**7.843**						
563												
564	Nonparametric Distribution Free UCL Statistics											
565	Data appear to follow a Discernible Distribution at 5% Significance Level											
566												
567	**Nonparametric Distribution Free UCLs**											

	A	B	C	D	E	F	G	H	I	J	K	L
568	**95% CLT UCL**					**4.07**	**% Jackknife UCL**					**4.111**
569	**95% Standard Bootstrap UCL**					**4.038**	**% Bootstrap-t UCL**					**4.092**
570	**95% Hall's Bootstrap UCL**					**4.046**	**rcentile Bootstrap UCL**					**4.036**
571	**95% BCA Bootstrap UCL**					**4**						
572	**90% Chebyshev(Mean, Sd) UCL**					**4.511**	**byshev(Mean, Sd) UCL**					**4.953**
573	**97.5% Chebyshev(Mean, Sd) UCL**					**5.566**	**byshev(Mean, Sd) UCL**					**6.77**
574												
575	**Suggested UCL to Use**											
576	**95% Student's-t UCL**					**4.111**						
577												
578	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
579	Recommendations are based upon data size, data distribution, and skewness.											
580	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
581	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
582												
583	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
584	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
585												
586												
587	**Conc (|arsenic|domain 1a|aecom|)**											
588												
589	**General Statistics**											
590	**Total Number of Observations**					**26**	**f Distinct Observations**					**1600%**
591						**Number of Missing Observations**							**0**
592	Minimum					4	Mean					12.42
593	Maximum					24	Median					12
594	SD					4.33	rror of Mean					0.849
595	**Coefficient of Variation**					**0.349**	**Skewness**					**0.582**
596												
597	**Normal GOF Test**											
598	**Shapiro Wilk Test Statistic**					**0.967**	**iro Wilk GOF Test**					
599	**5% Shapiro Wilk Critical Value**					**0.92**	**mal at 5% Significance Level**					
600	**Lilliefors Test Statistic**					**0.154**	**iefors GOF Test**					
601	**5% Lilliefors Critical Value**					**0.17**	**mal at 5% Significance Level**					
602	**Data appear Normal at 5% Significance Level**											
603												
604	**Assuming Normal Distribution**											
605	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
606	95% Student's-t UCL					13.87	(Chen-1995)					13.92
607					95% Modified-t UCL (Johnson-1978)							13.89
608												
609	**Gamma GOF Test**											
610	**A-D Test Statistic**					**0.334**	**arling Gamma GOF Test**					
611	**5% A-D Critical Value**					**0.745**	**ma Distributed at 5% Significance Level**					
612	**K-S Test Statistic**					**0.144**	**mirnov Gamma GOF Test**					
613	**5% K-S Critical Value**					**0.171**	**ma Distributed at 5% Significance Level**					
614	**Detected data appear Gamma Distributed at 5% Significance Level**											
615												
616	**Gamma Statistics**											
617	**k hat (MLE)**					**8.039**	**k star (bias corrected MLE)**					**7.137**
618	**Theta hat (MLE)**					**1.545**	**r (bias corrected MLE)**					**1.741**
619	**nu hat (MLE)**					**418**	**ar (bias corrected)**					**371.1**
620	MLE Mean (bias corrected)					12.42	as corrected)					4.65
621					Approximate Chi Square Value (0.05)							327.5
622	Adjusted Level of Significance					0.0398	quare Value					324.8
623												
624	**Assuming Gamma Distribution**											
625	**95% Approximate Gamma UCL (use when n>=50))**					**14.08**	**Gamma UCL (use when n<50)**					**14.2**
626												
627	**Lognormal GOF Test**											
628	**Shapiro Wilk Test Statistic**					**0.95**	**lk Lognormal GOF Test**					
629	**5% Shapiro Wilk Critical Value**					**0.92**	**ormal at 5% Significance Level**					
630	**Lilliefors Test Statistic**					**0.17**	**Lognormal GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
631	**5% Lilliefors Critical Value**					**0.17**	**Data appear Lognormal at 5% Significance Level**					
632	**Data appear Lognormal at 5% Significance Level**											
633												
634	Lognormal Statistics											
635	Minimum of Logged Data					1.386	logged Data					2.456
636	Maximum of Logged Data					3.178	logged Data					0.379
637												
638	**Assuming Lognormal Distribution**											
639	**95% H-UCL**					**14.44**	**ebyshev (MVUE) UCL**					**15.35**
640	**95% Chebyshev (MVUE) UCL**					**16.64**	**ıebyshev (MVUE) UCL**					**18.44**
641	**99% Chebyshev (MVUE) UCL**					**21.97**						
642												
643	**Nonparametric Distribution Free UCL Statistics**											
644	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
645												
646	**Nonparametric Distribution Free UCLs**											
647	**95% CLT UCL**					**13.82**	**% Jackknife UCL**					**13.87**
648	95% Standard Bootstrap UCL					13.79	ıtstrap-t UCL					14.04
649	95% Hall's Bootstrap UCL					14.11	›ootstrap UCL					13.8
650	95% BCA Bootstrap UCL					13.75						
651	**90% Chebyshev(Mean, Sd) UCL**					**1.50E+01**	**byshev(Mean, Sd) UCL**					**16.12**
652	**97.5% Chebyshev(Mean, Sd) UCL**					**17.73**	**byshev(Mean, Sd) UCL**					**20.87**
653												
654	**Suggested UCL to Use**											
655	**95% Student's-t UCL**					**13.87**						
656												
657	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
658	**Recommendations are based upon data size, data distribution, and skewness.**											
659	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
660	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
661												
662												
663	Conc (|arsenic|domain 1a|all|)											
664												
665	**General Statistics**											
666	**Total Number of Observations**					**60**	**f Distinct Observations**					**21**
667						**Number of Missing Observations**							**0**
668	**Minimum**					**4**	**Mean**					**14.79**
669	**Maximum**					**39**	**Median**					**14.5**
670	**SD**					**5.323**	**l. Error of Mean**					**0.687**
671	**Coefficient of Variation**					**0.36**	**Skewness**					**1.487**
672												
673	**Normal GOF Test**											
674	**Shapiro Wilk Test Statistic**					**0.905**	**iro Wilk GOF Test**					
675	**5% Shapiro Wilk P Value**					**8.26E-05**	**al at 5% Significance Level**					
676	Lilliefors Test Statistic					0.139	rs GOF Test					
677	5% Lilliefors Critical Value					0.114	icance Level					
678	Data Not Normal at 5% Significance Level											
679												
680	Assuming Normal Distribution											
681	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
682	95% Student's-t UCL					15.94	(Chen-1995)					16.06
683					95% Modified-t UCL (Johnson-1978)							15.96
684												
685	Gamma GOF Test											
686	**A-D Test Statistic**					**1.098**	**arling Gamma GOF Test**					
687	**5% A-D Critical Value**					**0.752**	**tributed at 5% Significance Level**					
688	**K-S Test Statistic**					**0.116**	**Smirnov Gamma GOF Test**					
689	**5% K-S Critical Value**					**0.115**	**tributed at 5% Significance Level**					
690	**Data Not Gamma Distributed at 5% Significance Level**											
691												
692	**Gamma Statistics**											
693	k hat (MLE)					7.955	**›ias corrected MLE)**					**7.568**

	A	B	C	D	E	F	G	H	I	J	K	L
694	Theta hat (MLE)					1.86	r (bias corrected MLE)					1.955
695	nu hat (MLE)					954.6	**ar (bias corrected)**					**908.2**
696	MLE Mean (bias corrected)					14.79	Sd (bias corrected)					5.377
697						**Approximate Chi Square Value (0.05)**						**839.2**
698	**Adjusted Level of Significance**					**0.046**	**d Chi Square Value**					**837.6**
699												
700	Assuming Gamma Distribution											
701	95% Approximate Gamma UCL (use when n>=50))					16.01	when n<50)					16.04
702												
703	Lognormal GOF Test											
704	Shapiro Wilk Test Statistic					0.929	al GOF Test					
705	5% Shapiro Wilk P Value					0.002	icance Level					
706	**Lilliefors Test Statistic**					**0.135**	**Lognormal GOF Test**					
707	**5% Lilliefors Critical Value**					**0.114**	**mal at 5% Significance Level**					
708	Data Not Lognormal at 5% Significance Level											
709												
710	Lognormal Statistics											
711	Minimum of Logged Data					1.386	n of logged Data					2.63
712	**Maximum of Logged Data**					**3.664**	**of logged Data**					**0.377**
713												
714	**Assuming Lognormal Distribution**											
715	95% H-UCL					16.25	MVUE) UCL					17.11
716	95% Chebyshev (MVUE) UCL					18.12	MVUE) UCL					19.53
717	99% Chebyshev (MVUE) UCL					22.28						
718												
719	**Nonparametric Distribution Free UCL Statistics**											
720	**Data do not follow a Discernible Distribution (0.05)**											
721												
722	Nonparametric Distribution Free UCLs											
723	95% CLT UCL					15.92	% Jackknife UCL					15.94
724	95% Standard Bootstrap UCL					15.9	% Bootstrap-t UCL					16.09
725	95% Hall's Bootstrap UCL					16.36	rcentile Bootstrap UCL					15.88
726	95% BCA Bootstrap UCL					16.03						
727	90% Chebyshev(Mean, Sd) UCL					16.86	an, Sd) UCL					17.79
728	97.5% Chebyshev(Mean, Sd) UCL					19.09	an, Sd) UCL					21.63
729												
730	Suggested UCL to Use											
731	95% Student's-t UCL					15.94	odified-t UCL					15.96
732												
733	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
734	Recommendations are based upon data size, data distribution, and skewness.											
735	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
736	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
737												
738												
739	Conc (|arsenic|domain 1b|aecom|)											
740												
741	General Statistics											
742	Total Number of Observations					14	Observations					13
743						Number of Missing Observations						0
744	**Minimum**					**1**	**Mean**					**12.56**
745	**Maximum**					**32**	**Median**					**8.9**
746	SD					8.769	rror of Mean					2.344
747	Coefficient of Variation					0.698	Skewness					1.099
748												
749	**Normal GOF Test**											
750	Shapiro Wilk Test Statistic					0.894	**iro Wilk GOF Test**					
751	5% Shapiro Wilk Critical Value					0.874	rmal at 5% Significance Level					
752	Lilliefors Test Statistic					0.229	**iefors GOF Test**					
753	5% Lilliefors Critical Value					0.226	al at 5% Significance Level					
754	**Data appear Approximate Normal at 5% Significance Level**											
755												
756	**Assuming Normal Distribution**											

	A	B	C	D	E	F	G	H	I	J	K	L
757	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
758	95% Student's-t UCL					16.71	(Chen-1995)					17.15
759					95% Modified-t UCL (Johnson-1978)							16.83
760												
761	Gamma GOF Test											
762	**A-D Test Statistic**					**0.326**	**arling Gamma GOF Test**					
763	**5% A-D Critical Value**					**0.746**	**ma Distributed at 5% Significance Level**					
764	K-S Test Statistic					0.154	na GOF Test					
765	5% K-S Critical Value					0.232	icance Level					
766	Detected data appear Gamma Distributed at 5% Significance Level											
767												
768	Gamma Statistics											
769	**k hat (MLE)**					**2.009**	**bias corrected MLE)**					**1.626**
770	**Theta hat (MLE)**					**6.254**	**r (bias corrected MLE)**					**7.727**
771	**nu hat (MLE)**					**56.25**	**ar (bias corrected)**					**45.53**
772	MLE Mean (bias corrected)					12.56	as corrected)					9.853
773					Approximate Chi Square Value (0.05)							31.05
774	Adjusted Level of Significance					0.0312	quare Value					29.47
775												
776	**Assuming Gamma Distribution**											
777	**95% Approximate Gamma UCL (use when n>=50))**					**18.42**	**Gamma UCL (use when n<50)**					**19.41**
778												
779	**Lognormal GOF Test**											
780	**Shapiro Wilk Test Statistic**					**0.901**	**lk Lognormal GOF Test**					
781	5% Shapiro Wilk Critical Value					0.874	icance Level					
782	**Lilliefors Test Statistic**					**0.207**	**Lognormal GOF Test**					
783	5% Lilliefors Critical Value					0.226	ormal at 5% Significance Level					
784	Data appear Lognormal at 5% Significance Level											
785												
786	Lognormal Statistics											
787	**Minimum of Logged Data**					**0**	**n of logged Data**					**2.262**
788	**Maximum of Logged Data**					**3.466**	**SD of logged Data**					**0.86**
789												
790	**Assuming Lognormal Distribution**											
791	95% H-UCL					25.66	MVUE) UCL					23.35
792	95% Chebyshev (MVUE) UCL					27.84	MVUE) UCL					34.07
793	99% Chebyshev (MVUE) UCL					46.31						
794												
795	Nonparametric Distribution Free UCL Statistics											
796	Data appear to follow a Discernible Distribution at 5% Significance Level											
797												
798	Nonparametric Distribution Free UCLs											
799	95% CLT UCL					16.42	ckknife UCL					16.71
800	95% Standard Bootstrap UCL					16.3	tstrap-t UCL					17.85
801	**95% Hall's Bootstrap UCL**					**18.39**	**rcentile Bootstrap UCL**					**16.52**
802	**95% BCA Bootstrap UCL**					**17.11**						
803	**90% Chebyshev(Mean, Sd) UCL**					**19.59**	**byshev(Mean, Sd) UCL**					**22.78**
804	**97.5% Chebyshev(Mean, Sd) UCL**					**27.2**	**byshev(Mean, Sd) UCL**					**35.88**
805												
806	**Suggested UCL to Use**											
807	**95% Student's-t UCL**					**16.71**						
808												
809	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
810	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
811												
812	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
813	**Recommendations are based upon data size, data distribution, and skewness.**											
814	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
815	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
816												
817												
818	Conc (|arsenic|domain 1b|all|)											
819												

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
820	General Statistics											
821	**Total Number of Observations**					**25**	**f Distinct Observations**					**19**
822							**Number of Missing Observations**					**0**
823	**Minimum**					**1**	**Mean**					**12.49**
824	**Maximum**					**32**	**Median**					**9**
825	**SD**					**8.33**	**l. Error of Mean**					**1.666**
826	Coefficient of Variation					0.667	Skewness					1.021
827												
828	Normal GOF Test											
829	Shapiro Wilk Test Statistic					0.885	ilk GOF Test					
830	**5% Shapiro Wilk Critical Value**					**0.918**	**al at 5% Significance Level**					
831	**Lilliefors Test Statistic**					**0.218**	**iefors GOF Test**					
832	5% Lilliefors Critical Value					0.173	icance Level					
833	Data Not Normal at 5% Significance Level											
834												
835	Assuming Normal Distribution											
836	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
837	95% Student's-t UCL					15.34	(Chen-1995)					15.6
838					95% Modified-t UCL (Johnson-1978)							15.4
839												
840	**Gamma GOF Test**											
841	**A-D Test Statistic**					**0.434**	**ıa GOF Test**					
842	5% A-D Critical Value					0.755	icance Level					
843	K-S Test Statistic					0.149	ıa GOF Test					
844	**5% K-S Critical Value**					**0.177**	**ma Distributed at 5% Significance Level**					
845	**Detected data appear Gamma Distributed at 5% Significance Level**											
846												
847	**Gamma Statistics**											
848	**k hat (MLE)**					**2.261**	**ıias corrected MLE)**					**2.017**
849	Theta hat (MLE)					5.525	rrected MLE)					6.195
850	nu hat (MLE)					113.1	ıs corrected)					100.8
851	MLE Mean (bias corrected)					12.49	ıs corrected)					8.797
852					Approximate Chi Square Value (0.05)							78.66
853	Adjusted Level of Significance					0.0395	quare Value					77.32
854												
855	**Assuming Gamma Distribution**											
856	95% Approximate Gamma UCL (use when n>=50)					16.01	when n<50)					16.29
857												
858	Lognormal GOF Test											
859	Shapiro Wilk Test Statistic					0.931	ıal GOF Test					
860	5% Shapiro Wilk Critical Value					0.918	icance Level					
861	**Lilliefors Test Statistic**					**0.161**	**Lognormal GOF Test**					
862	**5% Lilliefors Critical Value**					**0.173**	**ormal at 5% Significance Level**					
863	**Data appear Lognormal at 5% Significance Level**											
864												
865	Lognormal Statistics											
866	Minimum of Logged Data					0	logged Data					2.288
867	**Maximum of Logged Data**					**3.466**	**of logged Data**					**0.767**
868												
869	**Assuming Lognormal Distribution**											
870	**95% H-UCL**					**18.72**	**ebyshev (MVUE) UCL**					**19.57**
871	**95% Chebyshev (MVUE) UCL**					**22.53**	**ıebyshev (MVUE) UCL**					**26.63**
872	**99% Chebyshev (MVUE) UCL**					**34.7**						
873												
874	Nonparametric Distribution Free UCL Statistics											
875	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
876												
877	Nonparametric Distribution Free UCLs											
878	95% CLT UCL					15.23	% Jackknife UCL					15.34
879	95% Standard Bootstrap UCL					15.23	% Bootstrap-t UCL					15.85
880	95% Hall's Bootstrap UCL					15.7	rcentile Bootstrap UCL					15.37
881	**95% BCA Bootstrap UCL**					**15.81**						
882	**90% Chebyshev(Mean, Sd) UCL**					**17.49**	**95% Chebyshev(Mean, Sd) UCL**					**19.75**

	A	B	C	D	E	F	G	H	I	J	K	L
883	**97.5% Chebyshev(Mean, Sd) UCL**					**22.9**	**byshev(Mean, Sd) UCL**					**29.07**
884												
885	Suggested UCL to Use											
886	95% Adjusted Gamma UCL					16.29						
887												
888	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
889	**Recommendations are based upon data size, data distribution, and skewness.**											
890	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
891	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
892												
893												
894	**Conc (|arsenic|domain 2 |all|)**											
895												
896	**General Statistics**											
897	**Total Number of Observations**					**6**	**f Distinct Observations**					**4**
898						**Number of Missing Observations**							**0**
899	Minimum					3.8	Mean					14.97
900	Maximum					20	Median					15.5
901	SD					5.94	rror of Mean					2.425
902	**Coefficient of Variation**					**0.397**	**Skewness**					**-1.626**
903												
904	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
905	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
906	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
907	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**											
908												
909	**Normal GOF Test**											
910	**Shapiro Wilk Test Statistic**					**0.804**	**Shapiro Wilk GOF Test**					
911	**5% Shapiro Wilk Critical Value**					**0.788**	**mal at 5% Significance Level**					
912	**Lilliefors Test Statistic**					**0.336**	**iefors GOF Test**					
913	5% Lilliefors Critical Value					0.325	icance Level					
914	Data appear Approximate Normal at 5% Significance Level											
915												
916	**Assuming Normal Distribution**											
917	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
918	**95% Student's-t UCL**					**19.85**	**ed-CLT UCL (Chen-1995)**					**17.24**
919						**95% Modified-t UCL (Johnson-1978)**						**19.59**
920												
921	**Gamma GOF Test**											
922	**A-D Test Statistic**					**0.9**	**arling Gamma GOF Test**					
923	**5% A-D Critical Value**					**0.699**	**tributed at 5% Significance Level**					
924	**K-S Test Statistic**					**0.399**	**Kolmogorov-Smirnov Gamma GOF Test**					
925	**5% K-S Critical Value**					**0.333**	**tributed at 5% Significance Level**					
926	**Data Not Gamma Distributed at 5% Significance Level**											
927												
928	Gamma Statistics											
929	k hat (MLE)					4.328	rrected MLE)					2.275
930	**Theta hat (MLE)**					**3.458**	**r (bias corrected MLE)**					**6.579**
931	**nu hat (MLE)**					**5.19E+01**	**ar (bias corrected)**					**27.3**
932	**MLE Mean (bias corrected)**					**14.97**	**Sd (bias corrected)**					**9.923**
933						**Approximate Chi Square Value (0.05)**						**16.38**
934	**Adjusted Level of Significance**					**0.0122**	**d Chi Square Value**					**13.43**
935												
936	**Assuming Gamma Distribution**											
937	**95% Approximate Gamma UCL (use when n>=50))**					**24.94**	**Gamma UCL (use when n<50)**					**30.43**
938												
939	**Lognormal GOF Test**											
940	**Shapiro Wilk Test Statistic**					**0.678**	**lk Lognormal GOF Test**					
941	5% Shapiro Wilk Critical Value					0.788	icance Level					
942	Lilliefors Test Statistic					0.411	al GOF Test					
943	5% Lilliefors Critical Value					0.325	icance Level					
944	**Data Not Lognormal at 5% Significance Level**											
945												

	A	B	C	D	E	F	G	H	I	J	K	L
946	**Lognormal Statistics**											
947	**Minimum of Logged Data**					**1.335**	**n of logged Data**					**2.586**
948	**Maximum of Logged Data**					**2.996**	**of logged Data**					**0.627**
949												
950	**Assuming Lognormal Distribution**											
951	**95% H-UCL**					**37.1**	**ebyshev (MVUE) UCL**					**27.51**
952	**95% Chebyshev (MVUE) UCL**					**32.91**	**97.5% Chebyshev (MVUE) UCL**					**40.4**
953	**99% Chebyshev (MVUE) UCL**					**55.13**						
954												
955	Nonparametric Distribution Free UCL Statistics											
956	Data appear to follow a Discernible Distribution at 5% Significance Level											
957												
958	**Nonparametric Distribution Free UCLs**											
959	**95% CLT UCL**					**18.96**	**% Jackknife UCL**					**19.85**
960	**95% Standard Bootstrap UCL**					**N/A**	**% Bootstrap-t UCL**					**N/A**
961	**95% Hall's Bootstrap UCL**					**N/A**	**rcentile Bootstrap UCL**					**N/A**
962	**95% BCA Bootstrap UCL**					**N/A**						
963	**90% Chebyshev(Mean, Sd) UCL**					**22.24**	**byshev(Mean, Sd) UCL**					**25.54**
964	**97.5% Chebyshev(Mean, Sd) UCL**					**30.11**	**byshev(Mean, Sd) UCL**					**39.1**
965												
966	**Suggested UCL to Use**											
967	**95% Student's-t UCL**					**19.85**						
968												
969	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
970	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
971												
972	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
973	**Recommendations are based upon data size, data distribution, and skewness.**											
974	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
975	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
976												
977	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
978	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
979												
980												
981	**Conc (|arsenic|domain 2|aecom|)**											
982												
983	General Statistics											
984	Total Number of Observations					5	**)bservations**					5
985						Number of Missing Observations							0
986	**Minimum**					**4**	**Mean**					**8.44**
987	**Maximum**					**21**	**Median**					**5.8**
988	**SD**					**7.063**	**l. Error of Mean**					**3.159**
989	**Coefficient of Variation**					**0.837**	**Skewness**					**2.169**
990												
991	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
992	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
993	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
994	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**											
995												
996	**Normal GOF Test**											
997	Shapiro Wilk Test Statistic					0.651	**ilk GOF Test**					
998	5% Shapiro Wilk Critical Value					0.762	**icance Level**					
999	Lilliefors Test Statistic					0.44	**rs GOF Test**					
1000	**5% Lilliefors Critical Value**					**0.343**	**al at 5% Significance Level**					
1001	**Data Not Normal at 5% Significance Level**											
1002												
1003	**Assuming Normal Distribution**											
1004	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
1005	**95% Student's-t UCL**					**15.17**	**ed-CLT UCL (Chen-1995)**					**16.91**
1006						**95% Modified-t UCL (Johnson-1978)**						**15.68**
1007												
1008	**Gamma GOF Test**											

	A	B	C	D	E	F	G	H	I	J	K	L
1009	**A-D Test Statistic**					**0.866**	**arling Gamma GOF Test**					
1010	**5% A-D Critical Value**					**0.683**	**tributed at 5% Significance Level**					
1011	K-S Test Statistic					0.433	na GOF Test					
1012	5% K-S Critical Value					0.36	icance Level					
1013	Data Not Gamma Distributed at 5% Significance Level											
1014												
1015	**Gamma Statistics**											
1016	**k hat (MLE)**					**2.664**	**bias corrected MLE)**					**1.199**
1017	**Theta hat (MLE)**					**3.169**	**r (bias corrected MLE)**					**7.041**
1018	**nu hat (MLE)**					**26.64**	**ar (bias corrected)**					**11.99**
1019	**MLE Mean (bias corrected)**					**8.44**	**Sd (bias corrected)**					**7.709**
1020							**Approximate Chi Square Value (0.05)**					**5.219**
1021	**Adjusted Level of Significance**					**0.0086**	**d Chi Square Value**					**3.451**
1022												
1023	**Assuming Gamma Distribution**											
1024	**95% Approximate Gamma UCL (use when n>=50))**					**19.39**	**Gamma UCL (use when n<50)**					**29.32**
1025												
1026	Lognormal GOF Test											
1027	Shapiro Wilk Test Statistic					0.763	al GOF Test					
1028	**5% Shapiro Wilk Critical Value**					**0.762**	**ormal at 5% Significance Level**					
1029	**Lilliefors Test Statistic**					**0.398**	**Lognormal GOF Test**					
1030	**5% Lilliefors Critical Value**					**0.343**	**mal at 5% Significance Level**					
1031	**Data appear Approximate Lognormal at 5% Significance Level**											
1032												
1033	**Lognormal Statistics**											
1034	**Minimum of Logged Data**					**1.386**	**n of logged Data**					**1.934**
1035	**Maximum of Logged Data**					**3.045**	**of logged Data**					**0.641**
1036												
1037	**Assuming Lognormal Distribution**											
1038	**95% H-UCL**					**25.52**	**ebyshev (MVUE) UCL**					**14.98**
1039	95% Chebyshev (MVUE) UCL					18.09	MVUE) UCL					22.41
1040	99% Chebyshev (MVUE) UCL					30.89						
1041												
1042	**Nonparametric Distribution Free UCL Statistics**											
1043	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
1044												
1045	**Nonparametric Distribution Free UCLs**											
1046	**95% CLT UCL**					**13.64**	**% Jackknife UCL**					**15.17**
1047	**95% Standard Bootstrap UCL**					**13.09**	**% Bootstrap-t UCL**					**111.9**
1048	**95% Hall's Bootstrap UCL**					**123.8**	**rcentile Bootstrap UCL**					**14.5**
1049	**95% BCA Bootstrap UCL**					**14.88**						
1050	**90% Chebyshev(Mean, Sd) UCL**					**17.92**	**95% Chebyshev(Mean, Sd) UCL**					**22.21**
1051	**97.5% Chebyshev(Mean, Sd) UCL**					**28.17**	**byshev(Mean, Sd) UCL**					**39.87**
1052												
1053	Suggested UCL to Use											
1054	95% H-UCL					25.52						
1055												
1056	**Recommended UCL exceeds the maximum observation**											
1057												
1058	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1059	**Recommendations are based upon data size, data distribution, and skewness.**											
1060	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1061	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1062												
1063	**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**											
1064	**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**											
1065	**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**											
1066	**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**											
1067												
1068												
1069	Conc (|arsenic|domain 2|all|)											
1070												
1071	**General Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
1072	**Total Number of Observations**					**5**	**f Distinct Observations**					**5**
1073						**Number of Missing Observations**						**0**
1074	**Minimum**					**4**	**Mean**					**8.44**
1075	**Maximum**					**21**	**Median**					**5.8**
1076	**SD**					**7.063**	**l. Error of Mean**					**3.159**
1077	**Coefficient of Variation**					**0.837**	**Skewness**					**2.169**
1078												
1079	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
1080	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
1081	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
1082	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
1083												
1084	**Normal GOF Test**											
1085	**Shapiro Wilk Test Statistic**					**0.651**	**iro Wilk GOF Test**					
1086	**5% Shapiro Wilk Critical Value**					**7.62E-01**	**al at 5% Significance Level**					
1087	**Lilliefors Test Statistic**					**0.44**	**iefors GOF Test**					
1088	**5% Lilliefors Critical Value**					**0.343**	**al at 5% Significance Level**					
1089	**Data Not Normal at 5% Significance Level**											
1090												
1091	**Assuming Normal Distribution**											
1092	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
1093	**95% Student's-t UCL**					**15.17**	**ed-CLT UCL (Chen-1995)**					**16.91**
1094						**95% Modified-t UCL (Johnson-1978)**						**15.68**
1095												
1096	Gamma GOF Test											
1097	A-D Test Statistic					0.866	na GOF Test					
1098	**5% A-D Critical Value**					**0.683**	**tributed at 5% Significance Level**					
1099	**K-S Test Statistic**					**0.433**	**Smirnov Gamma GOF Test**					
1100	**5% K-S Critical Value**					**0.36**	**tributed at 5% Significance Level**					
1101	**Data Not Gamma Distributed at 5% Significance Level**											
1102												
1103	**Gamma Statistics**											
1104	**k hat (MLE)**					**2.664**	**bias corrected MLE)**					**1.199**
1105	**Theta hat (MLE)**					**3.169**	**r (bias corrected MLE)**					**7.041**
1106	**nu hat (MLE)**					**26.64**	**nu star (bias corrected)**					**11.99**
1107	**MLE Mean (bias corrected)**					**8.44**	**Sd (bias corrected)**					**7.709**
1108						**Approximate Chi Square Value (0.05)**						**5.219**
1109	Adjusted Level of Significance					0.0086	Square Value					3.451
1110												
1111	Assuming Gamma Distribution											
1112	**95% Approximate Gamma UCL (use when n>=50))**					**19.39**	**Gamma UCL (use when n<50)**					**29.32**
1113												
1114	**Lognormal GOF Test**											
1115	**Shapiro Wilk Test Statistic**					**0.763**	**lk Lognormal GOF Test**					
1116	**5% Shapiro Wilk Critical Value**					**7.62E-01**	**ormal at 5% Significance Level**					
1117	**Lilliefors Test Statistic**					**0.398**	**Lognormal GOF Test**					
1118	**5% Lilliefors Critical Value**					**0.343**	**mal at 5% Significance Level**					
1119	**Data appear Approximate Lognormal at 5% Significance Level**											
1120												
1121	**Lognormal Statistics**											
1122	**Minimum of Logged Data**					**1.386**	**n of logged Data**					**1.934**
1123	Maximum of Logged Data					3.045	logged Data					0.641
1124												
1125	Assuming Lognormal Distribution											
1126	**95% H-UCL**					**25.52**	**ebyshev (MVUE) UCL**					**14.98**
1127	**95% Chebyshev (MVUE) UCL**					**18.09**	**ebyshev (MVUE) UCL**					**22.41**
1128	**99% Chebyshev (MVUE) UCL**					**30.89**						
1129												
1130	**Nonparametric Distribution Free UCL Statistics**											
1131	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
1132												
1133	**Nonparametric Distribution Free UCLs**											
1134	**95% CLT UCL**					**13.64**	**95% Jackknife UCL**					**15.17**

	A	B	C	D	E	F	G	H	I	J	K	L
1135	**95% Standard Bootstrap UCL**					**13.04**	**% Bootstrap-t UCL**					**109.9**
1136	**95% Hall's Bootstrap UCL**					**67.31**	**rcentile Bootstrap UCL**					**14.5**
1137	95% BCA Bootstrap UCL					14.88						
1138	90% Chebyshev(Mean, Sd) UCL					17.92	an, Sd) UCL					22.21
1139	97.5% Chebyshev(Mean, Sd) UCL					28.17	an, Sd) UCL					39.87
1140												
1141	**Suggested UCL to Use**											
1142	**95% H-UCL**					**25.52**						
1143												
1144	**Recommended UCL exceeds the maximum observation**											
1145												
1146	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1147	**Recommendations are based upon data size, data distribution, and skewness.**											
1148	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1149	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1150												
1151	ProUCL computes and outputs H-statistic based UCLs for historical reasons only.											
1152	H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.											
1153	It is therefore recommended to avoid the use of H-statistic based 95% UCLs.											
1154	Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.											
1155												
1156	Conc (|cadmium|ambient|aecom|)											
1157												
1158	General Statistics											
1159	Total Number of Observations					14	)bservations					1
1160	Number of Detects					1	Non-Detects					13
1161	**Number of Distinct Detects**					**1**	**f Distinct Non-Detects**					**1**
1162												
1163	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
1164	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
1165												
1166	**The data set for variable Conc (|cadmium|ambient|aecom|) was not processed!**											
1167												
1168												
1169	**Conc (|cadmium|domain 1a|aecom|)**											
1170												
1171	**General Statistics**											
1172	Total Number of Observations					26	**f Distinct Observations**					**12**
1173	Number of Detects					20	)er of Non-Detects					6
1174	Number of Distinct Detects					11	**f Distinct Non-Detects**					**1**
1175	Minimum Detect					0.2	mum Non-Detect					0.1
1176	**Maximum Detect**					**2**	**mum Non-Detect**					**0.1**
1177	**Variance Detects**					**0.297**	**:ent Non-Detects**					**23.08%**
1178	**Mean Detects**					**0.845**	**SD Detects**					**0.545**
1179	Median Detects					0.7	CV Detects					0.645
1180	Skewness Detects					1.03	:osis Detects					0.231
1181	Mean of Logged Detects					-0.364	gged Detects					0.652
1182												
1183	Normal GOF Test on Detects Only											
1184	Shapiro Wilk Test Statistic					0.876	ilk GOF Test					
1185	**5% Shapiro Wilk Critical Value**					**0.905**	**Normal at 5% Significance Level**					
1186	**Lilliefors Test Statistic**					**0.187**	**iefors GOF Test**					
1187	**5% Lilliefors Critical Value**					**0.192**	**r Normal at 5% Significance Level**					
1188	**Detected Data appear Approximate Normal at 5% Significance Level**											
1189												
1190	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1191	KM Mean					0.673	:rror of Mean					0.113
1192	KM SD					0.562	1 (BCA) UCL					0.865
1193	95% KM (t) UCL					0.866	otstrap) UCL					0.854
1194	**95% KM (z) UCL**					**0.859**	**KM Bootstrap t UCL**					**0.908**
1195	**90% KM Chebyshev UCL**					**1.012**	**M Chebyshev UCL**					**1.166**
1196	97.5% KM Chebyshev UCL					1.379	:M Chebyshev UCL					1.798
1197												

	A	B	C	D	E	F	G	H	I	J	K	L
1198	Gamma GOF Tests on Detected Observations Only											
1199	A-D Test Statistic					0.384	on-Darling GOF Test					
1200	5% A-D Critical Value					0.749	ma Distributed at 5% Significance Level					
1201	K-S Test Statistic					0.17	mirnov GOF					
1202	5% K-S Critical Value					0.195	icance Level					
1203	Detected data appear Gamma Distributed at 5% Significance Level											
1204												
1205	Gamma Statistics on Detected Data Only											
1206	k hat (MLE)					2.708	rected MLE)					2.335
1207	Theta hat (MLE)					0.312	rected MLE)					0.362
1208	nu hat (MLE)					108.3	s corrected)					93.4
1209	Mean (detects)					0.845						
1210												
1211	**Gamma ROS Statistics using Imputed Non-Detects**											
1212	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1213	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1214	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1215	This is especially true when the sample size is small.											
1216	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1217	Minimum					0.01	Mean					0.656
1218	Maximum					2	Median					0.5
1219	**SD**					**0.592**	**CV**					**0.902**
1220	**k hat (MLE)**					**0.752**	**ias corrected MLE)**					**0.691**
1221	Theta hat (MLE)					0.872	rected MLE)					0.949
1222	nu hat (MLE)					39.11	s corrected)					35.93
1223	**Adjusted Level of Significance (β)**					**0.0398**						
1224	**Approximate Chi Square Value (35.93, α)**					**23.21**	**i Square Value (35.93, β)**					**22.54**
1225	95% Gamma Approximate UCL (use when n>=50)					1.015	**justed UCL (use when n<50)**					**1.046**
1226												
1227	Estimates of Gamma Parameters using KM Estimates											
1228	Mean (KM)					0.673	SD (KM)					0.562
1229	**Variance (KM)**					**0.316**	**E of Mean (KM)**					**0.113**
1230	**k hat (KM)**					**1.434**	**k star (KM)**					**1.295**
1231	**nu hat (KM)**					**74.59**	**nu star (KM)**					**67.32**
1232	theta hat (KM)					0.469	eta star (KM)					0.52
1233	80% gamma percentile (KM)					1.058	rcentile (KM)					1.454
1234	95% gamma percentile (KM)					1.843	rcentile (KM)					2.729
1235												
1236	Gamma Kaplan-Meier (KM) Statistics											
1237	**Approximate Chi Square Value (67.32, α)**					**49.44**	**i Square Value (67.32, β)**					**48.42**
1238	**95% Gamma Approximate KM-UCL (use when n>=50)**					**0.917**	**usted KM-UCL (use when n<50)**					**0.936**
1239												
1240	Lognormal GOF Test on Detected Observations Only											
1241	Shapiro Wilk Test Statistic					0.965	ilk GOF Test					
1242	5% Shapiro Wilk Critical Value					0.905	icance Level					
1243	Lilliefors Test Statistic					0.143	rs GOF Test					
1244	**5% Lilliefors Critical Value**					**0.192**	**Lognormal at 5% Significance Level**					
1245	**Detected Data appear Lognormal at 5% Significance Level**											
1246												
1247	Lognormal ROS Statistics Using Imputed Non-Detects											
1248	Mean in Original Scale					0.686	in Log Scale					-0.72
1249	SD in Original Scale					0.56	in Log Scale					0.886
1250	**95% t UCL (assumes normality of ROS data)**					**0.874**	**rcentile Bootstrap UCL**					**0.869**
1251	**95% BCA Bootstrap UCL**					**0.871**	**% Bootstrap t UCL**					**0.916**
1252	**95% H-UCL (Log ROS)**					**1.096**						
1253												
1254	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1255	**KM Mean (logged)**					**-0.812**	**KM Geo Mean**					**0.444**
1256	KM SD (logged)					0.989	ue (KM-Log)					2.493
1257	**KM Standard Error of Mean (logged)**					**0.199**	**H-UCL (KM -Log)**					**1.186**
1258	KM SD (logged)					0.989	tical H Value (KM-Log)					2.493
1259	KM Standard Error of Mean (logged)					0.199						
1260												

	A	B	C	D	E	F	G	H	I	J	K	L
1261	DL/2 Statistics											
1262	**DL/2 Normal**						**DL/2 Log-Transformed**					
1263	**Mean in Original Scale**					**0.662**	**Mean in Log Scale**					**-0.972**
1264	**SD in Original Scale**					**0.585**	**D in Log Scale**					**1.266**
1265	**95% t UCL (Assumes normality)**					**0.858**	**5% H-Stat UCL**					**1.743**
1266	DL/2 is not a recommended method, provided for comparisons and historical reasons											
1267												
1268	Nonparametric Distribution Free UCL Statistics											
1269	**Detected Data appear Approximate Normal Distributed at 5% Significance Level**											
1270												
1271	**Suggested UCL to Use**											
1272	**95% KM (t) UCL**					**0.866**						
1273												
1274	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
1275	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
1276												
1277	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1278	**Recommendations are based upon data size, data distribution, and skewness.**											
1279	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1280	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1281												
1282	Conc (|cadmium|domain 1a|all|)											
1283												
1284	**General Statistics**											
1285	**Total Number of Observations**					**60**	**f Distinct Observations**					**16**
1286	**Number of Detects**					**45**	**ber of Non-Detects**					**15**
1287	**Number of Distinct Detects**					**16**	**f Distinct Non-Detects**					**1**
1288	**Minimum Detect**					**0.1**	**mum Non-Detect**					**0.1**
1289	**Maximum Detect**					**4.5**	**mum Non-Detect**					**0.1**
1290	**Variance Detects**					**0.563**	**cent Non-Detects**					**25%**
1291	**Mean Detects**					**0.856**	**SD Detects**					**0.75**
1292	**Median Detects**					**0.6**	**CV Detects**					**0.877**
1293	**Skewness Detects**					**2.889**	**urtosis Detects**					**11.89**
1294	Mean of Logged Detects					-0.427	gged Detects					0.735
1295												
1296	Normal GOF Test on Detects Only											
1297	**Shapiro Wilk Test Statistic**					**0.737**	**iro Wilk GOF Test**					
1298	**5% Shapiro Wilk Critical Value**					**0.945**	**Normal at 5% Significance Level**					
1299	**Lilliefors Test Statistic**					**0.204**	**iefors GOF Test**					
1300	**5% Lilliefors Critical Value**					**0.131**	**Normal at 5% Significance Level**					
1301	**Detected Data Not Normal at 5% Significance Level**											
1302												
1303	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
1304	**KM Mean**					**0.667**	**ndard Error of Mean**					**0.0941**
1305	**KM SD**					**0.721**	**95% KM (BCA) UCL**					**0.825**
1306	**95% KM (t) UCL**					**0.824**	**'ercentile Bootstrap) UCL**					**0.832**
1307	**95% KM (z) UCL**					**0.821**	**KM Bootstrap t UCL**					**0.876**
1308	90% KM Chebyshev UCL					0.949	byshev UCL					1.077
1309	97.5% KM Chebyshev UCL					1.254	byshev UCL					1.603
1310												
1311	Gamma GOF Tests on Detected Observations Only											
1312	A-D Test Statistic					0.734	ng GOF Test					
1313	5% A-D Critical Value					0.761	icance Level					
1314	K-S Test Statistic					0.146	mirnov GOF					
1315	5% K-S Critical Value					0.133	icance Level					
1316	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
1317												
1318	**Gamma Statistics on Detected Data Only**											
1319	**k hat (MLE)**					**1.994**	**bias corrected MLE)**					**1.876**
1320	**Theta hat (MLE)**					**0.429**	**r (bias corrected MLE)**					**0.456**
1321	**nu hat (MLE)**					**179.5**	**ar (bias corrected)**					**168.8**
1322	**Mean (detects)**					**0.856**						
1323												

	A	B	C	D	E	F	G	H	I	J	K	L
1324	**Gamma ROS Statistics using Imputed Non-Detects**											
1325	**GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs**											
1326	**GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)**											
1327	**For such situations, GROS method may yield incorrect values of UCLs and BTVs**											
1328	**This is especially true when the sample size is small.**											
1329	**For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates**											
1330	**Minimum**					**0.01**	**Mean**					**0.644**
1331	**Maximum**					**4.5**	**Median**					**0.5**
1332	SD					0.746	CV					1.157
1333	k hat (MLE)					0.599	rected MLE)					0.58
1334	Theta hat (MLE)					1.076	rected MLE)					1.11
1335	nu hat (MLE)					71.87	s corrected)					69.61
1336	Adjusted Level of Significance (β)					0.046						
1337	Approximate Chi Square Value (69.61, α)					51.4	ue (69.61, β)					51.02
1338	**95% Gamma Approximate UCL (use when n>=50)**					**0.872**	**justed UCL (use when n<50)**					**0.879**
1339												
1340	**Estimates of Gamma Parameters using KM Estimates**											
1341	**Mean (KM)**					**0.667**	**SD (KM)**					**0.721**
1342	**Variance (KM)**					**0.52**	**E of Mean (KM)**					**0.0941**
1343	k hat (KM)					0.855	k star (KM)					0.824
1344	nu hat (KM)					1.03E+02	nu star (KM)					98.85
1345	theta hat (KM)					0.779	eta star (KM)					0.809
1346	80% gamma percentile (KM)					1.088	rcentile (KM)					1.61
1347	**95% gamma percentile (KM)**					**2.14**	**mma percentile (KM)**					**3.39**
1348												
1349	Gamma Kaplan-Meier (KM) Statistics											
1350	Approximate Chi Square Value (98.85, α)					76.92	ue (98.85, β)					76.44
1351	95% Gamma Approximate KM-UCL (use when n>=50)					0.857	when n<50)					0.862
1352												
1353	Lognormal GOF Test on Detected Observations Only											
1354	Shapiro Wilk Test Statistic					0.986	ilk GOF Test					
1355	5% Shapiro Wilk Critical Value					0.945	icance Level					
1356	**Lilliefors Test Statistic**					**0.101**	**iefors GOF Test**					
1357	**5% Lilliefors Critical Value**					**0.131**	**Lognormal at 5% Significance Level**					
1358	**Detected Data appear Lognormal at 5% Significance Level**											
1359												
1360	Lognormal ROS Statistics Using Imputed Non-Detects											
1361	**Mean in Original Scale**					**0.674**	**an in Log Scale**					**-0.853**
1362	**SD in Original Scale**					**0.722**	**D in Log Scale**					**1**
1363	**95% t UCL (assumes normality of ROS data)**					**0.83**	**rcentile Bootstrap UCL**					**0.832**
1364	**95% BCA Bootstrap UCL**					**0.884**	**% Bootstrap t UCL**					**0.891**
1365	**95% H-UCL (Log ROS)**					**0.955**						
1366												
1367	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
1368	KM Mean (logged)					-0.896	M Geo Mean					0.408
1369	KM SD (logged)					1.027	ue (KM-Log)					2.396
1370	KM Standard Error of Mean (logged)					0.134	L (KM -Log)					0.953
1371	**KM SD (logged)**					**1.027**	**tical H Value (KM-Log)**					**2.396**
1372	**KM Standard Error of Mean (logged)**					**0.134**						
1373												
1374	DL/2 Statistics											
1375	DL/2 Normal						DL/2 Log-Transformed					
1376	Mean in Original Scale					0.654	in Log Scale					-1.069
1377	SD in Original Scale					0.737	in Log Scale					1.289
1378	**95% t UCL (Assumes normality)**					**0.813**	**5% H-Stat UCL**					**1.285**
1379	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1380												
1381	Nonparametric Distribution Free UCL Statistics											
1382	Detected Data appear Approximate Gamma Distributed at 5% Significance Level											
1383												
1384	**Suggested UCL to Use**											
1385	**95% KM Approximate Gamma UCL**					**0.857**	**Approximate Gamma UCL**					**0.872**
1386												

	A	B	C	D	E	F	G	H	I	J	K	L
1387	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
1388	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
1389												
1390	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1391	**Recommendations are based upon data size, data distribution, and skewness.**											
1392	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1393	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1394												
1395	Conc (|cadmium|domain 1b|aecom|)											
1396												
1397	**General Statistics**											
1398	**Total Number of Observations**					**14**	**f Distinct Observations**					**2**
1399	**Number of Detects**					**6**	**ber of Non-Detects**					**8**
1400	Number of Distinct Detects					2	Non-Detects					1
1401	Minimum Detect					0.1	n Non-Detect					0.1
1402	Maximum Detect					0.2	n Non-Detect					0.1
1403	**Variance Detects**					**0.003**	**cent Non-Detects**					**57.14%**
1404	**Mean Detects**					**0.15**	**SD Detects**					**0.0548**
1405	**Median Detects**					**0.15**	**CV Detects**					**0.365**
1406	**Skewness Detects**					**1.19E-15**	**urtosis Detects**					**-3.333**
1407	**Mean of Logged Detects**					**-1.956**	**f Logged Detects**					**0.38**
1408												
1409	**Normal GOF Test on Detects Only**											
1410	**Shapiro Wilk Test Statistic**					**0.682**	**iro Wilk GOF Test**					
1411	**5% Shapiro Wilk Critical Value**					**0.788**	**Detected Data Not Normal at 5% Significance Level**					
1412	**Lilliefors Test Statistic**					**0.319**	**iefors GOF Test**					
1413	**5% Lilliefors Critical Value**					**0.325**	**r Normal at 5% Significance Level**					
1414	Detected Data appear Approximate Normal at 5% Significance Level											
1415												
1416	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1417	**KM Mean**					**0.121**	**ndard Error of Mean**					**0.012**
1418	**KM SD**					**0.041**	**% KM (BCA) UCL**					**N/A**
1419	**95% KM (t) UCL**					**0.143**	**ercentile Bootstrap) UCL**					**N/A**
1420	**95% KM (z) UCL**					**0.141**	**KM Bootstrap t UCL**					**N/A**
1421	**90% KM Chebyshev UCL**					**0.157**	**M Chebyshev UCL**					**0.174**
1422	**97.5% KM Chebyshev UCL**					**0.196**	**M Chebyshev UCL**					**0.241**
1423												
1424	**Gamma GOF Tests on Detected Observations Only**											
1425	**A-D Test Statistic**					**1.078**	**Anderson-Darling GOF Test**					
1426	**5% A-D Critical Value**					**0.698**	**a Distributed at 5% Significance Level**					
1427	**K-S Test Statistic**					**0.341**	**gorov-Smirnov GOF**					
1428	5% K-S Critical Value					0.333	icance Level					
1429	Detected Data Not Gamma Distributed at 5% Significance Level											
1430												
1431	**Gamma Statistics on Detected Data Only**											
1432	**k hat (MLE)**					**8.653**	**bias corrected MLE)**					**4.438**
1433	**Theta hat (MLE)**					**0.0173**	**r (bias corrected MLE)**					**0.0338**
1434	**nu hat (MLE)**					**103.8**	**ar (bias corrected)**					**53.25**
1435	**Mean (detects)**					**0.15**						
1436												
1437	**Gamma ROS Statistics using Imputed Non-Detects**											
1438	**GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs**											
1439	**GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)**											
1440	**For such situations, GROS method may yield incorrect values of UCLs and BTVs**											
1441	**This is especially true when the sample size is small.**											
1442	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1443	Minimum					0.01	Mean					0.0819
1444	Maximum					0.2	Median					0.0634
1445	**SD**					**0.0721**	**CV**					**0.879**
1446	**k hat (MLE)**					**1.17**	**bias corrected MLE)**					**0.967**
1447	**Theta hat (MLE)**					**0.07**	**r (bias corrected MLE)**					**0.0847**
1448	**nu hat (MLE)**					**32.76**	**ar (bias corrected)**					**27.07**
1449	**Adjusted Level of Significance (β)**					**0.0312**						

	A	B	C	D	E	F	G	H	I	J	K	L
1450	**Approximate Chi Square Value (27.07, α)**					**16.21**	**l Square Value (27.07, β)**					**15.1**
1451	**95% Gamma Approximate UCL (use when n>=50)**					**0.137**	**justed UCL (use when n<50)**					**0.147**
1452												
1453	**Estimates of Gamma Parameters using KM Estimates**											
1454	**Mean (KM)**					**0.121**	**SD (KM)**					**0.041**
1455	**Variance (KM)**					**0.00168**	**E of Mean (KM)**					**0.012**
1456	k hat (KM)					8.758	k star (KM)					6.929
1457	nu hat (KM)					245.2	nu star (KM)					194
1458	theta hat (KM)					0.0139	eta star (KM)					0.0175
1459	**80% gamma percentile (KM)**					**0.158**	**mma percentile (KM)**					**0.183**
1460	**95% gamma percentile (KM)**					**0.206**	**mma percentile (KM)**					**0.254**
1461												
1462	**Gamma Kaplan-Meier (KM) Statistics**											
1463	**Approximate Chi Square Value (194.00, α)**					**162.8**	**Square Value (194.00, β)**					**159**
1464	**95% Gamma Approximate KM-UCL (use when n>=50)**					**0.145**	**usted KM-UCL (use when n<50)**					**0.148**
1465												
1466	**Lognormal GOF Test on Detected Observations Only**											
1467	**Shapiro Wilk Test Statistic**					**0.682**	**Shapiro Wilk GOF Test**					
1468	**5% Shapiro Wilk Critical Value**					**0.788**	**gnormal at 5% Significance Level**					
1469	**Lilliefors Test Statistic**					**0.319**	**iefors GOF Test**					
1470	5% Lilliefors Critical Value					0.325	icance Level					
1471	Detected Data appear Approximate Lognormal at 5% Significance Level											
1472												
1473	**Lognormal ROS Statistics Using Imputed Non-Detects**											
1474	**Mean in Original Scale**					**0.0932**	**an in Log Scale**					**-2.578**
1475	**SD in Original Scale**					**0.0627**	**D in Log Scale**					**0.668**
1476	**95% t UCL (assumes normality of ROS data)**					**0.123**	**rcentile Bootstrap UCL**					**0.121**
1477	**95% BCA Bootstrap UCL**					**0.123**	**% Bootstrap t UCL**					**0.129**
1478	**95% H-UCL (Log ROS)**					**0.145**						
1479												
1480	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1481	**KM Mean (logged)**					**-2.154**	**KM Geo Mean**					**0.116**
1482	**KM SD (logged)**					**0.284**	**tical H Value (KM-Log)**					**1.881**
1483	**KM Standard Error of Mean (logged)**					**0.0833**	**H-UCL (KM -Log)**					**0.14**
1484	KM SD (logged)					0.284	ue (KM-Log)					1.881
1485	KM Standard Error of Mean (logged)					0.0833						
1486												
1487	**DL/2 Statistics**											
1488	**DL/2 Normal**						**DL/2 Log-Transformed**					
1489	**Mean in Original Scale**					**0.0929**	**an in Log Scale**					**-2.55**
1490	**SD in Original Scale**					**0.0616**	**D in Log Scale**					**0.584**
1491	**95% t UCL (Assumes normality)**					**0.122**	**5% H-Stat UCL**					**0.131**
1492	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1493												
1494	**Nonparametric Distribution Free UCL Statistics**											
1495	**Detected Data appear Approximate Normal Distributed at 5% Significance Level**											
1496												
1497	**Suggested UCL to Use**											
1498	95% KM (t) UCL					0.143						
1499												
1500	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
1501	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
1502												
1503	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1504	**Recommendations are based upon data size, data distribution, and skewness.**											
1505	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1506	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1507												
1508	**Conc (|cadmium|domain 1b|all|)**											
1509												
1510	**General Statistics**											
1511	**Total Number of Observations**					**25**	**f Distinct Observations**					**3**
1512	Number of Detects					6	Non-Detects					19

	A	B	C	D	E	F	G	H	I	J	K	L
1513	Number of Distinct Detects					2	Non-Detects					2
1514	Minimum Detect					0.1	n Non-Detect					0.1
1515	**Maximum Detect**					**0.2**	**mum Non-Detect**					**0.4**
1516	**Variance Detects**					**0.003**	**cent Non-Detects**					**76%**
1517	**Mean Detects**					**0.15**	**SD Detects**					**0.0548**
1518	**Median Detects**					**0.15**	**CV Detects**					**0.365**
1519	**Skewness Detects**					**1.19E-15**	**urtosis Detects**					**-3.333**
1520	**Mean of Logged Detects**					**-1.956**	**f Logged Detects**					**0.38**
1521												
1522	**Normal GOF Test on Detects Only**											
1523	**Shapiro Wilk Test Statistic**					**0.682**	**iro Wilk GOF Test**					
1524	**5% Shapiro Wilk Critical Value**					**0.788**	**Normal at 5% Significance Level**					
1525	Lilliefors Test Statistic					0.319	rs GOF Test					
1526	5% Lilliefors Critical Value					0.325	icance Level					
1527	Detected Data appear Approximate Normal at 5% Significance Level											
1528												
1529	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
1530	**KM Mean**					**0.113**	**ndard Error of Mean**					**0.0074**
1531	**KM SD**					**0.0331**	**% KM (BCA) UCL**					**N/A**
1532	**95% KM (t) UCL**					**0.125**	**ercentile Bootstrap) UCL**					**N/A**
1533	**95% KM (z) UCL**					**0.125**	**KM Bootstrap t UCL**					**N/A**
1534	**90% KM Chebyshev UCL**					**0.135**	**M Chebyshev UCL**					**0.145**
1535	**97.5% KM Chebyshev UCL**					**0.159**	**99% KM Chebyshev UCL**					**0.186**
1536												
1537	**Gamma GOF Tests on Detected Observations Only**											
1538	A-D Test Statistic					1.078	ng GOF Test					
1539	5% A-D Critical Value					0.698	icance Level					
1540	K-S Test Statistic					0.341	mirnov GOF					
1541	**5% K-S Critical Value**					**0.333**	**a Distributed at 5% Significance Level**					
1542	**Detected Data Not Gamma Distributed at 5% Significance Level**											
1543												
1544	**Gamma Statistics on Detected Data Only**											
1545	**k hat (MLE)**					**8.653**	**bias corrected MLE)**					**4.438**
1546	**Theta hat (MLE)**					**0.0173**	**r (bias corrected MLE)**					**0.0338**
1547	**nu hat (MLE)**					**103.8**	**ar (bias corrected)**					**53.25**
1548	**Mean (detects)**					**0.15**						
1549												
1550	**Gamma ROS Statistics using Imputed Non-Detects**											
1551	**GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs**											
1552	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1553	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1554	This is especially true when the sample size is small.											
1555	**For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates**											
1556	**Minimum**					**0.01**	**Mean**					**0.0529**
1557	**Maximum**					**0.2**	**Median**					**0.0186**
1558	**SD**					**0.0635**	**CV**					**1.2**
1559	**k hat (MLE)**					**0.906**	**bias corrected MLE)**					**82.40%**
1560	**Theta hat (MLE)**					**0.0584**	**r (bias corrected MLE)**					**0.0642**
1561	**nu hat (MLE)**					**45.3**	**ar (bias corrected)**					**41.2**
1562	**Adjusted Level of Significance (β)**					**0.0395**						
1563	**Approximate Chi Square Value (41.20, α)**					**27.49**	**Adjusted Chi Square Value (41.20, β)**					**26.72**
1564	**95% Gamma Approximate UCL (use when n>=50)**					**0.0793**	**justed UCL (use when n<50)**					**0.0815**
1565												
1566	Estimates of Gamma Parameters using KM Estimates											
1567	Mean (KM)					0.113	SD (KM)					0.0331
1568	Variance (KM)					0.00109	f Mean (KM)					0.0074
1569	**k hat (KM)**					**11.57**	**k star (KM)**					**10.21**
1570	**nu hat (KM)**					**578.6**	**nu star (KM)**					**510.5**
1571	**theta hat (KM)**					**0.00972**	**heta star (KM)**					**0.011**
1572	**80% gamma percentile (KM)**					**0.141**	**mma percentile (KM)**					**0.159**
1573	**95% gamma percentile (KM)**					**0.176**	**mma percentile (KM)**					**0.21**
1574												
1575	**Gamma Kaplan-Meier (KM) Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
1576	**Approximate Chi Square Value (510.48, α)**					**459.1**	**Square Value (510.48, β)**					**455.8**
1577	**95% Gamma Approximate KM-UCL (use when n>=50)**					**0.125**	**95% Gamma Adjusted KM-UCL (use when n<50)**					**0.126**
1578												
1579	**Lognormal GOF Test on Detected Observations Only**											
1580	Shapiro Wilk Test Statistic					0.682	ilk GOF Test					
1581	5% Shapiro Wilk Critical Value					0.788	icance Level					
1582	Lilliefors Test Statistic					0.319	rs GOF Test					
1583	**5% Lilliefors Critical Value**					**0.325**	**ognormal at 5% Significance Level**					
1584	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
1585												
1586	**Lognormal ROS Statistics Using Imputed Non-Detects**											
1587	**Mean in Original Scale**					**0.0672**	**an in Log Scale**					**-2.997**
1588	**SD in Original Scale**					**0.0564**	**D in Log Scale**					**0.787**
1589	**95% t UCL (assumes normality of ROS data)**					**0.0865**	**rcentile Bootstrap UCL**					**0.087**
1590	**95% BCA Bootstrap UCL**					**0.0892**	**% Bootstrap t UCL**					**0.0929**
1591	**95% H-UCL (Log ROS)**					**0.0976**						
1592												
1593	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1594	KM Mean (logged)					-2.216	M Geo Mean					0.109
1595	KM SD (logged)					0.229	ue (KM-Log)					1.771
1596	KM Standard Error of Mean (logged)					0.0513	CL (KM -Log)					0.122
1597	**KM SD (logged)**					**0.229**	**tical H Value (KM-Log)**					**1.771**
1598	**KM Standard Error of Mean (logged)**					**0.0513**						
1599												
1600	**DL/2 Statistics**											
1601	**DL/2 Normal**						**DL/2 Log-Transformed**					
1602	**Mean in Original Scale**					**0.08**	**an in Log Scale**					**-2.691**
1603	**SD in Original Scale**					**0.0559**	**D in Log Scale**					**0.532**
1604	**95% t UCL (Assumes normality)**					**0.0991**	**5% H-Stat UCL**					**0.097**
1605	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1606												
1607	**Nonparametric Distribution Free UCL Statistics**											
1608	Detected Data appear Approximate Normal Distributed at 5% Significance Level											
1609												
1610	Suggested UCL to Use											
1611	**95% KM (t) UCL**					**0.125**						
1612												
1613	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
1614	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
1615												
1616	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1617	**Recommendations are based upon data size, data distribution, and skewness.**											
1618	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1619	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1620												
1621	**Conc (|cadmium|domain 2 |all|)**											
1622												
1623	General Statistics											
1624	Total Number of Observations					6	Observations					2
1625	**Number of Detects**					**1**	**er of Non-Detects**					**5**
1626	**Number of Distinct Detects**					**1**	**f Distinct Non-Detects**					**1**
1627												
1628	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
1629	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
1630												
1631	**The data set for variable Conc (|cadmium|domain 2 |all|) was not processed!**											
1632												
1633												
1634	**Conc (|cadmium|domain 2|aecom|)**											
1635												
1636	General Statistics											
1637	Total Number of Observations					5	Observations					1
1638	Number of Detects					0	Non-Detects					5

	A	B	C	D	E	F	G	H	I	J	K	L
1639	**Number of Distinct Detects**					**0**	**f Distinct Non-Detects**					**1**
1640												
1641	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
1642	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
1643	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
1644												
1645	**The data set for variable Conc (|cadmium|domain 2|aecom|) was not processed!**											
1646												
1647												
1648	**Conc (|cadmium|domain 2|all|)**											
1649												
1650	General Statistics											
1651	Total Number of Observations					5	)bservations					1
1652	Number of Detects					0	Non-Detects					5
1653	**Number of Distinct Detects**					**0**	**f Distinct Non-Detects**					**1**
1654												
1655	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
1656	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
1657	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
1658												
1659	**The data set for variable Conc (|cadmium|domain 2|all|) was not processed!**											
1660												
1661												
1662												
1663	**Conc (|chromium|ambient|aecom|)**											
1664												
1665	General Statistics											
1666	Total Number of Observations					14	)bservations					13
1667						**Number of Missing Observations**							**0**
1668	**Minimum**					**5**	**Mean**					**11.5**
1669	**Maximum**					**27**	**Median**					**9.55**
1670	**SD**					**6.752**	**l. Error of Mean**					**1.804**
1671	**Coefficient of Variation**					**0.587**	**Skewness**					**1.192**
1672												
1673	**Normal GOF Test**											
1674	**Shapiro Wilk Test Statistic**					**0.866**	**iro Wilk GOF Test**					
1675	**5% Shapiro Wilk Critical Value**					**0.874**	**Data Not Normal at 5% Significance Level**					
1676	**Lilliefors Test Statistic**					**0.231**	**iefors GOF Test**					
1677	**5% Lilliefors Critical Value**					**0.226**	**al at 5% Significance Level**					
1678	Data Not Normal at 5% Significance Level											
1679												
1680	Assuming Normal Distribution											
1681	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
1682	**95% Student's-t UCL**					**14.7**	**ed-CLT UCL (Chen-1995)**					**15.08**
1683						**95% Modified-t UCL (Johnson-1978)**						**14.79**
1684												
1685	**Gamma GOF Test**											
1686	**A-D Test Statistic**					**0.394**	**arling Gamma GOF Test**					
1687	**5% A-D Critical Value**					**0.741**	**ma Distributed at 5% Significance Level**					
1688	**K-S Test Statistic**					**0.176**	**Smirnov Gamma GOF Test**					
1689	**5% K-S Critical Value**					**0.23**	**Detected data appear Gamma Distributed at 5% Significance Level**					
1690	**Detected data appear Gamma Distributed at 5% Significance Level**											
1691												
1692	Gamma Statistics											
1693	k hat (MLE)					3.63	rrected MLE)					2.899
1694	Theta hat (MLE)					3.168	rrected MLE)					3.966
1695	**nu hat (MLE)**					**101.6**	**ar (bias corrected)**					**81.18**
1696	**MLE Mean (bias corrected)**					**11.5**	**Sd (bias corrected)**					**6.754**
1697						**Approximate Chi Square Value (0.05)**						**61.42**
1698	**Adjusted Level of Significance**					**0.0312**	**d Chi Square Value**					**59.14**
1699												
1700	**Assuming Gamma Distribution**											
1701	**95% Approximate Gamma UCL (use when n>=50)**					**15.2**	**Gamma UCL (use when n<50)**					**15.79**

	A	B	C	D	E	F	G	H	I	J	K	L
1702												
1703	**Lognormal GOF Test**											
1704	**Shapiro Wilk Test Statistic**					**0.944**	**lk Lognormal GOF Test**					
1705	**5% Shapiro Wilk Critical Value**					**0.874**	**ormal at 5% Significance Level**					
1706	Lilliefors Test Statistic					0.14	al GOF Test					
1707	5% Lilliefors Critical Value					0.226	icance Level					
1708	Data appear Lognormal at 5% Significance Level											
1709												
1710	**Lognormal Statistics**											
1711	**Minimum of Logged Data**					**1.609**	**n of logged Data**					**2.298**
1712	**Maximum of Logged Data**					**3.296**	**of logged Data**					**0.546**
1713												
1714	**Assuming Lognormal Distribution**											
1715	**95% H-UCL**					**15.84**	**ebyshev (MVUE) UCL**					**16.59**
1716	**95% Chebyshev (MVUE) UCL**					**18.93**	**ebyshev (MVUE) UCL**					**22.19**
1717	**99% Chebyshev (MVUE) UCL**					**28.57**						
1718												
1719	**Nonparametric Distribution Free UCL Statistics**											
1720	Data appear to follow a Discernible Distribution at 5% Significance Level											
1721												
1722	Nonparametric Distribution Free UCLs											
1723	**95% CLT UCL**					**14.47**	**% Jackknife UCL**					**14.7**
1724	**95% Standard Bootstrap UCL**					**14.31**	**% Bootstrap-t UCL**					**15.89**
1725	**95% Hall's Bootstrap UCL**					**15.91**	**rcentile Bootstrap UCL**					**14.45**
1726	**95% BCA Bootstrap UCL**					**15.32**						
1727	**90% Chebyshev(Mean, Sd) UCL**					**16.91**	**byshev(Mean, Sd) UCL**					**19.37**
1728	**97.5% Chebyshev(Mean, Sd) UCL**					**22.77**	**byshev(Mean, Sd) UCL**					**29.45**
1729												
1730	**Suggested UCL to Use**											
1731	**95% Adjusted Gamma UCL**					**15.79**						
1732												
1733	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1734	Recommendations are based upon data size, data distribution, and skewness.											
1735	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1736	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1737												
1738												
1739	**Conc (|chromium|domain 1a|aecom|)**											
1740												
1741	**General Statistics**											
1742	**Total Number of Observations**					**26**	**f Distinct Observations**					**20**
1743						**Number of Missing Observations**						**0**
1744	**Minimum**					**10**	**Mean**					**32.46**
1745	**Maximum**					**67**	**Median**					**32**
1746	**SD**					**13.25**	**l. Error of Mean**					**2.599**
1747	**Coefficient of Variation**					**0.408**	**Skewness**					**0.615**
1748												
1749	Normal GOF Test											
1750	Shapiro Wilk Test Statistic					0.959	ilk GOF Test					
1751	**5% Shapiro Wilk Critical Value**					**0.92**	**mal at 5% Significance Level**					
1752	**Lilliefors Test Statistic**					**0.0957**	**iefors GOF Test**					
1753	**5% Lilliefors Critical Value**					**0.17**	**mal at 5% Significance Level**					
1754	**Data appear Normal at 5% Significance Level**											
1755												
1756	**Assuming Normal Distribution**											
1757	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
1758	**95% Student's-t UCL**					**36.9**	**ed-CLT UCL (Chen-1995)**					**37.07**
1759							**95% Modified-t UCL (Johnson-1978)**					**36.95**
1760												
1761	**Gamma GOF Test**											
1762	A-D Test Statistic					0.312	na GOF Test					
1763	5% A-D Critical Value					0.746	icance Level					
1764	K-S Test Statistic					0.115	na GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L
1765	5% K-S Critical Value					0.171	icance Level					
1766	Detected data appear Gamma Distributed at 5% Significance Level											
1767												
1768	Gamma Statistics											
1769	k hat (MLE)					6.037	rected MLE)					5.366
1770	Theta hat (MLE)					5.377	rected MLE)					6.05
1771	nu hat (MLE)					313.9	s corrected)					279
1772	**MLE Mean (bias corrected)**					**32.46**	**Sd (bias corrected)**					**14.01**
1773							**Approximate Chi Square Value (0.05)**					**241.3**
1774	**Adjusted Level of Significance**					**0.0398**	**d Chi Square Value**					**239**
1775												
1776	**Assuming Gamma Distribution**											
1777	**95% Approximate Gamma UCL (use when n>=50))**					**37.53**	**Gamma UCL (use when n<50)**					**37.89**
1778												
1779	Lognormal GOF Test											
1780	Shapiro Wilk Test Statistic					0.967	ilk Lognormal GOF Test					
1781	5% Shapiro Wilk Critical Value					0.92	**ormal at 5% Significance Level**					
1782	Lilliefors Test Statistic					0.129	Lognormal GOF Test					
1783	**5% Lilliefors Critical Value**					**0.17**	**ormal at 5% Significance Level**					
1784	**Data appear Lognormal at 5% Significance Level**											
1785												
1786	Lognormal Statistics											
1787	Minimum of Logged Data					2.303	logged Data					3.395
1788	Maximum of Logged Data					4.205	logged Data					0.434
1789												
1790	Assuming Lognormal Distribution											
1791	95% H-UCL					38.68	MVUE) UCL					41.24
1792	**95% Chebyshev (MVUE) UCL**					**45.13**	**ebyshev (MVUE) UCL**					**50.54**
1793	**99% Chebyshev (MVUE) UCL**					**61.17**						
1794												
1795	Nonparametric Distribution Free UCL Statistics											
1796	Data appear to follow a Discernible Distribution at 5% Significance Level											
1797												
1798	**Nonparametric Distribution Free UCLs**											
1799	**95% CLT UCL**					**36.74**	**% Jackknife UCL**					**36.9**
1800	**95% Standard Bootstrap UCL**					**36.62**	**% Bootstrap-t UCL**					**3715.00%**
1801	95% Hall's Bootstrap UCL					37.36	ootstrap UCL					36.62
1802	95% BCA Bootstrap UCL					37.04						
1803	90% Chebyshev(Mean, Sd) UCL					40.26	an, Sd) UCL					43.79
1804	97.5% Chebyshev(Mean, Sd) UCL					48.69	an, Sd) UCL					58.32
1805												
1806	**Suggested UCL to Use**											
1807	95% Student's-t UCL					36.9						
1808												
1809	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1810	Recommendations are based upon data size, data distribution, and skewness.											
1811	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1812	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1813												
1814												
1815	Conc (|chromium|domain 1a|all|)											
1816												
1817	General Statistics											
1818	Total Number of Observations					60	Observations					37
1819							Number of Missing Observations					0
1820	Minimum					10	Mean					42.82
1821	**Maximum**					**72**	**Median**					**42.5**
1822	**SD**					**15.19**	**I. Error of Mean**					**1.961**
1823	Coefficient of Variation					0.355	Skewness					-0.0919
1824												
1825	Normal GOF Test											
1826	Shapiro Wilk Test Statistic					0.968	ilk GOF Test					
1827	5% Shapiro Wilk P Value					0.251	icance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
1828	Lilliefors Test Statistic					0.0733	rs GOF Test					
1829	5% Lilliefors Critical Value					0.114	icance Level					
1830	**Data appear Normal at 5% Significance Level**											
1831												
1832	Assuming Normal Distribution											
1833	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
1834	**95% Student's-t UCL**					**46.09**	**ed-CLT UCL (Chen-1995)**					**46.02**
1835						**95% Modified-t UCL (Johnson-1978)**						**46.09**
1836												
1837	Gamma GOF Test											
1838	A-D Test Statistic					0.791	**arling Gamma GOF Test**					
1839	5% A-D Critical Value					0.753	stributed at 5% Significance Level					
1840	**K-S Test Statistic**					**0.114**	**Smirnov Gamma GOF Test**					
1841	**5% K-S Critical Value**					**0.115**	**ma Distributed at 5% Significance Level**					
1842	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
1843												
1844	Gamma Statistics											
1845	k hat (MLE)					6.754	rrected MLE)					6.427
1846	Theta hat (MLE)					6.34	rrected MLE)					6.662
1847	nu hat (MLE)					810.5	as corrected)					771.3
1848	**MLE Mean (bias corrected)**					**42.82**	**Sd (bias corrected)**					**16.89**
1849						**Approximate Chi Square Value (0.05)**						**707.8**
1850	Adjusted Level of Significance					0.046	quare Value					706.3
1851												
1852	Assuming Gamma Distribution											
1853	95% Approximate Gamma UCL (use when n>=50))					46.65	when n<50)					46.75
1854												
1855	**Lognormal GOF Test**											
1856	**Shapiro Wilk Test Statistic**					**0.922**	**lk Lognormal GOF Test**					
1857	**5% Shapiro Wilk P Value**					**8.23E-04**	**mal at 5% Significance Level**					
1858	Lilliefors Test Statistic					0.142	al GOF Test					
1859	5% Lilliefors Critical Value					0.114	icance Level					
1860	Data Not Lognormal at 5% Significance Level											
1861												
1862	**Lognormal Statistics**											
1863	**Minimum of Logged Data**					**2.303**	**n of logged Data**					**3.681**
1864	**Maximum of Logged Data**					**4.277**	**of logged Data**					**0.42**
1865												
1866	**Assuming Lognormal Distribution**											
1867	95% H-UCL					47.93	MVUE) UCL					50.57
1868	**95% Chebyshev (MVUE) UCL**					**53.87**	**ebyshev (MVUE) UCL**					**58.45**
1869	99% Chebyshev (MVUE) UCL					67.46						
1870												
1871	Nonparametric Distribution Free UCL Statistics											
1872	Data appear to follow a Discernible Distribution at 5% Significance Level											
1873												
1874	**Nonparametric Distribution Free UCLs**											
1875	**95% CLT UCL**					**46.04**	**% Jackknife UCL**					**46.09**
1876	**95% Standard Bootstrap UCL**					**45.94**	**% Bootstrap-t UCL**					**46.09**
1877	95% Hall's Bootstrap UCL					45.88	ootstrap UCL					45.87
1878	95% BCA Bootstrap UCL					45.98						
1879	90% Chebyshev(Mean, Sd) UCL					48.7	an, Sd) UCL					51.37
1880	97.5% Chebyshev(Mean, Sd) UCL					55.06	an, Sd) UCL					62.33
1881												
1882	Suggested UCL to Use											
1883	95% Student's-t UCL					46.09						
1884												
1885	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1886	Recommendations are based upon data size, data distribution, and skewness.											
1887	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1888	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1889												
1890	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											

	A	B	C	D	E	F	G	H	I	J	K	L
1891	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
1892												
1893												
1894	**Conc (|chromium|domain 1b|aecom|)**											
1895												
1896	**General Statistics**											
1897	**Total Number of Observations**					**14**	**f Distinct Observations**					**12**
1898						**Number of Missing Observations**							**0**
1899	**Minimum**					**11**	**Mean**					**27.64**
1900	**Maximum**					**54**	**Median**					**23.5**
1901	SD					13.6	rror of Mean					3.634
1902	Coefficient of Variation					0.492	Skewness					0.748
1903												
1904	Normal GOF Test											
1905	Shapiro Wilk Test Statistic					0.917	ilk GOF Test					
1906	5% Shapiro Wilk Critical Value					0.874	icance Level					
1907	**Lilliefors Test Statistic**					**0.187**	**iefors GOF Test**					
1908	**5% Lilliefors Critical Value**					**0.226**	**mal at 5% Significance Level**					
1909	**Data appear Normal at 5% Significance Level**											
1910												
1911	**Assuming Normal Distribution**											
1912	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
1913	95% Student's-t UCL					3.41E+01	(Chen-1995)					34.4
1914					95% Modified-t UCL (Johnson-1978)							34.2
1915												
1916	**Gamma GOF Test**											
1917	**A-D Test Statistic**					**0.266**	**arling Gamma GOF Test**					
1918	5% A-D Critical Value					0.739	icance Level					
1919	K-S Test Statistic					0.158	ıa GOF Test					
1920	5% K-S Critical Value					0.229	icance Level					
1921	Detected data appear Gamma Distributed at 5% Significance Level											
1922												
1923	Gamma Statistics											
1924	k hat (MLE)					4.62	rrected MLE)					3.677
1925	**Theta hat (MLE)**					**5.984**	**r (bias corrected MLE)**					**7.517**
1926	**nu hat (MLE)**					**129.4**	**ar (bias corrected)**					**103**
1927	**MLE Mean (bias corrected)**					**27.64**	ıs corrected)					14.41
1928					Approximate Chi Square Value (0.05)							80.56
1929	Adjusted Level of Significance					0.0312	quare Value					77.93
1930												
1931	**Assuming Gamma Distribution**											
1932	**95% Approximate Gamma UCL (use when n>=50))**					**35.33**	**Gamma UCL (use when n<50)**					**36.53**
1933												
1934	**Lognormal GOF Test**											
1935	Shapiro Wilk Test Statistic					0.964	al GOF Test					
1936	5% Shapiro Wilk Critical Value					0.874	icance Level					
1937	Lilliefors Test Statistic					0.129	al GOF Test					
1938	5% Lilliefors Critical Value					0.226	icance Level					
1939	Data appear Lognormal at 5% Significance Level											
1940												
1941	**Lognormal Statistics**											
1942	Minimum of Logged Data					2.398	logged Data					3.207
1943	Maximum of Logged Data					3.989	logged Data					0.495
1944												
1945	Assuming Lognormal Distribution											
1946	95% H-UCL					36.81	MVUE) UCL					38.96
1947	**95% Chebyshev (MVUE) UCL**					**44.07**	**ebyshev (MVUE) UCL**					**51.17**
1948	**99% Chebyshev (MVUE) UCL**					**65.11**						
1949												
1950	Nonparametric Distribution Free UCL Statistics											
1951	Data appear to follow a Discernible Distribution at 5% Significance Level											
1952												
1953	**Nonparametric Distribution Free UCLs**											

	A	B	C	D	E	F	G	H	I	J	K	L
1954	**95% CLT UCL**					**33.62**	**% Jackknife UCL**					**34.08**
1955	**95% Standard Bootstrap UCL**					**33.51**	**% Bootstrap-t UCL**					**35.52**
1956	**95% Hall's Bootstrap UCL**					**33.96**	**rcentile Bootstrap UCL**					**33.5**
1957	**95% BCA Bootstrap UCL**					**34.21**						
1958	**90% Chebyshev(Mean, Sd) UCL**					**38.54**	**byshev(Mean, Sd) UCL**					**43.48**
1959	97.5% Chebyshev(Mean, Sd) UCL					50.34	an, Sd) UCL					63.8
1960												
1961	**Suggested UCL to Use**											
1962	**95% Student's-t UCL**					**34.08**						
1963												
1964	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1965	Recommendations are based upon data size, data distribution, and skewness.											
1966	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1967	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
1968												
1969												
1970	**Conc (|chromium|domain 1b|all|)**											
1971												
1972	General Statistics											
1973	Total Number of Observations					25	)bservations					20
1974						Number of Missing Observations						0
1975	Minimum					11	Mean					34.92
1976	Maximum					67	Median					31
1977	SD					15.67	:rror of Mean					3.134
1978	Coefficient of Variation					0.449	Skewness					0.327
1979												
1980	Normal GOF Test											
1981	**Shapiro Wilk Test Statistic**					**0.961**	**iro Wilk GOF Test**					
1982	**5% Shapiro Wilk Critical Value**					**0.918**	**mal at 5% Significance Level**					
1983	**Lilliefors Test Statistic**					**0.119**	**iefors GOF Test**					
1984	**5% Lilliefors Critical Value**					**0.173**	**mal at 5% Significance Level**					
1985	**Data appear Normal at 5% Significance Level**											
1986												
1987	**Assuming Normal Distribution**											
1988	95% Normal UCL					**95% UCLs (Adjusted for Skewness)**						
1989	95% Student's-t UCL					40.28	:ed-CLT UCL (Chen-1995)					40.29
1990						**95% Modified-t UCL (Johnson-1978)**						**40.32**
1991												
1992	**Gamma GOF Test**											
1993	**A-D Test Statistic**					**0.272**	**arling Gamma GOF Test**					
1994	**5% A-D Critical Value**					**0.747**	**ma Distributed at 5% Significance Level**					
1995	K-S Test Statistic					0.115	ıa GOF Test					
1996	5% K-S Critical Value					0.175	icance Level					
1997	Detected data appear Gamma Distributed at 5% Significance Level											
1998												
1999	Gamma Statistics											
2000	k hat (MLE)					4.729	rrected MLE)					4.189
2001	**Theta hat (MLE)**					**7.384**	**r (bias corrected MLE)**					**8.337**
2002	**nu hat (MLE)**					**236.5**	**ar (bias corrected)**					**209.4**
2003	MLE Mean (bias corrected)					34.92	**Sd (bias corrected)**					**17.06**
2004						Approximate Chi Square Value (0.05)						176.9
2005	Adjusted Level of Significance					0.0395	**d Chi Square Value**					**174.9**
2006												
2007	**Assuming Gamma Distribution**											
2008	**95% Approximate Gamma UCL (use when n>=50))**					**41.33**	**Gamma UCL (use when n<50)**					**4181.00%**
2009												
2010	Lognormal GOF Test											
2011	Shapiro Wilk Test Statistic					9.56E-01	ıal GOF Test					
2012	5% Shapiro Wilk Critical Value					0.918	icance Level					
2013	Lilliefors Test Statistic					0.131	ıal GOF Test					
2014	**5% Lilliefors Critical Value**					**0.173**	**ormal at 5% Significance Level**					
2015	**Data appear Lognormal at 5% Significance Level**											
2016												

	A	B	C	D	E	F	G	H	I	J	K	L
2017	Lognormal Statistics											
2018	Minimum of Logged Data					2.398	ın of logged Data					3.444
2019	Maximum of Logged Data					4.205	) of logged Data					0.498
2020												
2021	Assuming Lognormal Distribution											
2022	95% H-UCL					43.25	MVUE) UCL					46.21
2023	95% Chebyshev (MVUE) UCL					51.18	MVUE) UCL					5808.00%
2024	99% Chebyshev (MVUE) UCL					71.62						
2025												
2026	Nonparametric Distribution Free UCL Statistics											
2027	Data appear to follow a Discernible Distribution at 5% Significance Level											
2028												
2029	Nonparametric Distribution Free UCLs											
2030	**95% CLT UCL**					**40.07**	**% Jackknife UCL**					**40.28**
2031	**95% Standard Bootstrap UCL**					**39.99**	**% Bootstrap-t UCL**					**40.33**
2032	95% Hall's Bootstrap UCL					40.32	ootstrap UCL					39.92
2033	95% BCA Bootstrap UCL					40.4						
2034	90% Chebyshev(Mean, Sd) UCL					44.32	an, Sd) UCL					48.58
2035	97.5% Chebyshev(Mean, Sd) UCL					54.49	an, Sd) UCL					66.1
2036												
2037	Suggested UCL to Use											
2038	95% Student's-t UCL					40.28						
2039												
2040	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2041	Recommendations are based upon data size, data distribution, and skewness.											
2042	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2043	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2044												
2045												
2046	Conc (|chromium|domain 2 |all|)											
2047												
2048	General Statistics											
2049	**Total Number of Observations**					**6**	**f Distinct Observations**					**6**
2050							**Number of Missing Observations**					**0**
2051	**Minimum**					**13**	**Mean**					**38.67**
2052	Maximum					67	Median					38.5
2053	SD					19.17	rror of Mean					7.826
2054	Coefficient of Variation					0.496	Skewness					0.201
2055												
2056	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
2057	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
2058	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
2059	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
2060												
2061	Normal GOF Test											
2062	Shapiro Wilk Test Statistic					0.993	ilk GOF Test					
2063	5% Shapiro Wilk Critical Value					0.788	icance Level					
2064	**Lilliefors Test Statistic**					**0.116**	**iefors GOF Test**					
2065	**5% Lilliefors Critical Value**					**0.325**	**mal at 5% Significance Level**					
2066	**Data appear Normal at 5% Significance Level**											
2067												
2068	Assuming Normal Distribution											
2069	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
2070	**95% Student's-t UCL**					**54.44**	**ed-CLT UCL (Chen-1995)**					**52.22**
2071						**95% Modified-t UCL (Johnson-1978)**						**54.54**
2072												
2073	**Gamma GOF Test**											
2074	**A-D Test Statistic**					**0.177**	**arling Gamma GOF Test**					
2075	**5% A-D Critical Value**					**0.7**	**ma Distributed at 5% Significance Level**					
2076	K-S Test Statistic					0.167	ıa GOF Test					
2077	**5% K-S Critical Value**					**0.333**	**ma Distributed at 5% Significance Level**					
2078	Detected data appear Gamma Distributed at 5% Significance Level											
2079												

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
2080	Gamma Statistics											
2081	k hat (MLE)					4.167	bias corrected MLE)					2.194
2082	**Theta hat (MLE)**					**9.28**	**r (bias corrected MLE)**					**17.62**
2083	**nu hat (MLE)**					**50**	**nu star (bias corrected)**					**26.33**
2084	**MLE Mean (bias corrected)**					**38.67**	**Sd (bias corrected)**					**26.1**
2085							**Approximate Chi Square Value (0.05)**					**15.64**
2086	Adjusted Level of Significance					0.0122	quare Value					12.76
2087												
2088	Assuming Gamma Distribution											
2089	95% Approximate Gamma UCL (use when n>=50))					65.12	when n<50)					79.81
2090												
2091	Lognormal GOF Test											
2092	Shapiro Wilk Test Statistic					0.958	al GOF Test					
2093	5% Shapiro Wilk Critical Value					0.788	icance Level					
2094	Lilliefors Test Statistic					0.169	al GOF Test					
2095	5% Lilliefors Critical Value					0.325	icance Level					
2096	**Data appear Lognormal at 5% Significance Level**											
2097												
2098	**Lognormal Statistics**											
2099	**Minimum of Logged Data**					**2.565**	**n of logged Data**					**3.53**
2100	**Maximum of Logged Data**					**4.205**	**of logged Data**					**0.582**
2101												
2102	**Assuming Lognormal Distribution**											
2103	**95% H-UCL**					**84.81**	**ebyshev (MVUE) UCL**					**67.09**
2104	**95% Chebyshev (MVUE) UCL**					**79.72**	**ebyshev (MVUE) UCL**					**97.25**
2105	**99% Chebyshev (MVUE) UCL**					**131.7**						
2106												
2107	Nonparametric Distribution Free UCL Statistics											
2108	Data appear to follow a Discernible Distribution at 5% Significance Level											
2109												
2110	Nonparametric Distribution Free UCLs											
2111	**95% CLT UCL**					**51.54**	**% Jackknife UCL**					**54.44**
2112	**95% Standard Bootstrap UCL**					**50.48**	**% Bootstrap-t UCL**					**55.47**
2113	**95% Hall's Bootstrap UCL**					**52.9**	**rcentile Bootstrap UCL**					**50.5**
2114	95% BCA Bootstrap UCL					50.83						
2115	90% Chebyshev(Mean, Sd) UCL					62.14	an, Sd) UCL					72.78
2116	97.5% Chebyshev(Mean, Sd) UCL					87.54	an, Sd) UCL					116.5
2117												
2118	Suggested UCL to Use											
2119	95% Student's-t UCL					54.44						
2120												
2121	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2122	**Recommendations are based upon data size, data distribution, and skewness.**											
2123	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2124	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2125												
2126												
2127	Conc (|chromium|domain 2|aecom|)											
2128												
2129	**General Statistics**											
2130	**Total Number of Observations**					**5**	**f Distinct Observations**					**5**
2131							Number of Missing Observations					0
2132	Minimum					4	Mean					17.4
2133	Maximum					27	Median					20
2134	SD					8.62	d. Error of Mean					3.855
2135	Coefficient of Variation					0.495	Skewness					-0.957
2136												
2137	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
2138	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.											
2139	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
2140	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
2141												
2142	Normal GOF Test											

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
2143	Shapiro Wilk Test Statistic					0.942	ilk GOF Test					
2144	5% Shapiro Wilk Critical Value					0.762	icance Level					
2145	**Lilliefors Test Statistic**					**0.219**	**iefors GOF Test**					
2146	**5% Lilliefors Critical Value**					**0.343**	**mal at 5% Significance Level**					
2147	Data appear Normal at 5% Significance Level											
2148												
2149	Assuming Normal Distribution											
2150	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
2151	95% Student's-t UCL					25.62	(Chen-1995)					21.98
2152					95% Modified-t UCL (Johnson-1978)							25.34
2153												
2154	**Gamma GOF Test**											
2155	**A-D Test Statistic**					**0.509**	**arling Gamma GOF Test**					
2156	5% A-D Critical Value					0.683	icance Level					
2157	K-S Test Statistic					0.275	ıa GOF Test					
2158	**5% K-S Critical Value**					**0.359**	**ma Distributed at 5% Significance Level**					
2159	**Detected data appear Gamma Distributed at 5% Significance Level**											
2160												
2161	Gamma Statistics											
2162	k hat (MLE)					3.091	**ıias corrected MLE)**					**1.37**
2163	Theta hat (MLE)					5.629	r (bias corrected MLE)					12.7
2164	**nu hat (MLE)**					**30.91**	**ar (bias corrected)**					**13.7**
2165	**MLE Mean (bias corrected)**					**17.4**	**3d (bias corrected)**					**14.87**
2166							**Approximate Chi Square Value (0.05)**					**6.365**
2167	Adjusted Level of Significance					0.0086	quare Value					4.36
2168												
2169	Assuming Gamma Distribution											
2170	95% Approximate Gamma UCL (use when n>=50))					37.45	when n<50)					54.67
2171												
2172	**Lognormal GOF Test**											
2173	**Shapiro Wilk Test Statistic**					**0.798**	**lk Lognormal GOF Test**					
2174	5% Shapiro Wilk Critical Value					0.762	icance Level					
2175	Lilliefors Test Statistic					0.312	al GOF Test					
2176	5% Lilliefors Critical Value					0.343	icance Level					
2177	Data appear Lognormal at 5% Significance Level											
2178												
2179	**Lognormal Statistics**											
2180	**Minimum of Logged Data**					**1.386**	**n of logged Data**					**2.686**
2181	**Maximum of Logged Data**					**3.296**	**of logged Data**					**0.756**
2182												
2183	Assuming Lognormal Distribution											
2184	95% H-UCL					84.74	MVUE) UCL					36.44
2185	**95% Chebyshev (MVUE) UCL**					**44.66**	**ebyshev (MVUE) UCL**					**56.06**
2186	**99% Chebyshev (MVUE) UCL**					**78.47**						
2187												
2188	**Nonparametric Distribution Free UCL Statistics**											
2189	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2190												
2191	Nonparametric Distribution Free UCLs											
2192	**95% CLT UCL**					**23.74**	**% Jackknife UCL**					**25.62**
2193	95% Standard Bootstrap UCL					23.01	% Bootstrap-t UCL					23.81
2194	95% Hall's Bootstrap UCL					22.14	rcentile Bootstrap UCL					23
2195	95% BCA Bootstrap UCL					22						
2196	90% Chebyshev(Mean, Sd) UCL					28.96	ebyshev(Mean, Sd) UCL					34.2
2197	**97.5% Chebyshev(Mean, Sd) UCL**					**41.47**	**byshev(Mean, Sd) UCL**					**55.76**
2198												
2199	**Suggested UCL to Use**											
2200	**95% Student's-t UCL**					**25.62**						
2201												
2202	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2203	Recommendations are based upon data size, data distribution, and skewness.											
2204	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2205	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
2206												
2207	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
2208	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
2209												
2210												
2211	**Conc (|chromium|domain 2|all|)**											
2212												
2213	**General Statistics**											
2214	**Total Number of Observations**					**5**	**f Distinct Observations**					**5**
2215							**Number of Missing Observations**					**0**
2216	**Minimum**					**4**	**Mean**					**17.4**
2217	**Maximum**					**27**	**Median**					**20**
2218	SD					8.62	**l. Error of Mean**					**3.855**
2219	Coefficient of Variation					0.495	Skewness					-0.957
2220												
2221	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
2222	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
2223	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
2224	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**											
2225												
2226	Normal GOF Test											
2227	Shapiro Wilk Test Statistic					0.942	ilk GOF Test					
2228	5% Shapiro Wilk Critical Value					0.762	icance Level					
2229	Lilliefors Test Statistic					0.219	rs GOF Test					
2230	5% Lilliefors Critical Value					0.343	icance Level					
2231	**Data appear Normal at 5% Significance Level**											
2232												
2233	Assuming Normal Distribution											
2234	95% Normal UCL					95% UCLs (Adjusted for Skewness)						
2235	95% Student's-t UCL					25.62	**ed-CLT UCL (Chen-1995)**					**21.98**
2236						95% Modified-t UCL (Johnson-1978)						25.34
2237												
2238	**Gamma GOF Test**											
2239	**A-D Test Statistic**					**0.509**	**arling Gamma GOF Test**					
2240	5% A-D Critical Value					0.683	icance Level					
2241	K-S Test Statistic					0.275	ıa GOF Test					
2242	5% K-S Critical Value					0.359	icance Level					
2243	Detected data appear Gamma Distributed at 5% Significance Level											
2244												
2245	**Gamma Statistics**											
2246	k hat (MLE)					3.091	bias corrected MLE)					1.37
2247	Theta hat (MLE)					5.629	r (bias corrected MLE)					12.7
2248	nu hat (MLE)					30.91	ar (bias corrected)					13.7
2249	MLE Mean (bias corrected)					17.4	Sd (bias corrected)					14.87
2250						Approximate Chi Square Value (0.05)						6.365
2251	Adjusted Level of Significance					0.0086	quare Value					4.36
2252												
2253	Assuming Gamma Distribution											
2254	95% Approximate Gamma UCL (use when n>=50))					37.45	when n<50)					54.67
2255												
2256	Lognormal GOF Test											
2257	Shapiro Wilk Test Statistic					0.798	al GOF Test					
2258	5% Shapiro Wilk Critical Value					0.762	icance Level					
2259	Lilliefors Test Statistic					0.312	al GOF Test					
2260	**5% Lilliefors Critical Value**					**0.343**	**ormal at 5% Significance Level**					
2261	**Data appear Lognormal at 5% Significance Level**											
2262												
2263	Lognormal Statistics											
2264	Minimum of Logged Data					1.386	logged Data					2.686
2265	Maximum of Logged Data					3.296	logged Data					0.756
2266												
2267	Assuming Lognormal Distribution											
2268	95% H-UCL					84.74	MVUE) UCL					36.44

	A	B	C	D	E	F	G	H	I	J	K	L
2269	**95% Chebyshev (MVUE) UCL**					**44.66**	**ebyshev (MVUE) UCL**					**56.06**
2270	**99% Chebyshev (MVUE) UCL**					**78.47**						
2271												
2272	Nonparametric Distribution Free UCL Statistics											
2273	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2274												
2275	Nonparametric Distribution Free UCLs											
2276	95% CLT UCL					23.74	% Jackknife UCL					25.62
2277	95% Standard Bootstrap UCL					22.93	**% Bootstrap-t UCL**					**23.88**
2278	95% Hall's Bootstrap UCL					21.97	rcentile Bootstrap UCL					23
2279	**95% BCA Bootstrap UCL**					**22**						
2280	**90% Chebyshev(Mean, Sd) UCL**					**28.96**	**byshev(Mean, Sd) UCL**					**34.2**
2281	**97.5% Chebyshev(Mean, Sd) UCL**					**41.47**	**byshev(Mean, Sd) UCL**					**55.76**
2282												
2283	Suggested UCL to Use											
2284	95% Student's-t UCL					25.62						
2285												
2286	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2287	**Recommendations are based upon data size, data distribution, and skewness.**											
2288	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2289	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2290												
2291	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
2292	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
2293												
2294												
2295	**Conc (|copper|ambient|aecom|)**											
2296												
2297	General Statistics											
2298	Total Number of Observations					14	)bservations					9
2299						Number of Missing Observations						0
2300	**Minimum**					**1**	**Mean**					**3.893**
2301	**Maximum**					**9.3**	**Median**					**3**
2302	**SD**					**2.624**	**l. Error of Mean**					**0.701**
2303	**Coefficient of Variation**					**0.674**	**Skewness**					**0.711**
2304												
2305	**Normal GOF Test**											
2306	Shapiro Wilk Test Statistic					0.912	ilk GOF Test					
2307	**5% Shapiro Wilk Critical Value**					**0.874**	**mal at 5% Significance Level**					
2308	Lilliefors Test Statistic					0.205	iefors GOF Test					
2309	5% Lilliefors Critical Value					0.226	rmal at 5% Significance Level					
2310	Data appear Normal at 5% Significance Level											
2311												
2312	**Assuming Normal Distribution**											
2313	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
2314	**95% Student's-t UCL**					**5.135**	**ed-CLT UCL (Chen-1995)**					**5.189**
2315						**95% Modified-t UCL (Johnson-1978)**						**5.157**
2316												
2317	Gamma GOF Test											
2318	A-D Test Statistic					0.347	na GOF Test					
2319	5% A-D Critical Value					0.745	icance Level					
2320	K-S Test Statistic					0.135	na GOF Test					
2321	5% K-S Critical Value					0.231	icance Level					
2322	Detected data appear Gamma Distributed at 5% Significance Level											
2323												
2324	Gamma Statistics											
2325	k hat (MLE)					2.212	rrected MLE)					1.786
2326	**Theta hat (MLE)**					**1.76**	**r (bias corrected MLE)**					**2.18**
2327	**nu hat (MLE)**					**61.93**	**ar (bias corrected)**					**50**
2328	**MLE Mean (bias corrected)**					**3.893**	**Sd (bias corrected)**					**2.913**
2329						**Approximate Chi Square Value (0.05)**						**34.76**
2330	**Adjusted Level of Significance**					**0.0312**	**d Chi Square Value**					**33.08**
2331												

	A	B	C	D	E	F	G	H	I	J	K	L
2332	**Assuming Gamma Distribution**											
2333	95% Approximate Gamma UCL (use when n>=50))					5.599	**Gamma UCL (use when n<50)**					**5.883**
2334												
2335	Lognormal GOF Test											
2336	Shapiro Wilk Test Statistic					0.922	ilk Lognormal GOF Test					
2337	**5% Shapiro Wilk Critical Value**					**0.874**	**ormal at 5% Significance Level**					
2338	**Lilliefors Test Statistic**					**0.143**	**Lognormal GOF Test**					
2339	**5% Lilliefors Critical Value**					**0.226**	**ormal at 5% Significance Level**					
2340	Data appear Lognormal at 5% Significance Level											
2341												
2342	Lognormal Statistics											
2343	Minimum of Logged Data					0	logged Data					1.116
2344	Maximum of Logged Data					2.23	logged Data					0.761
2345												
2346	**Assuming Lognormal Distribution**											
2347	**95% H-UCL**					**6.8**	**ebyshev (MVUE) UCL**					**6.543**
2348	95% Chebyshev (MVUE) UCL					7.706	**ebyshev (MVUE) UCL**					**9.319**
2349	99% Chebyshev (MVUE) UCL					12.49						
2350												
2351	Nonparametric Distribution Free UCL Statistics											
2352	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2353												
2354	**Nonparametric Distribution Free UCLs**											
2355	95% CLT UCL					5.047	ckknife UCL					5.135
2356	95% Standard Bootstrap UCL					4.993	tstrap-t UCL					5.323
2357	95% Hall's Bootstrap UCL					5.249	otstrap UCL					5.007
2358	95% BCA Bootstrap UCL					5.157						
2359	**90% Chebyshev(Mean, Sd) UCL**					**5.997**	**byshev(Mean, Sd) UCL**					**6.95**
2360	**97.5% Chebyshev(Mean, Sd) UCL**					**8.273**	**byshev(Mean, Sd) UCL**					**10.87**
2361												
2362	Suggested UCL to Use											
2363	95% Student's-t UCL					5.135						
2364												
2365	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2366	Recommendations are based upon data size, data distribution, and skewness.											
2367	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2368	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2369												
2370												
2371	Conc (|copper|domain 1a|aecom|)											
2372												
2373	General Statistics											
2374	Total Number of Observations					26	Observations					22
2375						**Number of Missing Observations**							**0**
2376	**Minimum**					**2**	**Mean**					**20.08**
2377	Maximum					59	Median					18.5
2378	SD					14.86	rror of Mean					2.914
2379	Coefficient of Variation					0.74	Skewness					1.018
2380												
2381	Normal GOF Test											
2382	Shapiro Wilk Test Statistic					0.91	ilk GOF Test					
2383	5% Shapiro Wilk Critical Value					0.92	icance Level					
2384	**Lilliefors Test Statistic**					**0.165**	**iefors GOF Test**					
2385	**5% Lilliefors Critical Value**					**0.17**	**mal at 5% Significance Level**					
2386	Data appear Approximate Normal at 5% Significance Level											
2387												
2388	**Assuming Normal Distribution**											
2389	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
2390	95% Student's-t UCL					25.06	**ed-CLT UCL (Chen-1995)**					**25.5**
2391						95% Modified-t UCL (Johnson-1978)						25.16
2392												
2393	Gamma GOF Test											
2394	**A-D Test Statistic**					**0.28**	**arling Gamma GOF Test**					

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
2395	**5% A-D Critical Value**					**0.76**	**ma Distributed at 5% Significance Level**					
2396	**K-S Test Statistic**					**0.1**	**Smirnov Gamma GOF Test**					
2397	5% K-S Critical Value					0.174	icance Level					
2398	Detected data appear Gamma Distributed at 5% Significance Level											
2399												
2400	Gamma Statistics											
2401	k hat (MLE)					1.691	rrected MLE)					1.522
2402	**Theta hat (MLE)**					**11.87**	**r (bias corrected MLE)**					**13.2**
2403	**nu hat (MLE)**					**87.95**	**ar (bias corrected)**					**79.14**
2404	MLE Mean (bias corrected)					20.08	as corrected)					16.28
2405					Approximate Chi Square Value (0.05)							59.64
2406	Adjusted Level of Significance					0.0398	Square Value					58.52
2407												
2408	Assuming Gamma Distribution											
2409	**95% Approximate Gamma UCL (use when n>=50))**					**26.65**	**Gamma UCL (use when n<50)**					**27.16**
2410												
2411	**Lognormal GOF Test**											
2412	Shapiro Wilk Test Statistic					0.942	al GOF Test					
2413	5% Shapiro Wilk Critical Value					0.92	icance Level					
2414	Lilliefors Test Statistic					0.144	al GOF Test					
2415	**5% Lilliefors Critical Value**					**0.17**	**ormal at 5% Significance Level**					
2416	**Data appear Lognormal at 5% Significance Level**											
2417												
2418	**Lognormal Statistics**											
2419	**Minimum of Logged Data**					**0.693**	**n of logged Data**					**2.676**
2420	**Maximum of Logged Data**					**4.078**	**of logged Data**					**0.908**
2421												
2422	**Assuming Lognormal Distribution**											
2423	95% H-UCL					33.88	ebyshev (MVUE) UCL					34.32
2424	95% Chebyshev (MVUE) UCL					40.14	ebyshev (MVUE) UCL					48.22
2425	99% Chebyshev (MVUE) UCL					64.08						
2426												
2427	**Nonparametric Distribution Free UCL Statistics**											
2428	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2429												
2430	**Nonparametric Distribution Free UCLs**											
2431	95% CLT UCL					24.88	ckknife UCL					25.06
2432	95% Standard Bootstrap UCL					24.74	tstrap-t UCL					26.07
2433	95% Hall's Bootstrap UCL					25.81	otstrap UCL					25.08
2434	95% BCA Bootstrap UCL					25.31						
2435	90% Chebyshev(Mean, Sd) UCL					28.83	an, Sd) UCL					32.79
2436	97.5% Chebyshev(Mean, Sd) UCL					38.28	an, Sd) UCL					49.08
2437												
2438	Suggested UCL to Use											
2439	95% Student's-t UCL					25.06						
2440												
2441	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
2442	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
2443												
2444	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2445	**Recommendations are based upon data size, data distribution, and skewness.**											
2446	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2447	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2448												
2449												
2450	Conc (|copper|domain 1a|all|)											
2451												
2452	**General Statistics**											
2453	**Total Number of Observations**					**60**	**f Distinct Observations**					**37**
2454							**Number of Missing Observations**					**0**
2455	Minimum					2	Mean					17.38
2456	Maximum					59	Median					16.5
2457	SD					11.6	rror of Mean					1.498

	A	B	C	D	E	F	G	H	I	J	K	L
2458	Coefficient of Variation					0.668	Skewness					1.324
2459												
2460	Normal GOF Test											
2461	**Shapiro Wilk Test Statistic**					**0.895**	**iro Wilk GOF Test**					
2462	**5% Shapiro Wilk P Value**					**2.15E-05**	**al at 5% Significance Level**					
2463	Lilliefors Test Statistic					0.131	**iefors GOF Test**					
2464	5% Lilliefors Critical Value					0.114	al at 5% Significance Level					
2465	Data Not Normal at 5% Significance Level											
2466												
2467	**Assuming Normal Distribution**											
2468	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
2469	**95% Student's-t UCL**					**19.88**	**ed-CLT UCL (Chen-1995)**					**20.11**
2470					95% Modified-t UCL (Johnson-1978)							19.92
2471												
2472	Gamma GOF Test											
2473	A-D Test Statistic					0.542	a GOF Test					
2474	**5% A-D Critical Value**					**0.762**	**ma Distributed at 5% Significance Level**					
2475	**K-S Test Statistic**					**0.0858**	**Smirnov Gamma GOF Test**					
2476	5% K-S Critical Value					0.116	ma Distributed at 5% Significance Level					
2477	Detected data appear Gamma Distributed at 5% Significance Level											
2478												
2479	Gamma Statistics											
2480	k hat (MLE)					2.265	bias corrected MLE)					2.163
2481	Theta hat (MLE)					7.671	rected MLE)					8.034
2482	nu hat (MLE)					271.8	as corrected)					259.6
2483	MLE Mean (bias corrected)					17.38	as corrected)					11.82
2484					Approximate Chi Square Value (0.05)							223.2
2485	Adjusted Level of Significance					0.046	quare Value					222.4
2486												
2487	Assuming Gamma Distribution											
2488	95% Approximate Gamma UCL (use when n>=50)					20.2	when n<50)					20.28
2489												
2490	**Lognormal GOF Test**											
2491	**Shapiro Wilk Test Statistic**					**0.955**	**lk Lognormal GOF Test**					
2492	5% Shapiro Wilk P Value					0.0556	icance Level					
2493	Lilliefors Test Statistic					0.128	al GOF Test					
2494	5% Lilliefors Critical Value					0.114	icance Level					
2495	Data appear Approximate Lognormal at 5% Significance Level											
2496												
2497	Lognormal Statistics											
2498	Minimum of Logged Data					0.693	logged Data					2.618
2499	**Maximum of Logged Data**					**4.078**	**of logged Data**					**0.743**
2500												
2501	Assuming Lognormal Distribution											
2502	95% H-UCL					22.1	MVUE) UCL					23.7
2503	**95% Chebyshev (MVUE) UCL**					**26.3**	**ebyshev (MVUE) UCL**					**29.9**
2504	**99% Chebyshev (MVUE) UCL**					**36.98**						
2505												
2506	Nonparametric Distribution Free UCL Statistics											
2507	Data appear to follow a Discernible Distribution at 5% Significance Level											
2508												
2509	**Nonparametric Distribution Free UCLs**											
2510	**95% CLT UCL**					**19.84**	**% Jackknife UCL**					**19.88**
2511	**95% Standard Bootstrap UCL**					**19.8**	**% Bootstrap-t UCL**					**20.29**
2512	95% Hall's Bootstrap UCL					20.34	ootstrap UCL					19.79
2513	95% BCA Bootstrap UCL					20.14						
2514	90% Chebyshev(Mean, Sd) UCL					21.87	an, Sd) UCL					23.91
2515	97.5% Chebyshev(Mean, Sd) UCL					26.73	an, Sd) UCL					32.28
2516												
2517	**Suggested UCL to Use**											
2518	**95% Approximate Gamma UCL**					**20.2**						
2519												
2520	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											

	A	B	C	D	E	F	G	H	I	J	K	L
2521	Recommendations are based upon data size, data distribution, and skewness.											
2522	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2523	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2524												
2525												
2526	**Conc (|copper|domain 1b|aecom|)**											
2527												
2528	General Statistics											
2529	Total Number of Observations					14	Observations					11
2530						**Number of Missing Observations**							**0**
2531	**Minimum**					**4**	**Mean**					**9.643**
2532	**Maximum**					**21**	**Median**					**9.15**
2533	**SD**					**5.384**	**l. Error of Mean**					**1.439**
2534	**Coefficient of Variation**					**0.558**	**Skewness**					**1.046**
2535												
2536	Normal GOF Test											
2537	**Shapiro Wilk Test Statistic**					**0.874**	**iro Wilk GOF Test**					
2538	5% Shapiro Wilk Critical Value					0.874	rmal at 5% Significance Level					
2539	Lilliefors Test Statistic					0.188	iefors GOF Test					
2540	5% Lilliefors Critical Value					0.226	rmal at 5% Significance Level					
2541	Data appear Normal at 5% Significance Level											
2542												
2543	**Assuming Normal Distribution**											
2544	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
2545	**95% Student's-t UCL**					**12.19**	**ed-CLT UCL (Chen-1995)**					**12.44**
2546					95% Modified-t UCL (Johnson-1978)							12.26
2547												
2548	Gamma GOF Test											
2549	A-D Test Statistic					0.4	na GOF Test					
2550	5% A-D Critical Value					0.741	icance Level					
2551	K-S Test Statistic					0.153	na GOF Test					
2552	5% K-S Critical Value					0.23	icance Level					
2553	Detected data appear Gamma Distributed at 5% Significance Level											
2554												
2555	Gamma Statistics											
2556	**k hat (MLE)**					**3.833**	**bias corrected MLE)**					**3.06**
2557	**Theta hat (MLE)**					**2.515**	**r (bias corrected MLE)**					**3.152**
2558	**nu hat (MLE)**					**107.3**	**ar (bias corrected)**					**85.67**
2559	**MLE Mean (bias corrected)**					**9.643**	**Sd (bias corrected)**					**5.513**
2560						**Approximate Chi Square Value (0.05)**						**65.33**
2561	**Adjusted Level of Significance**					**0.0312**	**d Chi Square Value**					**62.98**
2562												
2563	**Assuming Gamma Distribution**											
2564	**95% Approximate Gamma UCL (use when n>=50))**					**12.64**	**Gamma UCL (use when n<50)**					**13.12**
2565												
2566	**Lognormal GOF Test**											
2567	**Shapiro Wilk Test Statistic**					**0.942**	**lk Lognormal GOF Test**					
2568	**5% Shapiro Wilk Critical Value**					**0.874**	**ormal at 5% Significance Level**					
2569	**Lilliefors Test Statistic**					**0.143**	**Lognormal GOF Test**					
2570	5% Lilliefors Critical Value					0.226	icance Level					
2571	Data appear Lognormal at 5% Significance Level											
2572												
2573	Lognormal Statistics											
2574	Minimum of Logged Data					1.386	logged Data					2.13
2575	Maximum of Logged Data					3.045	logged Data					0.538
2576												
2577	**Assuming Lognormal Distribution**											
2578	**95% H-UCL**					**13.23**	**ebyshev (MVUE) UCL**					**13.89**
2579	**95% Chebyshev (MVUE) UCL**					**15.83**	**ebyshev (MVUE) UCL**					**18.52**
2580	**99% Chebyshev (MVUE) UCL**					**23.8**						
2581												
2582	Nonparametric Distribution Free UCL Statistics											
2583	Data appear to follow a Discernible Distribution at 5% Significance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
2584												
2585	**Nonparametric Distribution Free UCLs**											
2586	**95% CLT UCL**					**12.01**	**% Jackknife UCL**					**12.19**
2587	95% Standard Bootstrap UCL					11.9	tstrap-t UCL					13.19
2588	95% Hall's Bootstrap UCL					13.25	otstrap UCL					11.99
2589	95% BCA Bootstrap UCL					12.32						
2590	90% Chebyshev(Mean, Sd) UCL					13.96	an, Sd) UCL					15.92
2591	97.5% Chebyshev(Mean, Sd) UCL					18.63	an, Sd) UCL					23.96
2592												
2593	Suggested UCL to Use											
2594	**95% Student's-t UCL**					**12.19**						
2595												
2596	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2597	Recommendations are based upon data size, data distribution, and skewness.											
2598	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2599	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2600												
2601												
2602	**Conc (|copper|domain 1b|all|)**											
2603												
2604	General Statistics											
2605	Total Number of Observations					25	Observations					20
2606					Number of Missing Observations							0
2607	Minimum					4	Mean					8.288
2608	Maximum					21	Median					6.6
2609	**SD**					**4.554**	**l. Error of Mean**					**0.911**
2610	**Coefficient of Variation**					**0.549**	**Skewness**					**1.552**
2611												
2612	Normal GOF Test											
2613	Shapiro Wilk Test Statistic					0.823	ilk GOF Test					
2614	5% Shapiro Wilk Critical Value					0.918	icance Level					
2615	Lilliefors Test Statistic					0.18	rs GOF Test					
2616	**5% Lilliefors Critical Value**					**0.173**	**al at 5% Significance Level**					
2617	**Data Not Normal at 5% Significance Level**											
2618												
2619	Assuming Normal Distribution											
2620	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
2621	95% Student's-t UCL					9.846	(Chen-1995)					10.09
2622						**95% Modified-t UCL (Johnson-1978)**						**9.893**
2623												
2624	**Gamma GOF Test**											
2625	**A-D Test Statistic**					**0.724**	**arling Gamma GOF Test**					
2626	**5% A-D Critical Value**					**0.748**	**ma Distributed at 5% Significance Level**					
2627	**K-S Test Statistic**					**0.144**	**mirnov Gamma GOF Test**					
2628	5% K-S Critical Value					0.175	icance Level					
2629	Detected data appear Gamma Distributed at 5% Significance Level											
2630												
2631	**Gamma Statistics**											
2632	k hat (MLE)					4.397	bias corrected MLE)					3.896
2633	Theta hat (MLE)					1.885	r (bias corrected MLE)					2.128
2634	nu hat (MLE)					219.8	ar (bias corrected)					194.8
2635	MLE Mean (bias corrected)					8.288	Sd (bias corrected)					4.199
2636						**Approximate Chi Square Value (0.05)**						**163.5**
2637	**Adjusted Level of Significance**					**0.0395**	**d Chi Square Value**					**161.5**
2638												
2639	**Assuming Gamma Distribution**											
2640	**95% Approximate Gamma UCL (use when n>=50)**					**9.874**	**Gamma UCL (use when n<50)**					**9.993**
2641												
2642	Lognormal GOF Test											
2643	Shapiro Wilk Test Statistic					0.935	al GOF Test					
2644	5% Shapiro Wilk Critical Value					0.918	icance Level					
2645	Lilliefors Test Statistic					0.115	al GOF Test					
2646	5% Lilliefors Critical Value					0.173	icance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
2647	**Data appear Lognormal at 5% Significance Level**											
2648												
2649	**Lognormal Statistics**											
2650	**Minimum of Logged Data**					**1.386**	**n of logged Data**					**1.997**
2651	**Maximum of Logged Data**					**3.045**	**of logged Data**					**0.476**
2652												
2653	**Assuming Lognormal Distribution**											
2654	95% H-UCL					9.958	**ebyshev (MVUE) UCL**					**10.64**
2655	95% Chebyshev (MVUE) UCL					11.74	hebyshev (MVUE) UCL					13.27
2656	99% Chebyshev (MVUE) UCL					16.27						
2657												
2658	**Nonparametric Distribution Free UCL Statistics**											
2659	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2660												
2661	**Nonparametric Distribution Free UCLs**											
2662	95% CLT UCL					9.786	ıckknife UCL					9.846
2663	95% Standard Bootstrap UCL					9.801	ıtstrap-t UCL					10.23
2664	**95% Hall's Bootstrap UCL**					**10.27**	**rcentile Bootstrap UCL**					**9.776**
2665	**95% BCA Bootstrap UCL**					**10.03**						
2666	90% Chebyshev(Mean, Sd) UCL					11.02	**byshev(Mean, Sd) UCL**					**12.26**
2667	97.5% Chebyshev(Mean, Sd) UCL					13.98	ebyshev(Mean, Sd) UCL					17.35
2668												
2669	Suggested UCL to Use											
2670	**95% Adjusted Gamma UCL**					**9.993**						
2671												
2672	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2673	Recommendations are based upon data size, data distribution, and skewness.											
2674	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
2675	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2676												
2677												
2678	Conc (|copper|domain 2 |all|)											
2679												
2680	**General Statistics**											
2681	Total Number of Observations					6	)bservations					6
2682						**Number of Missing Observations**							**0**
2683	**Minimum**					**2.7**	**Mean**					**7.167**
2684	Maximum					9.1	**Median**					**7.9**
2685	SD					2.274	d. Error of Mean					0.928
2686	Coefficient of Variation					0.317	**Skewness**					**-2.04**
2687												
2688	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
2689	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
2690	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
2691	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
2692												
2693	**Normal GOF Test**											
2694	**Shapiro Wilk Test Statistic**					**0.754**	**iro Wilk GOF Test**					
2695	5% Shapiro Wilk Critical Value					0.788	icance Level					
2696	Lilliefors Test Statistic					0.339	rs GOF Test					
2697	5% Lilliefors Critical Value					0.325	icance Level					
2698	**Data Not Normal at 5% Significance Level**											
2699												
2700	**Assuming Normal Distribution**											
2701	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
2702	**95% Student's-t UCL**					**9.037**	**ed-CLT UCL (Chen-1995)**					**7.868**
2703					95% Modified-t UCL (Johnson-1978)							8.908
2704												
2705	Gamma GOF Test											
2706	A-D Test Statistic					1.024	ıa GOF Test					
2707	5% A-D Critical Value					0.698	icance Level					
2708	K-S Test Statistic					0.387	ıa GOF Test					
2709	**5% K-S Critical Value**					**0.333**	**stributed at 5% Significance Level**					

	A	B	C	D	E	F	G	H	I	J	K	L
2710	**Data Not Gamma Distributed at 5% Significance Level**											
2711												
2712	**Gamma Statistics**											
2713	k hat (MLE)					7.601	bias corrected MLE)					3.911
2714	Theta hat (MLE)					0.943	r (bias corrected MLE)					1.832
2715	nu hat (MLE)					91.21	ar (bias corrected)					46.94
2716	MLE Mean (bias corrected)					7.167	Sd (bias corrected)					3.624
2717						**Approximate Chi Square Value (0.05)**						**32.22**
2718	**Adjusted Level of Significance**					**0.0122**	**d Chi Square Value**					**27.88**
2719												
2720	**Assuming Gamma Distribution**											
2721	**95% Approximate Gamma UCL (use when n>=50))**					**10.44**	**Gamma UCL (use when n<50)**					**12.06**
2722												
2723	**Lognormal GOF Test**											
2724	**Shapiro Wilk Test Statistic**					**0.659**	**lk Lognormal GOF Test**					
2725	5% Shapiro Wilk Critical Value					0.788	icance Level					
2726	Lilliefors Test Statistic					0.397	al GOF Test					
2727	5% Lilliefors Critical Value					0.325	icance Level					
2728	Data Not Lognormal at 5% Significance Level											
2729												
2730	Lognormal Statistics											
2731	**Minimum of Logged Data**					**0.993**	**n of logged Data**					**1.902**
2732	**Maximum of Logged Data**					**2.208**	**of logged Data**					**0.452**
2733												
2734	**Assuming Lognormal Distribution**											
2735	**95% H-UCL**					**12.36**	**ebyshev (MVUE) UCL**					**11.32**
2736	**95% Chebyshev (MVUE) UCL**					**13.14**	**ebyshev (MVUE) UCL**					**15.67**
2737	**99% Chebyshev (MVUE) UCL**					**20.65**						
2738												
2739	Nonparametric Distribution Free UCL Statistics											
2740	Data do not follow a Discernible Distribution (0.05)											
2741												
2742	**Nonparametric Distribution Free UCLs**											
2743	**95% CLT UCL**					**8.694**	**% Jackknife UCL**					**9.037**
2744	**95% Standard Bootstrap UCL**					**8.546**	**% Bootstrap-t UCL**					**8.322**
2745	**95% Hall's Bootstrap UCL**					**8.069**	**rcentile Bootstrap UCL**					**8.333**
2746	95% BCA Bootstrap UCL					8.15						
2747	90% Chebyshev(Mean, Sd) UCL					9.952	an, Sd) UCL					11.21
2748	**97.5% Chebyshev(Mean, Sd) UCL**					**12.96**	**byshev(Mean, Sd) UCL**					**16.4**
2749												
2750	Suggested UCL to Use											
2751	95% Student's-t UCL					9.037	% Modified-t UCL					8.908
2752												
2753	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2754	**Recommendations are based upon data size, data distribution, and skewness.**											
2755	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2756	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2757												
2758	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
2759	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
2760												
2761												
2762	Conc (|copper|domain 2|aecom|)											
2763												
2764	**General Statistics**											
2765	Total Number of Observations					5	Observations					5
2766						**Number of Missing Observations**							**0**
2767	**Minimum**					**2**	**Mean**					**5.16**
2768	Maximum					10	**Median**					**5.3**
2769	SD					3.091	d. Error of Mean					1.382
2770	Coefficient of Variation					0.599	**Skewness**					**1.013**
2771												
2772	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											

	A	B	C	D	E	F	G	H	I	J	K	L
2773	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
2774	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
2775	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
2776												
2777	**Normal GOF Test**											
2778	**Shapiro Wilk Test Statistic**					**0.917**	**iro Wilk GOF Test**					
2779	5% Shapiro Wilk Critical Value					0.762	icance Level					
2780	Lilliefors Test Statistic					0.256	rs GOF Test					
2781	5% Lilliefors Critical Value					0.343	icance Level					
2782	**Data appear Normal at 5% Significance Level**											
2783												
2784	**Assuming Normal Distribution**											
2785	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
2786	**95% Student's-t UCL**					**8.107**	**ed-CLT UCL (Chen-1995)**					**8.103**
2787					95% Modified-t UCL (Johnson-1978)							8.211
2788												
2789	Gamma GOF Test											
2790	A-D Test Statistic					0.25	a GOF Test					
2791	5% A-D Critical Value					0.682	icance Level					
2792	K-S Test Statistic					0.19	a GOF Test					
2793	**5% K-S Critical Value**					**0.359**	**ma Distributed at 5% Significance Level**					
2794	**Detected data appear Gamma Distributed at 5% Significance Level**											
2795												
2796	**Gamma Statistics**											
2797	k hat (MLE)					3.546	bias corrected MLE)					1.552
2798	Theta hat (MLE)					1.455	r (bias corrected MLE)					3.325
2799	**nu hat (MLE)**					**35.46**	**ar (bias corrected)**					**15.52**
2800	MLE Mean (bias corrected)					5.16	Sd (bias corrected)					4.142
2801						Approximate Chi Square Value (0.05)						7.623
2802	Adjusted Level of Significance					0.0086	ed Chi Square Value					5.38
2803												
2804	**Assuming Gamma Distribution**											
2805	**95% Approximate Gamma UCL (use when n>=50))**					**10.5**	**95% Adjusted Gamma UCL (use when n<50)**					**14.88**
2806												
2807	**Lognormal GOF Test**											
2808	Shapiro Wilk Test Statistic					0.969	al GOF Test					
2809	5% Shapiro Wilk Critical Value					0.762	icance Level					
2810	Lilliefors Test Statistic					0.211	al GOF Test					
2811	5% Lilliefors Critical Value					0.343	icance Level					
2812	Data appear Lognormal at 5% Significance Level											
2813												
2814	Lognormal Statistics											
2815	Minimum of Logged Data					0.693	logged Data					1.493
2816	Maximum of Logged Data					2.303	logged Data					0.618
2817												
2818	**Assuming Lognormal Distribution**											
2819	**95% H-UCL**					**15.16**	**ebyshev (MVUE) UCL**					**9.388**
2820	**95% Chebyshev (MVUE) UCL**					**11.3**	**ebyshev (MVUE) UCL**					**13.95**
2821	**99% Chebyshev (MVUE) UCL**					**19.17**						
2822												
2823	**Nonparametric Distribution Free UCL Statistics**											
2824	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
2825												
2826	Nonparametric Distribution Free UCLs											
2827	95% CLT UCL					7.434	**% Jackknife UCL**					**8.107**
2828	95% Standard Bootstrap UCL					7.13	% Bootstrap-t UCL					9.569
2829	**95% Hall's Bootstrap UCL**					**9.569**	**rcentile Bootstrap UCL**					**7.26**
2830	**95% BCA Bootstrap UCL**					**7.5**						
2831	**90% Chebyshev(Mean, Sd) UCL**					**9.307**	**byshev(Mean, Sd) UCL**					**11.19**
2832	97.5% Chebyshev(Mean, Sd) UCL					13.79	an, Sd) UCL					18.91
2833												
2834	Suggested UCL to Use											
2835	95% Student's-t UCL					8.107						

	A	B	C	D	E	F	G	H	I	J	K	L
2836												
2837	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2838	**Recommendations are based upon data size, data distribution, and skewness.**											
2839	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2840	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
2841												
2842												
2843	Conc (|copper|domain 2|all|)											
2844												
2845	**General Statistics**											
2846	**Total Number of Observations**					**5**	**f Distinct Observations**					**5**
2847					Number of Missing Observations							0
2848	Minimum					2	Mean					5.16
2849	Maximum					10	Median					5.3
2850	SD					3.091	rror of Mean					1.382
2851	**Coefficient of Variation**					**0.599**	**Skewness**					**1.013**
2852												
2853	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
2854	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.											
2855	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
2856	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
2857												
2858	Normal GOF Test											
2859	Shapiro Wilk Test Statistic					0.917	ilk GOF Test					
2860	5% Shapiro Wilk Critical Value					0.762	icance Level					
2861	Lilliefors Test Statistic					0.256	rs GOF Test					
2862	5% Lilliefors Critical Value					0.343	icance Level					
2863	Data appear Normal at 5% Significance Level											
2864												
2865	Assuming Normal Distribution											
2866	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
2867	**95% Student's-t UCL**					**8.107**	**ed-CLT UCL (Chen-1995)**					**8.103**
2868						**95% Modified-t UCL (Johnson-1978)**						**8.211**
2869												
2870	Gamma GOF Test											
2871	A-D Test Statistic					0.25	na GOF Test					
2872	5% A-D Critical Value					0.682	icance Level					
2873	K-S Test Statistic					0.19	na GOF Test					
2874	5% K-S Critical Value					0.359	icance Level					
2875	Detected data appear Gamma Distributed at 5% Significance Level											
2876												
2877	**Gamma Statistics**											
2878	k hat (MLE)					3.546	rrected MLE)					1.552
2879	Theta hat (MLE)					1.455	rrected MLE)					3.325
2880	**nu hat (MLE)**					**35.46**	**ar (bias corrected)**					**15.52**
2881	**MLE Mean (bias corrected)**					**5.16**	**Sd (bias corrected)**					**4.142**
2882						**Approximate Chi Square Value (0.05)**						**7.623**
2883	Adjusted Level of Significance					0.0086	ed Chi Square Value					5.38
2884												
2885	Assuming Gamma Distribution											
2886	**95% Approximate Gamma UCL (use when n>=50))**					**10.5**	**Gamma UCL (use when n<50)**					**14.88**
2887												
2888	**Lognormal GOF Test**											
2889	Shapiro Wilk Test Statistic					0.969	al GOF Test					
2890	5% Shapiro Wilk Critical Value					0.762	icance Level					
2891	Lilliefors Test Statistic					0.211	al GOF Test					
2892	5% Lilliefors Critical Value					0.343	icance Level					
2893	Data appear Lognormal at 5% Significance Level											
2894												
2895	**Lognormal Statistics**											
2896	Minimum of Logged Data					0.693	logged Data					1.493
2897	Maximum of Logged Data					2.303	logged Data					0.618
2898												

	A	B	C	D	E	F	G	H	I	J	K	L
2899	Assuming Lognormal Distribution											
2900	95% H-UCL					15.16	MVUE) UCL					9.388
2901	**95% Chebyshev (MVUE) UCL**					**11.3**	**ıebyshev (MVUE) UCL**					**13.95**
2902	**99% Chebyshev (MVUE) UCL**					**19.17**						
2903												
2904	Nonparametric Distribution Free UCL Statistics											
2905	Data appear to follow a Discernible Distribution at 5% Significance Level											
2906												
2907	**Nonparametric Distribution Free UCLs**											
2908	**95% CLT UCL**					**7.434**	**% Jackknife UCL**					**8.107**
2909	**95% Standard Bootstrap UCL**					**7.163**	**ǫ Bootstrap-t UCL**					**9.607**
2910	**95% Hall's Bootstrap UCL**					**9.46**	**rcentile Bootstrap UCL**					**7.22**
2911	**95% BCA Bootstrap UCL**					**7.46**						
2912	**90% Chebyshev(Mean, Sd) UCL**					**9.307**	**byshev(Mean, Sd) UCL**					**11.19**
2913	97.5% Chebyshev(Mean, Sd) UCL					13.79	an, Sd) UCL					18.91
2914												
2915	Suggested UCL to Use											
2916	95% Student's-t UCL					8.107						
2917												
2918	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
2919	**Recommendations are based upon data size, data distribution, and skewness.**											
2920	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2921	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
2922												
2923	Conc (|dibutyltin as sn|ambient|aecom|)											
2924												
2925	General Statistics											
2926	Total Number of Observations					14	)bservations					1
2927	Number of Detects					0	Non-Detects					14
2928	Number of Distinct Detects					0	Non-Detects					1
2929												
2930	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
2931	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
2932	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
2933												
2934	**The data set for variable Conc (|dibutyltin as sn|ambient|aecom|) was not processed!**											
2935												
2936												
2937	**Conc (|dibutyltin as sn|domain 1a|aecom|)**											
2938												
2939	**General Statistics**											
2940	**Total Number of Observations**					**25**	**f Distinct Observations**					**13**
2941	**Number of Detects**					**0**	**ıer of Non-Detects**					**25**
2942	**Number of Distinct Detects**					**0**	**f Distinct Non-Detects**					**13**
2943												
2944	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
2945	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
2946	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
2947												
2948	**The data set for variable Conc (|dibutyltin as sn|domain 1a|aecom|) was not processed!**											
2949												
2950												
2951	Conc (|dibutyltin as sn|domain 1a|all|)											
2952												
2953	General Statistics											
2954	Total Number of Observations					34	)bservations					20
2955	Number of Detects					6	Non-Detects					28
2956	Number of Distinct Detects					6	Non-Detects					14
2957	**Minimum Detect**					**0.55**	**mum Non-Detect**					**0.5**
2958	**Maximum Detect**					**5.3**	**mum Non-Detect**					**5.7**
2959	**Variance Detects**					**3.124**	**ɛent Non-Detects**					**82.35%**
2960	**Mean Detects**					**2.475**	**SD Detects**					**1.767**
2961	**Median Detects**					**2.25**	**CV Detects**					**0.714**

	A	B	C	D	E	F	G	H	I	J	K	L
2962	Skewness Detects					0.698	osis Detects					-0.251
2963	Mean of Logged Detects					0.647	gged Detects					0.841
2964												
2965	Normal GOF Test on Detects Only											
2966	**Shapiro Wilk Test Statistic**					**0.95**	**iro Wilk GOF Test**					
2967	**5% Shapiro Wilk Critical Value**					**0.788**	**r Normal at 5% Significance Level**					
2968	Lilliefors Test Statistic					0.169	iefors GOF Test					
2969	5% Lilliefors Critical Value					0.325	ır Normal at 5% Significance Level					
2970	Detected Data appear Normal at 5% Significance Level											
2971												
2972	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
2973	KM Mean					0.995	rror of Mean					0.222
2974	KM SD					1.041	l (BCA) UCL					1.367
2975	95% KM (t) UCL					1.371	otstrap) UCL					1.362
2976	95% KM (z) UCL					1.361	otstrap t UCL					1.355
2977	90% KM Chebyshev UCL					1.662	byshev UCL					1.964
2978	97.5% KM Chebyshev UCL					2.382	byshev UCL					3.205
2979												
2980	Gamma GOF Tests on Detected Observations Only											
2981	A-D Test Statistic					0.175	ng GOF Test					
2982	**5% A-D Critical Value**					**0.704**	**ma Distributed at 5% Significance Level**					
2983	**K-S Test Statistic**					**0.16**	**gorov-Smirnov GOF**					
2984	5% K-S Critical Value					0.336	icance Level					
2985	Detected data appear Gamma Distributed at 5% Significance Level											
2986												
2987	Gamma Statistics on Detected Data Only											
2988	k hat (MLE)					2.081	rrected MLE)					1.152
2989	Theta hat (MLE)					1.189	rrected MLE)					2.149
2990	nu hat (MLE)					24.97	as corrected)					13.82
2991	**Mean (detects)**					**2.475**						
2992												
2993	Gamma ROS Statistics using Imputed Non-Detects											
2994	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
2995	**GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)**											
2996	**For such situations, GROS method may yield incorrect values of UCLs and BTVs**											
2997	This is especially true when the sample size is small.											
2998	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
2999	Minimum					0.01	**Mean**					**0.541**
3000	Maximum					5.3	Median					0.01
3001	**SD**					**1.172**	**CV**					**2.167**
3002	**k hat (MLE)**					**0.281**	**ias corrected MLE)**					**0.276**
3003	**Theta hat (MLE)**					**1.922**	**r (bias corrected MLE)**					**1.959**
3004	nu hat (MLE)					19.13	as corrected)					18.78
3005	Adjusted Level of Significance (β)					0.0422						
3006	Approximate Chi Square Value (18.78, α)					9.956	ue (18.78, β)					9.638
3007	95% Gamma Approximate UCL (use when n>=50)					1.02	when n<50)					1.054
3008												
3009	**Estimates of Gamma Parameters using KM Estimates**											
3010	**Mean (KM)**					**0.995**	**SD (KM)**					**1.041**
3011	Variance (KM)					1.083	f Mean (KM)					0.222
3012	k hat (KM)					0.914	k star (KM)					0.853
3013	nu hat (KM)					62.18	nu star (KM)					58.03
3014	theta hat (KM)					1.088	eta star (KM)					1.166
3015	80% gamma percentile (KM)					1.62	rcentile (KM)					2.383
3016	**95% gamma percentile (KM)**					**3.155**	**mma percentile (KM)**					**4.969**
3017												
3018	**Gamma Kaplan-Meier (KM) Statistics**											
3019	Approximate Chi Square Value (58.03, α)					41.51	ue (58.03, β)					40.82
3020	95% Gamma Approximate KM-UCL (use when n>=50)					1.391	when n<50)					1.415
3021												
3022	**Lognormal GOF Test on Detected Observations Only**											
3023	**Shapiro Wilk Test Statistic**					**0.97**	**iro Wilk GOF Test**					
3024	**5% Shapiro Wilk Critical Value**					**0.788**	**ognormal at 5% Significance Level**					

	A	B	C	D	E	F	G	H	I	J	K	L
3025	**Lilliefors Test Statistic**					**0.175**	**iefors GOF Test**					
3026	**5% Lilliefors Critical Value**					**0.325**	**.ognormal at 5% Significance Level**					
3027	**Detected Data appear Lognormal at 5% Significance Level**											
3028												
3029	**Lognormal ROS Statistics Using Imputed Non-Detects**											
3030	Mean in Original Scale					0.766	ean in Log Scale					-0.773
3031	SD in Original Scale					1.078	D in Log Scale					0.923
3032	95% t UCL (assumes normality of ROS data)					1.079	rcentile Bootstrap UCL					1.09
3033	95% BCA Bootstrap UCL					1.186	% Bootstrap t UCL					1.432
3034	**95% H-UCL (Log ROS)**					**1.033**						
3035												
3036	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
3037	**KM Mean (logged)**					**-0.288**	**KM Geo Mean**					**0.75**
3038	KM SD (logged)					0.643	ue (KM-Log)					2.063
3039	KM Standard Error of Mean (logged)					0.168	CL (KM -Log)					1.161
3040	KM SD (logged)					0.643	ue (KM-Log)					2.063
3041	KM Standard Error of Mean (logged)					0.168						
3042												
3043	DL/2 Statistics											
3044	DL/2 Normal						DL/2 Log-Transformed					
3045	Mean in Original Scale					1.356	in Log Scale					0.0592
3046	SD in Original Scale					1.04	in Log Scale					0.722
3047	95% t UCL (Assumes normality)					1.658	H-Stat UCL					1.802
3048	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
3049												
3050	**Nonparametric Distribution Free UCL Statistics**											
3051	**Detected Data appear Normal Distributed at 5% Significance Level**											
3052												
3053	**Suggested UCL to Use**											
3054	**95% KM (t) UCL**					**1.371**						
3055												
3056	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
3057	Recommendations are based upon data size, data distribution, and skewness.											
3058	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
3059	**However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.**											
3060												
3061	**Conc (|dibutyltin as sn|domain 1b|aecom|)**											
3062												
3063	General Statistics											
3064	Total Number of Observations					14	Observations					2
3065	Number of Detects					0	Non-Detects					14
3066	Number of Distinct Detects					0	Non-Detects					2
3067												
3068	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
3069	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
3070	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
3071												
3072	The data set for variable Conc (|dibutyltin as sn|domain 1b|aecom|) was not processed!											
3073												
3074												
3075	**Conc (|dibutyltin as sn|domain 1b|all|)**											
3076												
3077	General Statistics											
3078	Total Number of Observations					18	Observations					3
3079	Number of Detects					0	Non-Detects					18
3080	Number of Distinct Detects					0	Non-Detects					3
3081												
3082	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
3083	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
3084	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
3085												
3086	The data set for variable Conc (|dibutyltin as sn|domain 1b|all|) was not processed!											
3087												

	A	B	C	D	E	F	G	H	I	J	K	L
3088												
3089	Conc (|dibutyltin as sn|domain 2|aecom|)											
3090												
3091	General Statistics											
3092	Total Number of Observations					6	)bservations					2
3093	Number of Detects					0	Non-Detects					6
3094	Number of Distinct Detects					0	Non-Detects					2
3095												
3096	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
3097	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
3098	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
3099												
3100	The data set for variable Conc (|dibutyltin as sn|domain 2|aecom|) was not processed!											
3101												
3102												
3103	Conc (|dibutyltin as sn|domain 2|all|)											
3104												
3105	General Statistics											
3106	**Total Number of Observations**					**6**	**f Distinct Observations**					**2**
3107	**Number of Detects**					**0**	**)er of Non-Detects**					**6**
3108	Number of Distinct Detects					0	Non-Detects					2
3109												
3110	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
3111	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
3112	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
3113												
3114	The data set for variable Conc (|dibutyltin as sn|domain 2|all|) was not processed!											
3115												
3116												
3117												
3118	**Conc (|lead|ambient|aecom|)**											
3119												
3120	General Statistics											
3121	Total Number of Observations					14	)bservations					8
3122					Number of Missing Observations							0
3123	Minimum					2	Mean					4.779
3124	**Maximum**					**9.5**	**Median**					**4**
3125	**SD**					**2.522**	**l. Error of Mean**					**0.674**
3126	Coefficient of Variation					0.528	Skewness					0.627
3127												
3128	Normal GOF Test											
3129	Shapiro Wilk Test Statistic					0.888	ilk GOF Test					
3130	5% Shapiro Wilk Critical Value					0.874	icance Level					
3131	**Lilliefors Test Statistic**					**0.264**	**iefors GOF Test**					
3132	**5% Lilliefors Critical Value**					**0.226**	**al at 5% Significance Level**					
3133	**Data appear Approximate Normal at 5% Significance Level**											
3134												
3135	Assuming Normal Distribution											
3136	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
3137	**95% Student's-t UCL**					**5.972**	**ed-CLT UCL (Chen-1995)**					**6.008**
3138						**95% Modified-t UCL (Johnson-1978)**						**5.991**
3139												
3140	**Gamma GOF Test**											
3141	**A-D Test Statistic**					**0.529**	**arling Gamma GOF Test**					
3142	**5% A-D Critical Value**					**0.74**	**ma Distributed at 5% Significance Level**					
3143	K-S Test Statistic					0.21	na GOF Test					
3144	**5% K-S Critical Value**					**0.23**	**ma Distributed at 5% Significance Level**					
3145	Detected data appear Gamma Distributed at 5% Significance Level											
3146												
3147	Gamma Statistics											
3148	k hat (MLE)					3.913	bias corrected MLE)					3.122
3149	**Theta hat (MLE)**					**1.221**	**r (bias corrected MLE)**					**1.53**
3150	**nu hat (MLE)**					**109.6**	**nu star (bias corrected)**					**87.43**

ProUCL Output
(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
3151	**MLE Mean (bias corrected)**					**4.779**	**Sd (bias corrected)**					**2.704**
3152						**Approximate Chi Square Value (0.05)**						**66.87**
3153	Adjusted Level of Significance					0.0312	quare Value					64.49
3154												
3155	Assuming Gamma Distribution											
3156	95% Approximate Gamma UCL (use when n>=50))					6.247	when n<50)					6.478
3157												
3158	Lognormal GOF Test											
3159	Shapiro Wilk Test Statistic					0.913	al GOF Test					
3160	5% Shapiro Wilk Critical Value					0.874	icance Level					
3161	Lilliefors Test Statistic					0.176	al GOF Test					
3162	5% Lilliefors Critical Value					0.226	icance Level					
3163	**Data appear Lognormal at 5% Significance Level**											
3164												
3165	**Lognormal Statistics**											
3166	**Minimum of Logged Data**					**0.693**	**n of logged Data**					**1.431**
3167	**Maximum of Logged Data**					**2.251**	**of logged Data**					**0.542**
3168												
3169	**Assuming Lognormal Distribution**											
3170	95% H-UCL					6.615	**ebyshev (MVUE) UCL**					**6.938**
3171	95% Chebyshev (MVUE) UCL					7.912	ebyshev (MVUE) UCL					9.263
3172	99% Chebyshev (MVUE) UCL					11.92						
3173												
3174	**Nonparametric Distribution Free UCL Statistics**											
3175	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
3176												
3177	Nonparametric Distribution Free UCLs											
3178	95% CLT UCL					5.887	ckknife UCL					5.972
3179	95% Standard Bootstrap UCL					5.847	tstrap-t UCL					6.214
3180	95% Hall's Bootstrap UCL					5.905	otstrap UCL					5.864
3181	95% BCA Bootstrap UCL					5.957						
3182	90% Chebyshev(Mean, Sd) UCL					6.801	an, Sd) UCL					7.717
3183	**97.5% Chebyshev(Mean, Sd) UCL**					**8.988**	**byshev(Mean, Sd) UCL**					**11.49**
3184												
3185	Suggested UCL to Use											
3186	95% Student's-t UCL					5.972						
3187												
3188	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
3189	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
3190												
3191	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
3192	Recommendations are based upon data size, data distribution, and skewness.											
3193	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
3194	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3195												
3196												
3197	**Conc (|lead|domain 1a|aecom|)**											
3198												
3199	General Statistics											
3200	Total Number of Observations					26	f Distinct Observations					24
3201							Number of Missing Observations					0
3202	Minimum					3	Mean					58.36
3203	Maximum					200	Median					55.5
3204	SD					47.63	rror of Mean					9.341
3205	Coefficient of Variation					0.816	Skewness					1.086
3206												
3207	Normal GOF Test											
3208	Shapiro Wilk Test Statistic					0.912	ilk GOF Test					
3209	5% Shapiro Wilk Critical Value					0.92	icance Level					
3210	Lilliefors Test Statistic					0.137	rs GOF Test					
3211	5% Lilliefors Critical Value					0.17	icance Level					
3212	**Data appear Approximate Normal at 5% Significance Level**											
3213												

	A	B	C	D	E	F	G	H	I	J	K	L
3214	Assuming Normal Distribution											
3215	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
3216	95% Student's-t UCL					74.32	(Chen-1995)					75.85
3217					95% Modified-t UCL (Johnson-1978)							74.65
3218												
3219	Gamma GOF Test											
3220	A-D Test Statistic					0.506	na GOF Test					
3221	**5% A-D Critical Value**					**0.769**	**ma Distributed at 5% Significance Level**					
3222	**K-S Test Statistic**					**0.137**	**Smirnov Gamma GOF Test**					
3223	5% K-S Critical Value					0.176	icance Level					
3224	Detected data appear Gamma Distributed at 5% Significance Level											
3225												
3226	**Gamma Statistics**											
3227	k hat (MLE)					1.175	**bias corrected MLE)**					**1.065**
3228	Theta hat (MLE)					49.65	r (bias corrected MLE)					54.78
3229	nu hat (MLE)					61.12	**ar (bias corrected)**					**55.4**
3230	MLE Mean (bias corrected)					58.36	Sd (bias corrected)					56.54
3231						**Approximate Chi Square Value (0.05)**						**39.3**
3232	**Adjusted Level of Significance**					**0.0398**	**d Chi Square Value**					**38.4**
3233												
3234	Assuming Gamma Distribution											
3235	95% Approximate Gamma UCL (use when n>=50))					82.28	when n<50)					84.2
3236												
3237	Lognormal GOF Test											
3238	Shapiro Wilk Test Statistic					0.9	al GOF Test					
3239	**5% Shapiro Wilk Critical Value**					**0.92**	**mal at 5% Significance Level**					
3240	**Lilliefors Test Statistic**					**0.182**	**Lognormal GOF Test**					
3241	5% Lilliefors Critical Value					0.17	icance Level					
3242	Data Not Lognormal at 5% Significance Level											
3243												
3244	Lognormal Statistics											
3245	Minimum of Logged Data					1.099	logged Data					3.584
3246	**Maximum of Logged Data**					**5.298**	**of logged Data**					**1.188**
3247												
3248	**Assuming Lognormal Distribution**											
3249	95% H-UCL					140.6	MVUE) UCL					127.5
3250	95% Chebyshev (MVUE) UCL					153.6	MVUE) UCL					189.8
3251	99% Chebyshev (MVUE) UCL					261						
3252												
3253	**Nonparametric Distribution Free UCL Statistics**											
3254	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
3255												
3256	**Nonparametric Distribution Free UCLs**											
3257	**95% CLT UCL**					**73.73**	**% Jackknife UCL**					**74.32**
3258	95% Standard Bootstrap UCL					73.34	tstrap-t UCL					75.62
3259	**95% Hall's Bootstrap UCL**					**79.37**	**rcentile Bootstrap UCL**					**73.69**
3260	95% BCA Bootstrap UCL					75.11						
3261	90% Chebyshev(Mean, Sd) UCL					86.38	ebyshev(Mean, Sd) UCL					99.08
3262	97.5% Chebyshev(Mean, Sd) UCL					116.7	ebyshev(Mean, Sd) UCL					151.3
3263												
3264	**Suggested UCL to Use**											
3265	**95% Student's-t UCL**					**74.32**						
3266												
3267	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
3268	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
3269												
3270	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
3271	Recommendations are based upon data size, data distribution, and skewness.											
3272	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
3273	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3274												
3275												
3276	Conc (|lead|domain 1a|all|)											

	A	B	C	D	E	F	G	H	I	J	K	L
3277												
3278	**General Statistics**											
3279	**Total Number of Observations**					**60**	**f Distinct Observations**					**44**
3280							**Number of Missing Observations**					**0**
3281	**Minimum**					**3**	**Mean**					**58.32**
3282	**Maximum**					**210**	**Median**					**48**
3283	**SD**					**49.89**	**l. Error of Mean**					**6.441**
3284	**Coefficient of Variation**					**0.856**	**Skewness**					**1.178**
3285												
3286	Normal GOF Test											
3287	Shapiro Wilk Test Statistic					0.881	**iro Wilk GOF Test**					
3288	5% Shapiro Wilk P Value					3.05E-06	al at 5% Significance Level					
3289	**Lilliefors Test Statistic**					**0.134**	**iefors GOF Test**					
3290	**5% Lilliefors Critical Value**					**0.114**	**al at 5% Significance Level**					
3291	**Data Not Normal at 5% Significance Level**											
3292												
3293	Assuming Normal Distribution											
3294	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
3295	95% Student's-t UCL					69.08	(Chen-1995)					69.96
3296					95% Modified-t UCL (Johnson-1978)							69.24
3297												
3298	**Gamma GOF Test**											
3299	**A-D Test Statistic**					**0.597**	**arling Gamma GOF Test**					
3300	5% A-D Critical Value					0.775	**ma Distributed at 5% Significance Level**					
3301	K-S Test Statistic					0.114	Smirnov Gamma GOF Test					
3302	5% K-S Critical Value					0.118	**ma Distributed at 5% Significance Level**					
3303	Detected data appear Gamma Distributed at 5% Significance Level											
3304												
3305	**Gamma Statistics**											
3306	**k hat (MLE)**					**1.198**	**ias corrected MLE)**					**1.149**
3307	Theta hat (MLE)					48.68	rected MLE)					50.75
3308	nu hat (MLE)					143.7	s corrected)					137.9
3309	MLE Mean (bias corrected)					58.32	s corrected)					54.4
3310					Approximate Chi Square Value (0.05)							111.8
3311	**Adjusted Level of Significance**					**0.046**	**d Chi Square Value**					**111.2**
3312												
3313	Assuming Gamma Distribution											
3314	95% Approximate Gamma UCL (use when n>=50)					71.95	Gamma UCL (use when n<50)					72.32
3315												
3316	Lognormal GOF Test											
3317	Shapiro Wilk Test Statistic					0.923	ilk Lognormal GOF Test					
3318	5% Shapiro Wilk P Value					9.22E-04	icance Level					
3319	Lilliefors Test Statistic					0.135	al GOF Test					
3320	5% Lilliefors Critical Value					0.114	icance Level					
3321	Data Not Lognormal at 5% Significance Level											
3322												
3323	Lognormal Statistics											
3324	Minimum of Logged Data					1.099	logged Data					3.594
3325	Maximum of Logged Data					5.347	logged Data					1.115
3326												
3327	**Assuming Lognormal Distribution**											
3328	**95% H-UCL**					**98**	**ebyshev (MVUE) UCL**					**101.7**
3329	95% Chebyshev (MVUE) UCL					117.6	MVUE) UCL					139.6
3330	99% Chebyshev (MVUE) UCL					182.9						
3331												
3332	Nonparametric Distribution Free UCL Statistics											
3333	Data appear to follow a Discernible Distribution at 5% Significance Level											
3334												
3335	Nonparametric Distribution Free UCLs											
3336	**95% CLT UCL**					**68.91**	**% Jackknife UCL**					**69.08**
3337	**95% Standard Bootstrap UCL**					**69.43**	**% Bootstrap-t UCL**					**71.11**
3338	95% Hall's Bootstrap UCL					70.91	ootstrap UCL					69.42
3339	95% BCA Bootstrap UCL					69.66						

	A	B	C	D	E	F	G	H	I	J	K	L
3340	**90% Chebyshev(Mean, Sd) UCL**					**77.64**	**byshev(Mean, Sd) UCL**					**86.39**
3341	**97.5% Chebyshev(Mean, Sd) UCL**					**98.54**	**byshev(Mean, Sd) UCL**					**122.4**
3342												
3343	Suggested UCL to Use											
3344	95% Approximate Gamma UCL					71.95						
3345												
3346	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
3347	**Recommendations are based upon data size, data distribution, and skewness.**											
3348	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
3349	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3350												
3351												
3352	Conc (|lead|domain 1b|aecom|)											
3353												
3354	**General Statistics**											
3355	**Total Number of Observations**					**14**	**f Distinct Observations**					**14**
3356					Number of Missing Observations							0
3357	Minimum					3	Mean					10.3
3358	Maximum					44	Median					7.5
3359	SD					10.2	rror of Mean					2.726
3360	Coefficient of Variation					0.99	Skewness					3.155
3361												
3362	**Normal GOF Test**											
3363	**Shapiro Wilk Test Statistic**					**0.584**	**iro Wilk GOF Test**					
3364	5% Shapiro Wilk Critical Value					0.874	icance Level					
3365	Lilliefors Test Statistic					0.292	rs GOF Test					
3366	5% Lilliefors Critical Value					0.226	icance Level					
3367	**Data Not Normal at 5% Significance Level**											
3368												
3369	**Assuming Normal Distribution**											
3370	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
3371	**95% Student's-t UCL**					**15.13**	**ed-CLT UCL (Chen-1995)**					**17.24**
3372						**95% Modified-t UCL (Johnson-1978)**						**15.51**
3373												
3374	**Gamma GOF Test**											
3375	A-D Test Statistic					0.932	arling Gamma GOF Test					
3376	5% A-D Critical Value					0.745	stributed at 5% Significance Level					
3377	K-S Test Statistic					0.245	Smirnov Gamma GOF Test					
3378	5% K-S Critical Value					0.231	stributed at 5% Significance Level					
3379	**Data Not Gamma Distributed at 5% Significance Level**											
3380												
3381	**Gamma Statistics**											
3382	**k hat (MLE)**					**2.191**	**ias corrected MLE)**					**1.769**
3383	Theta hat (MLE)					4.702	rrected MLE)					5.823
3384	nu hat (MLE)					61.34	s corrected)					49.53
3385	MLE Mean (bias corrected)					10.3	s corrected)					7.744
3386					Approximate Chi Square Value (0.05)							34.37
3387	Adjusted Level of Significance					0.0312	quare Value					32.7
3388												
3389	Assuming Gamma Distribution											
3390	95% Approximate Gamma UCL (use when n>=50))					14.84	when n<50)					15.6
3391												
3392	Lognormal GOF Test											
3393	**Shapiro Wilk Test Statistic**					**0.913**	**lk Lognormal GOF Test**					
3394	**5% Shapiro Wilk Critical Value**					**0.874**	**ormal at 5% Significance Level**					
3395	**Lilliefors Test Statistic**					**0.196**	**Lognormal GOF Test**					
3396	**5% Lilliefors Critical Value**					**0.226**	**ormal at 5% Significance Level**					
3397	**Data appear Lognormal at 5% Significance Level**											
3398												
3399	**Lognormal Statistics**											
3400	**Minimum of Logged Data**					**1.099**	**n of logged Data**					**2.087**
3401	**Maximum of Logged Data**					**3.784**	**of logged Data**					**0.646**
3402												

	A	B	C	D	E	F	G	H	I	J	K	L
3403	**Assuming Lognormal Distribution**											
3404	**95% H-UCL**					**14.93**	**ebyshev (MVUE) UCL**					**15.04**
3405	**95% Chebyshev (MVUE) UCL**					**17.43**	**ıebyshev (MVUE) UCL**					**20.75**
3406	**99% Chebyshev (MVUE) UCL**					**27.27**						
3407												
3408	Nonparametric Distribution Free UCL Statistics											
3409	Data appear to follow a Discernible Distribution at 5% Significance Level											
3410												
3411	Nonparametric Distribution Free UCLs											
3412	95% CLT UCL					14.78	ıckknife UCL					15.13
3413	**95% Standard Bootstrap UCL**					**14.55**	**% Bootstrap-t UCL**					**23.83**
3414	**95% Hall's Bootstrap UCL**					**31.57**	**rcentile Bootstrap UCL**					**15.39**
3415	**95% BCA Bootstrap UCL**					**18.04**						
3416	**90% Chebyshev(Mean, Sd) UCL**					**18.48**	**byshev(Mean, Sd) UCL**					**22.18**
3417	**97.5% Chebyshev(Mean, Sd) UCL**					**27.32**	**byshev(Mean, Sd) UCL**					**37.42**
3418												
3419	Suggested UCL to Use											
3420	95% H-UCL					14.93						
3421												
3422	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
3423	**Recommendations are based upon data size, data distribution, and skewness.**											
3424	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
3425	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3426												
3427	ProUCL computes and outputs H-statistic based UCLs for historical reasons only.											
3428	H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.											
3429	It is therefore recommended to avoid the use of H-statistic based 95% UCLs.											
3430	Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.											
3431												
3432												
3433	**Conc (|lead|domain 1b|all|)**											
3434												
3435	General Statistics											
3436	**Total Number of Observations**					**25**	**f Distinct Observations**					**24**
3437						**Number of Missing Observations**							**0**
3438	**Minimum**					**3**	**Mean**					**8.932**
3439	**Maximum**					**44**	**Median**					**6.9**
3440	**SD**					**7.89**	**l. Error of Mean**					**1.578**
3441	Coefficient of Variation					0.883	Skewness					3.918
3442												
3443	Normal GOF Test											
3444	Shapiro Wilk Test Statistic					0.554	ilk GOF Test					
3445	5% Shapiro Wilk Critical Value					0.918	icance Level					
3446	**Lilliefors Test Statistic**					**0.237**	**iefors GOF Test**					
3447	**5% Lilliefors Critical Value**					**0.173**	**al at 5% Significance Level**					
3448	Data Not Normal at 5% Significance Level											
3449												
3450	Assuming Normal Distribution											
3451	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
3452	95% Student's-t UCL					11.63	(Chen-1995)					12.85
3453						**95% Modified-t UCL (Johnson-1978)**							**11.84**
3454												
3455	**Gamma GOF Test**											
3456	A-D Test Statistic					1.06	ıa GOF Test					
3457	5% A-D Critical Value					0.752	icance Level					
3458	K-S Test Statistic					0.149	ıa GOF Test					
3459	**5% K-S Critical Value**					**0.176**	**ma Distributed at 5% Significance Level**					
3460	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
3461												
3462	**Gamma Statistics**											
3463	**k hat (MLE)**					**2.855**	**ıias corrected MLE)**					**2.539**
3464	**Theta hat (MLE)**					**3.129**	**r (bias corrected MLE)**					**3.518**
3465	nu hat (MLE)					142.7	ıs corrected)					127

	A	B	C	D	E	F	G	H	I	J	K	L
3466	MLE Mean (bias corrected)					8.932	as corrected)					5.605
3467						**Approximate Chi Square Value (0.05)**						**101.9**
3468	**Adjusted Level of Significance**					**0.0395**	**d Chi Square Value**					**100.4**
3469												
3470	Assuming Gamma Distribution											
3471	95% Approximate Gamma UCL (use when n>=50)					11.12	Gamma UCL (use when n<50)					11.29
3472												
3473	**Lognormal GOF Test**											
3474	**Shapiro Wilk Test Statistic**					**0.923**	**Shapiro Wilk Lognormal GOF Test**					
3475	**5% Shapiro Wilk Critical Value**					**0.918**	**ormal at 5% Significance Level**					
3476	**Lilliefors Test Statistic**					**0.0995**	**Lognormal GOF Test**					
3477	5% Lilliefors Critical Value					0.173	icance Level					
3478	Data appear Lognormal at 5% Significance Level											
3479												
3480	Lognormal Statistics											
3481	Minimum of Logged Data					1.099	logged Data					2.004
3482	Maximum of Logged Data					3.784	logged Data					0.551
3483												
3484	Assuming Lognormal Distribution											
3485	95% H-UCL					10.82	MVUE) UCL					11.55
3486	95% Chebyshev (MVUE) UCL					12.9	MVUE) UCL					14.77
3487	**99% Chebyshev (MVUE) UCL**					**18.44**						
3488												
3489	**Nonparametric Distribution Free UCL Statistics**											
3490	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
3491												
3492	**Nonparametric Distribution Free UCLs**											
3493	**95% CLT UCL**					**11.53**	**% Jackknife UCL**					**11.63**
3494	**95% Standard Bootstrap UCL**					**11.54**	**% Bootstrap-t UCL**					**15.16**
3495	**95% Hall's Bootstrap UCL**					**21.94**	**rcentile Bootstrap UCL**					**11.78**
3496	**95% BCA Bootstrap UCL**					**13.36**						
3497	**90% Chebyshev(Mean, Sd) UCL**					**13.67**	**byshev(Mean, Sd) UCL**					**15.81**
3498	97.5% Chebyshev(Mean, Sd) UCL					18.79	**byshev(Mean, Sd) UCL**					**24.63**
3499												
3500	Suggested UCL to Use											
3501	95% Adjusted Gamma UCL					11.29						
3502												
3503	**When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test**											
3504	**When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
3505												
3506	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
3507	Recommendations are based upon data size, data distribution, and skewness.											
3508	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
3509	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3510												
3511												
3512	**Conc (|lead|domain 2 |all|)**											
3513												
3514	**General Statistics**											
3515	**Total Number of Observations**					**6**	**f Distinct Observations**					**6**
3516					Number of Missing Observations							0
3517	Minimum					2.2	Mean					10.78
3518	Maximum					32	Median					7.45
3519	SD					10.71	rror of Mean					4.373
3520	**Coefficient of Variation**					**0.993**	**Skewness**					**2.124**
3521												
3522	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
3523	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.											
3524	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
3525	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
3526												
3527	Normal GOF Test											
3528	Shapiro Wilk Test Statistic					0.73	ilk GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L
3529	5% Shapiro Wilk Critical Value					0.788	icance Level					
3530	Lilliefors Test Statistic					0.362	rs GOF Test					
3531	5% Lilliefors Critical Value					0.325	icance Level					
3532	Data Not Normal at 5% Significance Level											
3533												
3534	Assuming Normal Distribution											
3535	95% Normal UCL				95% UCLs (Adjusted for Skewness)							
3536	**95% Student's-t UCL**					**19.6**	**ed-CLT UCL (Chen-1995)**					**22.03**
3537						**95% Modified-t UCL (Johnson-1978)**						**20.23**
3538												
3539	Gamma GOF Test											
3540	A-D Test Statistic					0.436	ıa GOF Test					
3541	5% A-D Critical Value					0.707	icance Level					
3542	K-S Test Statistic					0.267	ıa GOF Test					
3543	5% K-S Critical Value					0.337	icance Level					
3544	Detected data appear Gamma Distributed at 5% Significance Level											
3545												
3546	**Gamma Statistics**											
3547	k hat (MLE)					1.667	rrected MLE)					0.944
3548	Theta hat (MLE)					6.47	rrected MLE)					11.42
3549	**nu hat (MLE)**					**20**	**ar (bias corrected)**					**11.33**
3550	**MLE Mean (bias corrected)**					**10.78**	**Sd (bias corrected)**					**11.1**
3551						**Approximate Chi Square Value (0.05)**						**4.792**
3552	Adjusted Level of Significance					0.0122	ed Chi Square Value					3.38
3553												
3554	Assuming Gamma Distribution											
3555	**95% Approximate Gamma UCL (use when n>=50)**					**25.51**	**Gamma UCL (use when n<50)**					**36.16**
3556												
3557	**Lognormal GOF Test**											
3558	Shapiro Wilk Test Statistic					0.949	al GOF Test					
3559	5% Shapiro Wilk Critical Value					0.788	icance Level					
3560	Lilliefors Test Statistic					0.219	al GOF Test					
3561	5% Lilliefors Critical Value					0.325	icance Level					
3562	Data appear Lognormal at 5% Significance Level											
3563												
3564	**Lognormal Statistics**											
3565	Minimum of Logged Data					0.788	logged Data					2.049
3566	Maximum of Logged Data					3.466	logged Data					0.869
3567												
3568	Assuming Lognormal Distribution											
3569	95% H-UCL					47.29	MVUE) UCL					21.54
3570	**95% Chebyshev (MVUE) UCL**					**26.55**	**ebyshev (MVUE) UCL**					**33.49**
3571	**99% Chebyshev (MVUE) UCL**					**47.14**						
3572												
3573	Nonparametric Distribution Free UCL Statistics											
3574	Data appear to follow a Discernible Distribution at 5% Significance Level											
3575												
3576	**Nonparametric Distribution Free UCLs**											
3577	**95% CLT UCL**					**17.98**	**% Jackknife UCL**					**19.6**
3578	**95% Standard Bootstrap UCL**					**17.19**	**% Bootstrap-t UCL**					**36.31**
3579	**95% Hall's Bootstrap UCL**					**56.14**	**rcentile Bootstrap UCL**					**19.22**
3580	**95% BCA Bootstrap UCL**					**19.78**						
3581	**90% Chebyshev(Mean, Sd) UCL**					**23.9**	**byshev(Mean, Sd) UCL**					**29.85**
3582	97.5% Chebyshev(Mean, Sd) UCL					38.09	an, Sd) UCL					54.3
3583												
3584	Suggested UCL to Use											
3585	95% Adjusted Gamma UCL					36.16						
3586												
3587	Recommended UCL exceeds the maximum observation											
3588												
3589	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
3590	**Recommendations are based upon data size, data distribution, and skewness.**											
3591	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											

	A	B	C	D	E	F	G	H	I	J	K	L
3592	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
3593												
3594												
3595	Conc (|lead|domain 2|aecom|)											
3596												
3597	General Statistics											
3598	Total Number of Observations					5	Observations					4
3599					Number of Missing Observations							0
3600	Minimum					3	Mean					4.66
3601	Maximum					6.5	Median					4
3602	**SD**					**1.442**	**l. Error of Mean**					**0.645**
3603	**Coefficient of Variation**					**0.309**	**Skewness**					**0.356**
3604												
3605	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
3606	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
3607	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
3608	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**											
3609												
3610	**rmal GOF Test**											
3611	**o Wilk Test Statistic**					0.917	Shapiro Wilk GOF Test					
3612	**iro Wilk Critical Value**					0.762	Data appear Normal at 5% Significance Level					
3613	**fors Test Statistic**					0.276	Lilliefors GOF Test					
3614	**iefors Critical Value**					0.343	Data appear Normal at 5% Significance Level					
3615	**mal at 5% Significance Level**											
3616												
3617	l Distribution											
3618	Normal UCL				95% UCLs (Adjusted for Skewness)							
3619	dent's-t UCL					6.034	(Chen-1995)					5.83
3620					95% Modified-t UCL (Johnson-1978)							6.051
3621												
3622	**mma GOF Test**											
3623	**D Test Statistic**					0.348	Anderson-Darling Gamma GOF Test					
3624	**A-D Critical Value**					0.679	Detected data appear Gamma Distributed at 5% Significance Level					
3625	**S Test Statistic**					0.272	Kolmogorov-Smirnov Gamma GOF Test					
3626	**K-S Critical Value**					0.357	Detected data appear Gamma Distributed at 5% Significance Level					
3627	icance Level											
3628												
3629	ma Statistics											
3630	k hat (MLE)					13.04	rrected MLE)					5.348
3631	**heta hat (MLE)**					0.357	Theta star (bias corrected MLE)					0.871
3632	**nu hat (MLE)**					130.4	nu star (bias corrected)					53.48
3633	as corrected)					4.66	as corrected)					2.015
3634					Approximate Chi Square Value (0.05)							37.68
3635	Significance					0.0086	quare Value					31.98
3636												
3637	a Distribution											
3638	hen n>=50))					6.614	when n<50)					7.793
3639												
3640	**normal GOF Test**											
3641	**o Wilk Test Statistic**					0.93	Shapiro Wilk Lognormal GOF Test					
3642	**iro Wilk Critical Value**					0.762	icance Level					
3643	Test Statistic					0.242	al GOF Test					
3644	Critical Value					0.343	icance Level					
3645	**ormal at 5% Significance Level**											
3646												
3647	**normal Statistics**											
3648	**um of Logged Data**					1.099	Mean of logged Data					1.5
3649	**um of Logged Data**					1.872	SD of logged Data					0.313
3650												
3651	l Distribution											
3652	95% H-UCL					6.887	MVUE) UCL					6.61
3653	MVUE) UCL					7.494	MVUE) UCL					8.72
3654	MVUE) UCL					11.13						

	A	B	C	D	E	F	G	H	I	J	K	L
3655												
3656	**istribution Free UCL Statistics**											
3657	icance Level											
3658												
3659	n Free UCLs											
3660	% CLT UCL					5.72	ıckknife UCL					6.034
3661	otstrap UCL					N/A	ıtstrap-t UCL					N/A
3662	**Hall's Bootstrap UCL**					N/A	95% Percentile Bootstrap UCL					N/A
3663	**BCA Bootstrap UCL**					N/A						
3664	**byshev(Mean, Sd) UCL**					6.594	**byshev(Mean, Sd) UCL**					7.47
3665	an, Sd) UCL					8.686	an, Sd) UCL					11.07
3666												
3667	UCL to Use											
3668	**Student's-t UCL**					6.034						
3669												
3670	**are provided to help the user to select the most appropriate 95% UCL.**											
3671	**on data size, data distribution, and skewness.**											
3672	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
3673	**ta sets; for additional insight the user may want to consult a statistician.**											
3674												
3675												
3676	**lead|domain 2|all|)**											
3677												
3678	eneral Statistics											
3679	mber of Observations					5	Number of Distinct Observations					4
3680							Number of Missing Observations					0
3681	Minimum					3	Mean					4.66
3682	**Maximum**					6.5	Median					4
3683	**SD**					1.442	Std. Error of Mean					0.645
3684	**ficient of Variation**					0.309	Skewness					0.356
3685												
3686	u should use											
3687	s of interest.											
3688	TRC, 2012).											
3689	ProUCL 5.1											
3690												
3691	al GOF Test											
3692	Test Statistic					0.917	ilk GOF Test					
3693	Critical Value					0.762	icance Level					
3694	Test Statistic					0.276	rs GOF Test					
3695	Critical Value					0.343	icance Level					
3696	**mal at 5% Significance Level**											
3697												
3698	**g Normal Distribution**											
3699	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
3700	**% Student's-t UCL**					6.034	95% Adjusted-CLT UCL (Chen-1995)					5.83
3701							95% Modified-t UCL (Johnson-1978)					6.051
3702												
3703	ma GOF Test											
3704	Test Statistic					0.348	arling Gamma GOF Test					
3705	Critical Value					0.679	**ma Distributed at 5% Significance Level**					
3706	Test Statistic					0.272	Smirnov Gamma GOF Test					
3707	**K-S Critical Value**					0.357	Detected data appear Gamma Distributed at 5% Significance Level					
3708	**ma Distributed at 5% Significance Level**											
3709												
3710	ma Statistics											
3711	k hat (MLE)					13.04	rrected MLE)					5.348
3712	ta hat (MLE)					0.357	rrected MLE)					0.871
3713	hu hat (MLE)					130.4	as corrected)					53.48
3714	as corrected)					4.66	as corrected)					2.015
3715					Approximate Chi Square Value (0.05)							37.68
3716	**Level of Significance**					0.0086	Adjusted Chi Square Value					31.98
3717												

	A	B	C	D	E	F	G	H	I	J	K	L
3718	n Distribution											
3719	hen n>=50))					6.614	Gamma UCL (use when n<50)					7.793
3720												
3721	al GOF Test											
3722	**o Wilk Test Statistic**					0.93	Shapiro Wilk Lognormal GOF Test					
3723	**iro Wilk Critical Value**					0.762	Data appear Lognormal at 5% Significance Level					
3724	**fors Test Statistic**					0.242	Lilliefors Lognormal GOF Test					
3725	Critical Value					0.343	icance Level					
3726	icance Level											
3727												
3728	nal Statistics											
3729	**um of Logged Data**					1.099	Mean of logged Data					1.5
3730	**um of Logged Data**					1.872	SD of logged Data					0.313
3731												
3732	Lognormal Distribution											
3733	95% H-UCL					6.887	90% Chebyshev (MVUE) UCL					6.61
3734	ebyshev (MVUE) UCL					7.494	97.5% Chebyshev (MVUE) UCL					8.72
3735	ebyshev (MVUE) UCL					11.13						
3736												
3737	CL Statistics											
3738	icance Level											
3739												
3740	n Free UCLs											
3741	% CLT UCL					5.72	ıckknife UCL					6.034
3742	ootstrap UCL					N/A	ıtstrap-t UCL					N/A
3743	ootstrap UCL					N/A	ootstrap UCL					N/A
3744	ootstrap UCL					N/A						
3745	**byshev(Mean, Sd) UCL**					6.594	95% Chebyshev(Mean, Sd) UCL					7.47
3746	**ebyshev(Mean, Sd) UCL**					8.686	99% Chebyshev(Mean, Sd) UCL					11.07
3747												
3748	UCL to Use											
3749	dent's-t UCL					6.034						
3750												
3751	e 95% UCL.											
3752	d skewness.											
3753	Lee (2006).											
3754	**ta sets; for additional insight the user may want to consult a statistician.**											
3755												
3756	ient|aecom|)											
3757												
3758	**neral Statistics**											
3759	**mber of Observations**					14	Number of Distinct Observations					5
3760	er of Detects					11	**er of Non-Detects**					3
3761	tinct Detects					5	of Distinct Non-Detects					1
3762	imum Detect					0.01	**mum Non-Detect**					0.01
3763	imum Detect					0.05	imum Non-Detect					0.01
3764	**riance Detects**					2.16E-04	Percent Non-Detects					21.43%
3765	**Mean Detects**					0.0282	SD Detects					0.0147
3766	**edian Detects**					0.02	CV Detects					0.522
3767	ness Detects					0.379	osis Detects					-1.313
3768	gged Detects					-3.709	gged Detects					0.575
3769												
3770	Detects Only											
3771	Test Statistic					0.884	ilk GOF Test					
3772	**iro Wilk Critical Value**					0.85	Detected Data appear Normal at 5% Significance Level					
3773	**fors Test Statistic**					0.256	Lilliefors GOF Test					
3774	Critical Value					0.251	icance Level					
3775	icance Level											
3776												
3777	metric UCLs											
3778	KM Mean					0.0243	rror of Mean					0.00406
3779	**KM SD**					0.0145	95% KM (BCA) UCL					0.0314
3780	**5% KM (t) UCL**					0.0315	95% KM (Percentile Bootstrap) UCL					0.0307

	A	B	C	D	E	F	G	H	I	J	K	L
3781	**5% KM (z) UCL**					0.031	**KM Bootstrap t UCL**					0.0323
3782	byshev UCL					0.0365	byshev UCL					0.042
3783	byshev UCL					0.0497	byshev UCL					0.0647
3784												
3785	**on Detected Observations Only**											
3786	**D Test Statistic**					0.516	Anderson-Darling GOF Test					
3787	**A-D Critical Value**					0.733	Detected data appear Gamma Distributed at 5% Significance Level					
3788	**S Test Statistic**					0.219	Kolmogorov-Smirnov GOF					
3789	**K-S Critical Value**					0.257	Detected data appear Gamma Distributed at 5% Significance Level					
3790	**ma Distributed at 5% Significance Level**											
3791												
3792	**tics on Detected Data Only**											
3793	k hat (MLE)					3.743	k star (bias corrected MLE)					2.783
3794	heta hat (MLE)					0.00753	Theta star (bias corrected MLE)					0.0101
3795	nu hat (MLE)					82.35	nu star (bias corrected)					61.22
3796	Mean (detects)					0.0282						
3797												
3798	**Gamma ROS Statistics using Imputed Non-Detects**											
3799	**> 50% NDs with many tied observations at multiple DLs**											
3800	**uch as <1.0, especially when the sample size is small (e.g., <15-20)**											
3801	Ls and BTVs											
3802	size is small.											
3803	M estimates											
3804	Minimum					0.01	Mean					0.0243
3805	Maximum					0.05	Median					0.02
3806	SD					0.015	CV					0.62
3807	k hat (MLE)					2.891	rected MLE)					2.319
3808	ta hat (MLE)					0.0084	rected MLE)					0.0105
3809	hu hat (MLE)					80.94	as corrected)					64.93
3810	nificance (β)					0.0312						
3811	**hi Square Value (64.93, α)**					47.39	Adjusted Chi Square Value (64.93, β)					45.41
3812	**ximate UCL (use when n>=50)**					0.0333	95% Gamma Adjusted UCL (use when n<50)					0.0347
3813												
3814	**Parameters using KM Estimates**											
3815	**Mean (KM)**					0.0243	SD (KM)					0.0145
3816	**ariance (KM)**					2.10E-04	SE of Mean (KM)					0.00406
3817	**k hat (KM)**					2.806	k star (KM)					2.252
3818	**nu hat (KM)**					78.56	nu star (KM)					63.06
3819	**heta hat (KM)**					0.00866	theta star (KM)					0.0108
3820	**mma percentile (KM)**					0.0359	90% gamma percentile (KM)					0.0459
3821	**mma percentile (KM)**					0.0555	99% gamma percentile (KM)					0.0766
3822												
3823	M) Statistics											
3824	ue (63.06, α)					45.79	**i Square Value (63.06, β)**					43.85
3825	when n>=50)					0.0334	usted KM-UCL (use when n<50)					0.0349
3826												
3827	**t on Detected Observations Only**											
3828	**o Wilk Test Statistic**					0.893	Shapiro Wilk GOF Test					
3829	Critical Value					0.85	icance Level					
3830	Test Statistic					0.184	rs GOF Test					
3831	Critical Value					0.251	icance Level					
3832	icance Level											
3833												
3834	Non-Detects											
3835	**n in Original Scale**					0.0235	Mean in Log Scale					-3.996
3836	**in Original Scale**					0.0159	SD in Log Scale					0.769
3837	**umes normality of ROS data)**					0.0311	95% Percentile Bootstrap UCL					0.0305
3838	**BCA Bootstrap UCL**					0.0309	95% Bootstrap t UCL					0.0318
3839	**H-UCL (Log ROS)**					0.0415						
3840												
3841	l Distribution											
3842	ean (logged)					-3.901	M Geo Mean					0.0202
3843	SD (logged)					0.61	ue (KM-Log)					2.222

	A	B	C	D	E	F	G	H	I	J	K	L
3844	**d Error of Mean (logged)**					0.171	95% H-UCL (KM -Log)					0.0355
3845	**M SD (logged)**					0.61	95% Critical H Value (KM-Log)					2.222
3846	d Error of Mean (logged)					0.171						
3847												
3848	DL/2 Statistics											
3849	DL/2 Normal						DL/2 Log-Transformed					
3850	n in Original Scale					0.0232	Mean in Log Scale					-4.049
3851	riginal Scale					0.0162	in Log Scale					0.844
3852	es normality)					0.0309	H-Stat UCL					0.0452
3853	ical reasons											
3854												
3855	CL Statistics											
3856	icance Level											
3857												
3858	UCL to Use											
3859	KM (t) UCL					0.0315						
3860												
3861	**e.g., normal) distribution passing one of the GOF test**											
3862	s in ProUCL											
3863												
3864	e 95% UCL.											
3865	d skewness.											
3866	Lee (2006).											
3867	statistician.											
3868												
3869	**cury|domain 1a|aecom|)**											
3870												
3871	ral Statistics											
3872	Observations					26	Observations					18
3873	**mber of Detects**					24	Number of Non-Detects					2
3874	**r of Distinct Detects**					18	Number of Distinct Non-Detects					1
3875	imum Detect					0.01	**mum Non-Detect**					0.01
3876	imum Detect					0.76	imum Non-Detect					0.01
3877	ance Detects					0.0463	**cent Non-Detects**					7.69%
3878	lean Detects					0.264	SD Detects					0.215
3879	**edian Detects**					0.25	CV Detects					0.816
3880	**ewness Detects**					0.69	Kurtosis Detects					-0.0276
3881	**of Logged Detects**					-1.937	SD of Logged Detects					1.399
3882												
3883	Detects Only											
3884	Test Statistic					0.92	ilk GOF Test					
3885	Critical Value					0.916	icance Level					
3886	Test Statistic					0.121	rs GOF Test					
3887	**lefors Critical Value**					0.177	Detected Data appear Normal at 5% Significance Level					
3888	**r Normal at 5% Significance Level**											
3889												
3890	metric UCLs											
3891	KM Mean					0.244	rror of Mean					0.0427
3892	KM SD					0.213	(BCA) UCL					0.316
3893	KM (t) UCL					0.317	otstrap) UCL					0.314
3894	**5% KM (z) UCL**					0.315	95% KM Bootstrap t UCL					0.33
3895	**M Chebyshev UCL**					0.372	95% KM Chebyshev UCL					0.431
3896	**KM Chebyshev UCL**					0.511	**M Chebyshev UCL**					0.67
3897												
3898	vations Only											
3899	Test Statistic					0.969	ng GOF Test					
3900	**A-D Critical Value**					0.774	Detected Data Not Gamma Distributed at 5% Significance Level					
3901	**S Test Statistic**					0.184	Kolmogorov-Smirnov GOF					
3902	**K-S Critical Value**					0.183	Detected Data Not Gamma Distributed at 5% Significance Level					
3903	**a Distributed at 5% Significance Level**											
3904												
3905	**tics on Detected Data Only**											
3906	k hat (MLE)					0.96	rrected MLE)					0.868

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
3907	**heta hat (MLE)**					0.275	Theta star (bias corrected MLE)					0.304
3908	nu hat (MLE)					46.08	nu star (bias corrected)					41.66
3909	Mean (detects)					0.264						
3910												
3911	stics using Imputed Non-Detects											
3912	**> 50% NDs with many tied observations at multiple DLs**											
3913	**GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)**											
3914	**l may yield incorrect values of UCLs and BTVs**											
3915	**e when the sample size is small.**											
3916	M estimates											
3917	Minimum					0.01	Mean					0.245
3918	Maximum					0.76	Median					0.245
3919	SD					0.217	CV					0.884
3920	k hat (MLE)					0.862	rected MLE)					0.788
3921	ta hat (MLE)					0.284	rected MLE)					0.311
3922	hu hat (MLE)					44.83	as corrected)					40.99
3923	nificance (β)					0.0398						
3924	ue (40.99, α)					27.32	ue (40.99, β)					26.58
3925	when n>=50)					0.368	when n<50)					0.378
3926												
3927	**Parameters using KM Estimates**											
3928	**Mean (KM)**					0.244	SD (KM)					0.213
3929	**/ariance (KM)**					0.0455	SE of Mean (KM)					0.0427
3930	**k hat (KM)**					1.31	k star (KM)					1.185
3931	**nu hat (KM)**					68.12	nu star (KM)					61.59
3932	**heta hat (KM)**					0.186	theta star (KM)					0.206
3933	rcentile (KM)					0.387	**mma percentile (KM)**					0.539
3934	rcentile (KM)					0.69	mma percentile (KM)					1.034
3935												
3936	M) Statistics											
3937	**hi Square Value (61.59, α)**					44.54	Adjusted Chi Square Value (61.59, β)					43.59
3938	**kimate KM-UCL (use when n>=50)**					0.338	95% Gamma Adjusted KM-UCL (use when n<50)					0.345
3939												
3940	vations Only											
3941	Test Statistic					0.84	ilk GOF Test					
3942	Critical Value					0.916	icance Level					
3943	Test Statistic					0.23	rs GOF Test					
3944	Critical Value					0.177	icance Level					
3945	icance Level											
3946												
3947	**istics Using Imputed Non-Detects**											
3948	riginal Scale					0.244	**an in Log Scale**					-2.172
3949	riginal Scale					0.218	D in Log Scale					1.581
3950	of ROS data)					0.317	**rcentile Bootstrap UCL**					0.319
3951	otstrap UCL					0.318	% Bootstrap t UCL					0.331
3952	**H-UCL (Log ROS)**					1.142						
3953												
3954	**gged Data and Assuming Lognormal Distribution**											
3955	ean (logged)					-2.142	M Geo Mean					0.117
3956	SD (logged)					1.496	ue (KM-Log)					3.21
3957	ean (logged)					0.3	CL (KM -Log)					0.939
3958	SD (logged)					1.496	ue (KM-Log)					3.21
3959	**d Error of Mean (logged)**					0.3						
3960												
3961	DL/2 Statistics											
3962	DL/2 Normal						DL/2 Log-Transformed					
3963	n in Original Scale					0.244	Mean in Log Scale					-2.195
3964	in Original Scale					0.218	SD in Log Scale					1.623
3965	CL (Assumes normality)					0.317	95% H-Stat UCL					1.256
3966	ical reasons											
3967												
3968	CL Statistics											
3969	icance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
3970												
3971	UCL to Use											
3972	KM (t) UCL					0.317						
3973												
3974	e 95% UCL.											
3975	**on data size, data distribution, and skewness.**											
3976	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
3977	statistician.											
3978												
3979	main 1a|all|)											
3980												
3981	ral Statistics											
3982	Observations					60	Observations					35
3983	er of Detects					53	Non-Detects					7
3984	**r of Distinct Detects**					35	Number of Distinct Non-Detects					1
3985	**inimum Detect**					0.01	Minimum Non-Detect					0.01
3986	imum Detect					0.76	Non-Detect					0.01
3987	ance Detects					0.0364	Non-Detects					11.67%
3988	**Mean Detects**					0.254	SD Detects					0.191
3989	**edian Detects**					0.25	CV Detects					0.752
3990	ness Detects					0.692	**rtosis Detects**					0.0499
3991	gged Detects					-1.857	f Logged Detects					1.228
3992												
3993	Detects Only											
3994	**o Wilk Test Statistic**					0.929	Normal GOF Test on Detected Observations Only					
3995	**apiro Wilk P Value**					0.00436	Detected Data Not Normal at 5% Significance Level					
3996	**fors Test Statistic**					0.101	Lilliefors GOF Test					
3997	Critical Value					0.121	icance Level					
3998	icance Level											
3999												
4000	metric UCLs											
4001	KM Mean					0.225	rror of Mean					0.0253
4002	**KM SD**					0.194	95% KM (BCA) UCL					0.266
4003	**5% KM (t) UCL**					0.267	95% KM (Percentile Bootstrap) UCL					0.267
4004	KM (z) UCL					0.267	otstrap t UCL					0.271
4005	byshev UCL					0.301	byshev UCL					0.335
4006	byshev UCL					0.383	byshev UCL					0.477
4007												
4008	vations Only											
4009	**D Test Statistic**					1.429	Anderson-Darling GOF Test					
4010	**A-D Critical Value**					0.776	Detected Data Not Gamma Distributed at 5% Significance Level					
4011	**S Test Statistic**					0.147	**gorov-Smirnov GOF**					
4012	Critical Value					0.125	icance Level					
4013	icance Level											
4014												
4015	**tics on Detected Data Only**											
4016	**k hat (MLE)**					1.17	k star (bias corrected MLE)					1.116
4017	**heta hat (MLE)**					0.217	Theta star (bias corrected MLE)					0.227
4018	**nu hat (MLE)**					124	nu star (bias corrected)					118.3
4019	**lean (detects)**					0.254						
4020												
4021	Non-Detects											
4022	**> 50% NDs with many tied observations at multiple DLs**											
4023	such as <1.0, especially when the sample size is small (e.g., <15-20)											
4024	d may yield incorrect values of UCLs and BTVs											
4025	ue when the sample size is small.											
4026	CLs may be computed using gamma distribution on KM estimates											
4027	**Minimum**					0.01	Mean					0.227
4028	**Maximum**					0.76	Median					0.205
4029	**SD**					0.194	CV					0.853
4030	**k hat (MLE)**					0.977	k star (bias corrected MLE)					0.939
4031	ta hat (MLE)					0.232	rrected MLE)					0.242
4032	nu hat (MLE)					117.2	as corrected)					112.7

	A	B	C	D	E	F	G	H	I	J	K	L
4033	nificance (β)					0.046						
4034	e (112.67, α)					89.16	e (112.67, β)					88.65
4035	when n>=50)					0.287	when n<50)					0.288
4036												
4037	M Estimates											
4038	Mean (KM)					0.225	SD (KM)					0.194
4039	ariance (KM)					0.0376	f Mean (KM)					0.0253
4040	k hat (KM)					1.347	k star (KM)					1.29
4041	**nu hat (KM)**					161.6	nu star (KM)					154.9
4042	**heta hat (KM)**					0.167	theta star (KM)					0.174
4043	**mma percentile (KM)**					0.354	90% gamma percentile (KM)					0.487
4044	**mma percentile (KM)**					0.617	99% gamma percentile (KM)					0.915
4045												
4046	**lan-Meier (KM) Statistics**											
4047	**hi Square Value (154.85, α)**					127.1	Adjusted Chi Square Value (154.85, β)					126.5
4048	**kimate KM-UCL (use when n>=50)**					0.274	95% Gamma Adjusted KM-UCL (use when n<50)					0.276
4049												
4050	**t on Detected Observations Only**											
4051	**Approximate Test Statistic**					0.843	Shapiro Wilk GOF Test					
4052	Wilk P Value					2.68E-07	**gnormal at 5% Significance Level**					
4053	Test Statistic					0.184	iefors GOF Test					
4054	Critical Value					0.121	**gnormal at 5% Significance Level**					
4055	icance Level											
4056												
4057	**istics Using Imputed Non-Detects**											
4058	**n in Original Scale**					0.226	Mean in Log Scale					-2.155
4059	riginal Scale					0.195	in Log Scale					1.426
4060	f ROS data)					0.268	otstrap UCL					0.267
4061	otstrap UCL					0.265	otstrap t UCL					0.271
4062	L (Log ROS)					0.571						
4063												
4064	l Distribution											
4065	**l Mean (logged)**					-2.178	KM Geo Mean					0.113
4066	**M SD (logged)**					1.444	95% Critical H Value (KM-Log)					3.129
4067	**d Error of Mean (logged)**					0.188	95% H-UCL (KM -Log)					0.579
4068	**M SD (logged)**					1.444	95% Critical H Value (KM-Log)					3.129
4069	**d Error of Mean (logged)**					0.188						
4070												
4071	L/2 Statistics											
4072	DL/2 Normal						DL/2 Log-Transformed					
4073	riginal Scale					0.225	in Log Scale					-2.258
4074	**in Original Scale**					0.196	SD in Log Scale					1.603
4075	**CL (Assumes normality)**					0.267	95% H-Stat UCL					0.758
4076	, provided for comparisons and historical reasons											
4077												
4078	istribution Free UCL Statistics											
4079	te Normal Distributed at 5% Significance Level											
4080												
4081	l UCL to Use											
4082	s KM (t) UCL					0.267						
4083												
4084	he GOF test											
4085	s in ProUCL											
4086												
4087	e 95% UCL.											
4088	d skewness.											
4089	Lee (2006).											
4090	**ta sets; for additional insight the user may want to consult a statistician.**											
4091												
4092	n 1b|aecom|)											
4093												
4094	ral Statistics											
4095	Observations					14	Observations					4

	A	B	C	D	E	F	G	H	I	J	K	L
4096	er of Detects					9	Non-Detects					5
4097	tinct Detects					4	Non-Detects					1
4098	imum Detect					0.01	n Non-Detect					0.01
4099	**aximum Detect**					0.16	Maximum Non-Detect					0.01
4100	**riance Detects**					0.00222	Percent Non-Detects					35.71%
4101	lean Detects					0.0378	SD Detects					0.0471
4102	dian Detects					0.02	CV Detects					1.247
4103	**ewness Detects**					2.706	Kurtosis Detects					7.649
4104	**of Logged Detects**					-3.681	SD of Logged Detects					0.849
4105												
4106	Detects Only											
4107	Test Statistic					0.586	**iro Wilk GOF Test**					
4108	Critical Value					0.829	Normal at 5% Significance Level					
4109	**fors Test Statistic**					0.37	Lilliefors GOF Test					
4110	**iefors Critical Value**					0.274	Detected Data Not Normal at 5% Significance Level					
4111	**Normal at 5% Significance Level**											
4112												
4113	metric UCLs											
4114	KM Mean					0.0279	rror of Mean					0.0108
4115	KM SD					0.038	l (BCA) UCL					N/A
4116	KM (t) UCL					0.0469	otstrap) UCL					N/A
4117	**5% KM (z) UCL**					0.0456	95% KM Bootstrap t UCL					N/A
4118	**M Chebyshev UCL**					0.0602	95% KM Chebyshev UCL					0.0748
4119	byshev UCL					0.0952	byshev UCL					0.135
4120												
4121	vations Only											
4122	Test Statistic					0.948	ng GOF Test					
4123	Critical Value					0.737	icance Level					
4124	**S Test Statistic**					0.313	Kolmogorov-Smirnov GOF					
4125	**K-S Critical Value**					0.285	Detected Data Not Gamma Distributed at 5% Significance Level					
4126	**a Distributed at 5% Significance Level**											
4127												
4128	ed Data Only											
4129	k hat (MLE)					1.378	rrected MLE)					0.992
4130	**heta hat (MLE)**					0.0274	Theta star (bias corrected MLE)					0.0381
4131	**nu hat (MLE)**					24.8	nu star (bias corrected)					17.86
4132	**lean (detects)**					0.0378						
4133												
4134	**tics using Imputed Non-Detects**											
4135	**> 50% NDs with many tied observations at multiple DLs**											
4136	e.g., <15-20)											
4137	**l may yield incorrect values of UCLs and BTVs**											
4138	ue when the sample size is small.											
4139	CLs may be computed using gamma distribution on KM estimates											
4140	Minimum					0.01	Mean					0.0279
4141	Maximum					0.16	Median					0.015
4142	**SD**					0.0395	CV					1.416
4143	**k hat (MLE)**					1.303	k star (bias corrected MLE)					1.072
4144	**heta hat (MLE)**					0.0214	Theta star (bias corrected MLE)					0.026
4145	**nu hat (MLE)**					36.49	nu star (bias corrected)					30
4146	nificance (β)					0.0312						
4147	ue (30.00, α)					18.5	ue (30.00, β)					17.31
4148	when n>=50)					0.0452	when n<50)					0.0483
4149												
4150	M Estimates											
4151	Mean (KM)					0.0279	SD (KM)					0.038
4152	ariance (KM)					0.00145	f Mean (KM)					0.0108
4153	k hat (KM)					0.537	k star (KM)					0.469
4154	nu hat (KM)					15.03	nu star (KM)					13.14
4155	eta hat (KM)					0.0519	eta star (KM)					0.0593
4156	**mma percentile (KM)**					0.0456	90% gamma percentile (KM)					0.0763
4157	**mma percentile (KM)**					0.109	99% gamma percentile (KM)					0.191
4158												

	A	B	C	D	E	F	G	H	I	J	K	L
4159	lan-Meier (KM) Statistics											
4160	hi Square Value (13.14, α)					5.99	Adjusted Chi Square Value (13.14, β)					5.362
4161	ximate KM-UCL (use when n>=50)					0.0611	95% Gamma Adjusted KM-UCL (use when n<50)					0.0683
4162												
4163	vations Only											
4164	Test Statistic					0.854	iro Wilk GOF Test					
4165	Critical Value					0.829	**ognormal at 5% Significance Level**					
4166	Test Statistic					0.274	iefors GOF Test					
4167	**iefors Critical Value**					0.274	Detected Data appear Lognormal at 5% Significance Level					
4168	**ognormal at 5% Significance Level**											
4169												
4170	Non-Detects											
4171	riginal Scale					0.0255	in Log Scale					-4.445
4172	riginal Scale					0.0407	in Log Scale					1.294
4173	f ROS data)					0.0448	otstrap UCL					0.046
4174	otstrap UCL					0.054	tstrap t UCL					0.0805
4175	L (Log ROS)					0.0889						
4176												
4177	**gged Data and Assuming Lognormal Distribution**											
4178	ean (logged)					-4.011	**M Geo Mean**					0.0181
4179	SD (logged)					0.78	tical H Value (KM-Log)					2.449
4180	ean (logged)					0.221	**H-UCL (KM -Log)**					0.0417
4181	SD (logged)					0.78	tical H Value (KM-Log)					2.449
4182	**d Error of Mean (logged)**					0.221						
4183												
4184	**L/2 Statistics**											
4185	DL/2 Normal						DL/2 Log-Transformed					
4186	riginal Scale					0.0261	in Log Scale					-4.259
4187	riginal Scale					0.0404	in Log Scale					1.044
4188	es normality)					0.0452	H-Stat UCL					0.0559
4189	**provided for comparisons and historical reasons**											
4190												
4191	istribution Free UCL Statistics											
4192	rmal Distributed at 5% Significance Level											
4193												
4194	ested UCL to Use											
4195	KM H-UCL					0.0417						
4196												
4197	e 95% UCL.											
4198	d skewness.											
4199	Lee (2006).											
4200	statistician.											
4201												
4202	main 1b|all|)											
4203												
4204	ral Statistics											
4205	**mber of Observations**					25	Number of Distinct Observations					5
4206	**mber of Detects**					11	Number of Non-Detects					14
4207	tinct Detects					4	Non-Detects					2
4208	imum Detect					0.01	Non-Detect					0.01
4209	imum Detect					0.16	Non-Detect					0.1
4210	nce Detects					0.0019	Non-Detects					56%
4211	ean Detects					0.0327	SD Detects					0.0436
4212	dian Detects					0.02	CV Detects					1.333
4213	ness Detects					2.958	osis Detects					9.193
4214	**of Logged Detects**					-3.849	SD of Logged Detects					0.846
4215												
4216	Detects Only											
4217	Test Statistic					0.549	ilk GOF Test					
4218	**iro Wilk Critical Value**					0.85	Detected Data Not Normal at 5% Significance Level					
4219	**fors Test Statistic**					0.343	Lilliefors GOF Test					
4220	Critical Value					0.251	**Normal at 5% Significance Level**					
4221	icance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
4222												
4223	metric UCLs											
4224	**KM Mean**					0.0202	KM Standard Error of Mean					0.00626
4225	**KM SD**					0.0298	95% KM (BCA) UCL					N/A
4226	**5% KM (t) UCL**					0.0309	95% KM (Percentile Bootstrap) UCL					N/A
4227	KM (z) UCL					0.0305	otstrap t UCL					N/A
4228	byshev UCL					0.039	byshev UCL					0.0475
4229	byshev UCL					0.0593	byshev UCL					0.0825
4230												
4231	vations Only											
4232	**D Test Statistic**					1.159	Anderson-Darling GOF Test					
4233	**A-D Critical Value**					0.746	Detected Data Not Gamma Distributed at 5% Significance Level					
4234	Test Statistic					0.313	mirnov GOF					
4235	Critical Value					0.261	icance Level					
4236	icance Level											
4237												
4238	ed Data Only											
4239	**k hat (MLE)**					1.306	k star (bias corrected MLE)					1.01
4240	**heta hat (MLE)**					0.0251	Theta star (bias corrected MLE)					0.0324
4241	**nu hat (MLE)**					28.73	**ar (bias corrected)**					22.23
4242	ean (detects)					0.0327						
4243												
4244	Non-Detects											
4245	**> 50% NDs with many tied observations at multiple DLs**											
4246	**uch as <1.0, especially when the sample size is small (e.g., <15-20)**											
4247	**l may yield incorrect values of UCLs and BTVs**											
4248	**e when the sample size is small.**											
4249	**Ls may be computed using gamma distribution on KM estimates**											
4250	**Minimum**					0.01	Mean					0.02
4251	Maximum					0.16	Median					0.01
4252	**SD**					0.0304	CV					1.521
4253	k hat (MLE)					1.533	k star (bias corrected MLE)					1.375
4254	heta hat (MLE)					0.013	Theta star (bias corrected MLE)					0.0145
4255	**nu hat (MLE)**					76.63	nu star (bias corrected)					68.77
4256	Level of Significance (β)					0.0395						
4257	Chi Square Value (68.77, α)					50.68	Adjusted Chi Square Value (68.77, β)					49.62
4258	oximate UCL (use when n>=50)					0.0271	95% Gamma Adjusted UCL (use when n<50)					0.0277
4259												
4260	**Parameters using KM Estimates**											
4261	**Mean (KM)**					0.0202	SD (KM)					0.0298
4262	**Variance (KM)**					8.88E-04	SE of Mean (KM)					0.00626
4263	**k hat (KM)**					0.458	k star (KM)					0.43
4264	nu hat (KM)					22.91	nu star (KM)					21.49
4265	eta hat (KM)					0.044	eta star (KM)					0.0469
4266	rcentile (KM)					0.0328	rcentile (KM)					0.0562
4267	rcentile (KM)					0.0817	rcentile (KM)					0.145
4268												
4269	M) Statistics											
4270	ue (21.49, α)					11.96	ue (21.49, β)					11.47
4271	when n>=50)					0.0363	when n<50)					0.0378
4272												
4273	vations Only											
4274	**o Wilk Test Statistic**					0.821	Shapiro Wilk GOF Test					
4275	**iro Wilk Critical Value**					0.85	Detected Data Not Lognormal at 5% Significance Level					
4276	**fors Test Statistic**					0.257	Lilliefors GOF Test					
4277	**iefors Critical Value**					0.251	Detected Data Not Lognormal at 5% Significance Level					
4278	**gnormal at 5% Significance Level**											
4279												
4280	**istics Using Imputed Non-Detects**											
4281	riginal Scale					0.016	**an in Log Scale**					-5.101
4282	riginal Scale					0.032	D in Log Scale					1.393
4283	of ROS data)					0.027	**rcentile Bootstrap UCL**					0.0281
4284	ootstrap UCL					0.0325	% Bootstrap t UCL					0.0467

	A	B	C	D	E	F	G	H	I	J	K	L
4285	**H-UCL (Log ROS)**					0.0381						
4286												
4287	**gged Data and Assuming Lognormal Distribution**											
4288	ean (logged)					-4.263	M Geo Mean					0.0141
4289	SD (logged)					0.656	ue (KM-Log)					2.102
4290	ean (logged)					0.139	L (KM -Log)					0.0232
4291	SD (logged)					0.656	ue (KM-Log)					2.102
4292	ean (logged)					0.139						
4293												
4294	**DL/2 Statistics**											
4295	**DL/2 Normal**						DL/2 Log-Transformed					
4296	riginal Scale					0.019	**an in Log Scale**					-4.569
4297	riginal Scale					0.032	D in Log Scale					0.963
4298	es normality)					0.03	**5% H-Stat UCL**					0.0267
4299	ical reasons											
4300												
4301	**istribution Free UCL Statistics**											
4302	**ible Distribution at 5% Significance Level**											
4303												
4304	UCL to Use											
4305	yshev) UCL					0.0475						
4306												
4307	**are provided to help the user to select the most appropriate 95% UCL.**											
4308	**on data size, data distribution, and skewness.**											
4309	he simulation studies summarized in Singh, Maichle, and Lee (2006).											
4310	ata sets; for additional insight the user may want to consult a statistician.											
4311												
4312	ercury|domain 2 |all|)											
4313												
4314	ral Statistics											
4315	Observations					6	Observations					2
4316	er of Detects					1	Non-Detects					5
4317	tinct Detects					1	Non-Detects					1
4318												
4319	h a data set!											
4320	EPC, BTV).											
4321												
4322	t processed!											
4323												
4324												
4325												
4326	in 2|aecom|)											
4327												
4328	ral Statistics											
4329	Observations					5	Observations					2
4330						Number of Missing Observations						0
4331	Minimum					0.01	Mean					0.016
4332	**Maximum**					0.04	Median					0.01
4333	**SD**					0.0134	Std. Error of Mean					0.006
4334	t of Variation					0.839	Skewness					2.236
4335												
4336	**ata are collected using ISM approach, you should use**											
4337	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
4338	TRC, 2012).											
4339	ProUCL 5.1											
4340												
4341	al GOF Test											
4342	**o Wilk Test Statistic**					0.552	Shapiro Wilk GOF Test					
4343	**iro Wilk Critical Value**					0.762	Data Not Normal at 5% Significance Level					
4344	**fors Test Statistic**					0.473	Lilliefors GOF Test					
4345	Critical Value					0.343	icance Level					
4346	icance Level											
4347												

	A	B	C	D	E	F	G	H	I	J	K	L
4348	l Distribution											
4349	Normal UCL				95% UCLs (Adjusted for Skewness)							
4350	**% Student's-t UCL**					0.0288	95% Adjusted-CLT UCL (Chen-1995)					0.0323
4351							95% Modified-t UCL (Johnson-1978)					0.0298
4352												
4353	ıa GOF Test											
4354	Test Statistic					1.34	ıa GOF Test					
4355	Critical Value					0.683	icance Level					
4356	Test Statistic					0.496	ıa GOF Test					
4357	**K-S Critical Value**					0.36	Data Not Gamma Distributed at 5% Significance Level					
4358	**tributed at 5% Significance Level**											
4359												
4360	ma Statistics											
4361	k hat (MLE)					2.749	rected MLE)					1.233
4362	ta hat (MLE)					0.00582	rected MLE)					0.013
4363	**nu hat (MLE)**					27.49	nu star (bias corrected)					12.33
4364	**ean (bias corrected)**					0.016	MLE Sd (bias corrected)					0.0144
4365							Approximate Chi Square Value (0.05)					5.446
4366	**Level of Significance**					0.0086	Adjusted Chi Square Value					3.629
4367												
4368	**g Gamma Distribution**											
4369	hen n>=50))					0.0362	when n<50)					0.0544
4370												
4371	normal GOF Test											
4372	o Wilk Test Statistic					0.552	Shapiro Wilk Lognormal GOF Test					
4373	iro Wilk Critical Value					0.762	Data Not Lognormal at 5% Significance Level					
4374	fors Test Statistic					0.473	Lilliefors Lognormal GOF Test					
4375	**iefors Critical Value**					0.343	Data Not Lognormal at 5% Significance Level					
4376	**Data Not Lognormal at 5% Significance Level**											
4377												
4378	**normal Statistics**											
4379	Logged Data					-4.605	logged Data					-4.328
4380	Logged Data					-3.219	logged Data					0.62
4381												
4382	**Lognormal Distribution**											
4383	**95% H-UCL**					0.0453	90% Chebyshev (MVUE) UCL					0.0279
4384	**ebyshev (MVUE) UCL**					0.0336	97.5% Chebyshev (MVUE) UCL					0.0415
4385	**ebyshev (MVUE) UCL**					0.057						
4386												
4387	**istribution Free UCL Statistics**											
4388	**a Discernible Distribution (0.05)**											
4389												
4390	**Nonparametric Distribution Free UCLs**											
4391	**95% CLT UCL**					0.0259	95% Jackknife UCL					N/A
4392	**andard Bootstrap UCL**					N/A	95% Bootstrap-t UCL					N/A
4393	ootstrap UCL					N/A	ootstrap UCL					N/A
4394	ootstrap UCL					N/A						
4395	an, Sd) UCL					0.034	an, Sd) UCL					0.0422
4396	an, Sd) UCL					0.0535	an, Sd) UCL					0.0757
4397												
4398	UCL to Use											
4399	an, Sd) UCL					0.0422						
4400												
4401	observation											
4402												
4403	**are provided to help the user to select the most appropriate 95% UCL.**											
4404	**on data size, data distribution, and skewness.**											
4405	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
4406	**ta sets; for additional insight the user may want to consult a statistician.**											
4407												
4408												
4409	**ercury|domain 2|all|)**											
4410												

	A	B	C	D	E	F	G	H	I	J	K	L
4411	neral Statistics											
4412	mber of Observations					5	Number of Distinct Observations					2
4413							Number of Missing Observations					0
4414	Minimum					0.01	Mean					0.016
4415	Maximum					0.04	Median					0.01
4416	SD					0.0134	Std. Error of Mean					0.006
4417	t of Variation					0.839	Skewness					2.236
4418												
4419	u should use											
4420	s of interest.											
4421	TRC, 2012).											
4422	ProUCL 5.1											
4423												
4424	rmal GOF Test											
4425	o Wilk Test Statistic					0.552	Shapiro Wilk GOF Test					
4426	iro Wilk Critical Value					0.762	Data Not Normal at 5% Significance Level					
4427	fors Test Statistic					0.473	Lilliefors GOF Test					
4428	Critical Value					0.343	icance Level					
4429	icance Level											
4430												
4431	l Distribution											
4432	5% Normal UCL						95% UCLs (Adjusted for Skewness)					
4433	% Student's-t UCL					0.0288	95% Adjusted-CLT UCL (Chen-1995)					0.0323
4434					95% Modified-t UCL (Johnson-1978)							0.0298
4435												
4436	ha GOF Test											
4437	Test Statistic					1.34	ha GOF Test					
4438	Critical Value					0.683	icance Level					
4439	Test Statistic					0.496	ha GOF Test					
4440	Critical Value					0.36	icance Level					
4441	tributed at 5% Significance Level											
4442												
4443	mma Statistics											
4444	k hat (MLE)					2.749	rrected MLE)					1.233
4445	ta hat (MLE)					0.00582	rrected MLE)					0.013
4446	nu hat (MLE)					27.49	nu star (bias corrected)					12.33
4447	ean (bias corrected)					0.016	MLE Sd (bias corrected)					0.0144
4448							Approximate Chi Square Value (0.05)					5.446
4449	Level of Significance					0.0086	Adjusted Chi Square Value					3.629
4450												
4451	a Distribution											
4452	hen n>=50))					0.0362	when n<50)					0.0544
4453												
4454	al GOF Test											
4455	Test Statistic					0.552	al GOF Test					
4456	iro Wilk Critical Value					0.762	Data Not Lognormal at 5% Significance Level					
4457	fors Test Statistic					0.473	Lilliefors Lognormal GOF Test					
4458	Critical Value					0.343	icance Level					
4459	icance Level											
4460												
4461	nal Statistics											
4462	Logged Data					-4.605	logged Data					-4.328
4463	um of Logged Data					-3.219	SD of logged Data					0.62
4464												
4465	Lognormal Distribution											
4466	95% H-UCL					0.0453	MVUE) UCL					0.0279
4467	MVUE) UCL					0.0336	MVUE) UCL					0.0415
4468	MVUE) UCL					0.057						
4469												
4470	stribution Free UCL Statistics											
4471	a Discernible Distribution (0.05)											
4472												
4473	ic Distribution Free UCLs											

ProUCL Output

(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
4474	**95% CLT UCL**					0.0259	95% Jackknife UCL					N/A
4475	ootstrap UCL					N/A	ıtstrap-t UCL					N/A
4476	ootstrap UCL					N/A	ootstrap UCL					N/A
4477	**BCA Bootstrap UCL**					N/A						
4478	**byshev(Mean, Sd) UCL**					0.034	95% Chebyshev(Mean, Sd) UCL					0.0422
4479	ebyshev(Mean, Sd) UCL					0.0535	99% Chebyshev(Mean, Sd) UCL					0.0757
4480												
4481	ested UCL to Use											
4482	byshev (Mean, Sd) UCL					0.0422						
4483												
4484	**xceeds the maximum observation**											
4485												
4486	**are provided to help the user to select the most appropriate 95% UCL.**											
4487	**on data size, data distribution, and skewness.**											
4488	Lee (2006).											
4489	a statistician.											
4490												
4491	main 1a|all|)											
4492												
4493	ral Statistics											
4494	**mber of Observations**					9	Number of Distinct Observations					5
4495	**mber of Detects**					4	Number of Non-Detects					5
4496	**r of Distinct Detects**					4	Number of Distinct Non-Detects					1
4497	**inimum Detect**					0.69	Minimum Non-Detect					0.5
4498	**aximum Detect**					2.3	Maximum Non-Detect					0.5
4499	**riance Detects**					0.454	Percent Non-Detects					55.56%
4500	**Mean Detects**					1.373	SD Detects					0.674
4501	dian Detects					1.25	**CV Detects**					0.491
4502	hess Detects					1.035	urtosis Detects					2.013
4503	gged Detects					0.227	**f Logged Detects**					0.493
4504												
4505	**ata are collected using ISM approach, you should use**											
4506	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
4507	**Chebyshev UCL to estimate EPC (ITRC, 2012).**											
4508	**he Nonparametric and All UCL Options of ProUCL 5.1**											
4509												
4510	Detects Only											
4511	**o Wilk Test Statistic**					0.927	Shapiro Wilk GOF Test					
4512	**iro Wilk Critical Value**					0.748	Detected Data appear Normal at 5% Significance Level					
4513	Test Statistic					0.293	**iefors GOF Test**					
4514	Critical Value					0.375	ır Normal at 5% Significance Level					
4515	icance Level											
4516												
4517	**mal Critical Values and other Nonparametric UCLs**											
4518	**KM Mean**					0.888	KM Standard Error of Mean					0.224
4519	**KM SD**					0.582	95% KM (BCA) UCL					N/A
4520	o KM (t) UCL					1.305	otstrap) UCL					N/A
4521	KM (z) UCL					1.257	otstrap t UCL					N/A
4522	byshev UCL					1.56	byshev UCL					1.865
4523	byshev UCL					2.288	byshev UCL					3.118
4524												
4525	vations Only											
4526	**D Test Statistic**					0.277	Anderson-Darling GOF Test					
4527	**A-D Critical Value**					0.659	Detected data appear Gamma Distributed at 5% Significance Level					
4528	Test Statistic					0.245	mirnov GOF					
4529	**K-S Critical Value**					0.396	Detected data appear Gamma Distributed at 5% Significance Level					
4530	**ma Distributed at 5% Significance Level**											
4531												
4532	ed Data Only											
4533	k hat (MLE)					5.717	**ias corrected MLE)**					1.596
4534	ta hat (MLE)					0.24	r (bias corrected MLE)					0.86
4535	**nu hat (MLE)**					45.74	nu star (bias corrected)					12.77
4536	**lean (detects)**					1.373						

	A	B	C	D	E	F	G	H	I	J	K	L
4537												
4538	Non-Detects											
4539	multiple DLs											
4540	**uch as <1.0, especially when the sample size is small (e.g., <15-20)**											
4541	**l may yield incorrect values of UCLs and BTVs**											
4542	size is small.											
4543	M estimates											
4544	Minimum					0.01	Mean					0.626
4545	**Maximum**					2.3	Median					0.105
4546	**SD**					0.82	CV					1.31
4547	**k hat (MLE)**					0.383	k star (bias corrected MLE)					0.33
4548	**heta hat (MLE)**					1.633	Theta star (bias corrected MLE)					1.899
4549	**nu hat (MLE)**					6.899	nu star (bias corrected)					5.933
4550	nificance (β)					0.0231						
4551	lue (5.93, α)					1.606	lue (5.93, β)					1.179
4552	when n>=50)					2.313	when n<50)					N/A
4553												
4554	M Estimates											
4555	Mean (KM)					0.888	SD (KM)					0.582
4556	**/ariance (KM)**					0.339	SE of Mean (KM)					0.224
4557	**k hat (KM)**					2.324	k star (KM)					1.623
4558	nu hat (KM)					41.82	nu star (KM)					29.22
4559	**heta hat (KM)**					0.382	theta star (KM)					0.547
4560	mma percentile (KM)					1.36E+00	90% gamma percentile (KM)					1.815
4561	mma percentile (KM)					2.253	99% gamma percentile (KM)					3.237
4562												
4563	plan-Meier (KM) Statistics											
4564	**hi Square Value (29.22, α)**					17.88	Adjusted Chi Square Value (29.22, β)					16.03
4565	**95% Gamma Approximate KM-UCL (use when n>=50)**					1.451	95% Gamma Adjusted KM-UCL (use when n<50)					1.618
4566												
4567	**t on Detected Observations Only**											
4568	Test Statistic					0.971	ilk GOF Test					
4569	Critical Value					0.748	icance Level					
4570	Test Statistic					0.221	rs GOF Test					
4571	Critical Value					0.375	icance Level					
4572	icance Level											
4573												
4574	Non-Detects											
4575	riginal Scale					0.758	in Log Scale					-0.695
4576	riginal Scale					0.72	in Log Scale					1.003
4577	of ROS data)					1.205	ootstrap UCL					1.136
4578	**BCA Bootstrap UCL**					1.258	95% Bootstrap t UCL					1.457
4579	**H-UCL (Log ROS)**					2.606						
4580												
4581	**gged Data and Assuming Lognormal Distribution**											
4582	**l Mean (logged)**					-0.284	KM Geo Mean					0.752
4583	**M SD (logged)**					0.538	95% Critical H Value (KM-Log)					2.294
4584	**d Error of Mean (logged)**					0.207	95% H-UCL (KM -Log)					1.346
4585	SD (logged)					0.538	**tical H Value (KM-Log)**					2.294
4586	ean (logged)					0.207						
4587												
4588	L/2 Statistics											
4589	**DL/2 Normal**						DL/2 Log-Transformed					
4590	**n in Original Scale**					7.49E-01	Mean in Log Scale					-0.669
4591	**in Original Scale**					0.721	SD in Log Scale					0.902
4592	es normality)					1.196	H-Stat UCL					2.018
4593	ical reasons											
4594												
4595	CL Statistics											
4596	icance Level											
4597												
4598	**ested UCL to Use**											
4599	**5% KM (t) UCL**					1.305						

	A	B	C	D	E	F	G	H	I	J	K	L
4600												
4601	e 95% UCL.											
4602	d skewness.											
4603	Lee (2006).											
4604	**ta sets; for additional insight the user may want to consult a statistician.**											
4605												
4606	**utyltin as sn|domain 1b|all|)**											
4607												
4608	ral Statistics											
4609	Observations					4	Observations					2
4610	er of Detects					1	Non-Detects					3
4611	**r of Distinct Detects**					1	Number of Distinct Non-Detects					1
4612												
4613	oUCL (or any other software) should not be used on such a data set!											
4614	by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
4615												
4616	obutyltin as sn|domain 1b|all|) was not processed!											
4617												
4618												
4619	ient|aecom|)											
4620												
4621	ral Statistics											
4622	Observations					14	Observations					1
4623	er of Detects					0	Non-Detects					14
4624	tinct Detects					0	Non-Detects					1
4625												
4626	also be NDs!											
4627	**r statistics are also NDs lying below the largest detection limit!**											
4628	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
4629												
4630	t processed!											
4631												
4632												
4633	n 1a|aecom|)											
4634												
4635	ral Statistics											
4636	**mber of Observations**					25	Number of Distinct Observations					13
4637	**mber of Detects**					0	Number of Non-Detects					25
4638	tinct Detects					0	Non-Detects					13
4639												
4640	**s), therefore all statistics and estimates should also be NDs!**											
4641	**r statistics are also NDs lying below the largest detection limit!**											
4642	EPC, BTV).											
4643												
4644	t processed!											
4645												
4646												
4647	**obutyltin|domain 1a|all|)**											
4648												
4649	ral Statistics											
4650	Observations					25	Observations					13
4651	er of Detects					0	Non-Detects					25
4652	tinct Detects					0	Non-Detects					13
4653												
4654	**s), therefore all statistics and estimates should also be NDs!**											
4655	**r statistics are also NDs lying below the largest detection limit!**											
4656	EPC, BTV).											
4657												
4658	t processed!											
4659												
4660												
4661	**utyltin|domain 1b|aecom|)**											
4662												

	A	B	C	D	E	F	G	H	I	J	K	L
4663	**neral Statistics**											
4664	Observations					14	Observations					2
4665	er of Detects					0	Non-Detects					14
4666	tinct Detects					0	Non-Detects					2
4667												
4668	**s), therefore all statistics and estimates should also be NDs!**											
4669	**r statistics are also NDs lying below the largest detection limit!**											
4670	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
4671												
4672	**obutyltin|domain 1b|aecom|) was not processed!**											
4673												
4674												
4675	obutyltin|domain 1b|all|)											
4676												
4677	eneral Statistics											
4678	mber of Observations					14	Number of Distinct Observations					2
4679	**mber of Detects**					0	Number of Non-Detects					14
4680	**Number of Distinct Detects**					0	Number of Distinct Non-Detects					2
4681												
4682	**s), therefore all statistics and estimates should also be NDs!**											
4683	tection limit!											
4684	EPC, BTV).											
4685												
4686	t processed!											
4687												
4688												
4689	in 2|aecom|)											
4690												
4691	ral Statistics											
4692	Observations					6	Observations					2
4693	**mber of Detects**					0	Number of Non-Detects					6
4694	**r of Distinct Detects**					0	Number of Distinct Non-Detects					2
4695												
4696	**s), therefore all statistics and estimates should also be NDs!**											
4697	**r statistics are also NDs lying below the largest detection limit!**											
4698	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
4699												
4700	t processed!											
4701												
4702												
4703	omain 2|all|)											
4704												
4705	**neral Statistics**											
4706	**mber of Observations**					6	Number of Distinct Observations					2
4707	er of Detects					0	Non-Detects					6
4708	tinct Detects					0	Non-Detects					2
4709												
4710	also be NDs!											
4711	tection limit!											
4712	EPC, BTV).											
4713												
4714	**nonobutyltin|domain 2|all|) was not processed!**											
4715												
4716												
4717												
4718	ient|aecom|)											
4719												
4720	**neral Statistics**											
4721	**mber of Observations**					14	Number of Distinct Observations					9
4722					Number of Missing Observations							0
4723	Minimum					2	Mean					5.836
4724	Maximum					14	Median					5
4725	SD					3.613	rror of Mean					0.966

	A	B	C	D	E	F	G	H	I	J	K	L
4726	**ficient of Variation**					0.619	Skewness					1.018
4727												
4728	rmal GOF Test											
4729	o Wilk Test Statistic					0.887	Shapiro Wilk GOF Test					
4730	iro Wilk Critical Value					0.874	Data appear Normal at 5% Significance Level					
4731	fors Test Statistic					0.234	Lilliefors GOF Test					
4732	iefors Critical Value					0.226	Data Not Normal at 5% Significance Level					
4733	icance Level											
4734												
4735	l Distribution											
4736	Normal UCL				95% UCLs (Adjusted for Skewness)							
4737	dent's-t UCL					7.546	(Chen-1995)					7.705
4738					95% Modified-t UCL (Johnson-1978)							7.59
4739												
4740	ha GOF Test											
4741	Test Statistic					0.382	ha GOF Test					
4742	**A-D Critical Value**					0.742	Detected data appear Gamma Distributed at 5% Significance Level					
4743	**S Test Statistic**					0.17	Kolmogorov-Smirnov Gamma GOF Test					
4744	Critical Value					0.23	icance Level					
4745	icance Level											
4746												
4747	ma Statistics											
4748	k hat (MLE)					3.027	rected MLE)					2.426
4749	ta hat (MLE)					1.928	rected MLE)					2.406
4750	hu hat (MLE)					84.75	as corrected)					67.92
4751	**ean (bias corrected)**					5.836	MLE Sd (bias corrected)					3.747
4752							Approximate Chi Square Value (0.05)					49.96
4753	Significance					0.0312	quare Value					47.92
4754												
4755	**g Gamma Distribution**											
4756	**Gamma UCL (use when n>=50))**					7.935	95% Adjusted Gamma UCL (use when n<50)					8.273
4757												
4758	al GOF Test											
4759	Test Statistic					0.948	**lk Lognormal GOF Test**					
4760	Critical Value					0.874	ormal at 5% Significance Level					
4761	**fors Test Statistic**					0.144	Lilliefors Lognormal GOF Test					
4762	**iefors Critical Value**					0.226	Data appear Lognormal at 5% Significance Level					
4763	**ormal at 5% Significance Level**											
4764												
4765	nal Statistics											
4766	Logged Data					0.693	logged Data					1.59
4767	Logged Data					2.639	logged Data					0.616
4768												
4769	**Lognormal Distribution**											
4770	**95% H-UCL**					8.68E+00	90% Chebyshev (MVUE) UCL					883.60%
4771	MVUE) UCL					10.2	MVUE) UCL					12.08
4772	MVUE) UCL					15.79						
4773												
4774	CL Statistics											
4775	icance Level											
4776												
4777	**ic Distribution Free UCLs**											
4778	**95% CLT UCL**					7.424	**% Jackknife UCL**					7.546
4779	otstrap UCL					7.36	tstrap-t UCL					7.867
4780	otstrap UCL					8.008	otstrap UCL					7.371
4781	otstrap UCL					7.621						
4782	**byshev(Mean, Sd) UCL**					8.733	95% Chebyshev(Mean, Sd) UCL					10.04
4783	**byshev(Mean, Sd) UCL**					11.87	99% Chebyshev(Mean, Sd) UCL					15.44
4784												
4785	**ested UCL to Use**											
4786	**Student's-t UCL**					7.546						
4787												
4788	he GOF test											

	A	B	C	D	E	F	G	H	I	J	K	L
4789	**pon a distribution (e.g., gamma) passing both GOF tests in ProUCL**											
4790												
4791	are provided to help the user to select the most appropriate 95% UCL.											
4792	on data size, data distribution, and skewness.											
4793	he simulation studies summarized in Singh, Maichle, and Lee (2006).											
4794	**ta sets; for additional insight the user may want to consult a statistician.**											
4795												
4796												
4797	**kel|domain 1a|aecom|)**											
4798												
4799	ral Statistics											
4800	Observations					26	Observations					17
4801						Number of Missing Observations						0
4802	Minimum					5.4	Mean					18.47
4803	Maximum					35	Median					19
4804	SD					6.33	rror of Mean					1.241
4805	t of Variation					0.343	Skewness					0.282
4806												
4807	al GOF Test											
4808	**o Wilk Test Statistic**					0.976	Shapiro Wilk GOF Test					
4809	**iro Wilk Critical Value**					0.92	Data appear Normal at 5% Significance Level					
4810	**fors Test Statistic**					0.114	Lilliefors GOF Test					
4811	**iefors Critical Value**					0.17	Data appear Normal at 5% Significance Level					
4812	**mal at 5% Significance Level**											
4813												
4814	**g Normal Distribution**											
4815	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
4816	**% Student's-t UCL**					20.59	95% Adjusted-CLT UCL (Chen-1995)					20.58
4817							95% Modified-t UCL (Johnson-1978)					20.6
4818												
4819	**mma GOF Test**											
4820	**D Test Statistic**					0.486	Anderson-Darling Gamma GOF Test					
4821	**A-D Critical Value**					0.745	Detected data appear Gamma Distributed at 5% Significance Level					
4822	Test Statistic					1.56E-01	a GOF Test					
4823	Critical Value					0.171	icance Level					
4824	icance Level											
4825												
4826	ma Statistics											
4827	k hat (MLE)					7.758	rected MLE)					6.888
4828	**heta hat (MLE)**					2.381	Theta star (bias corrected MLE)					2.681
4829	**nu hat (MLE)**					403.4	nu star (bias corrected)					358.2
4830	**ean (bias corrected)**					18.47	MLE Sd (bias corrected)					7.037
4831							Approximate Chi Square Value (0.05)					315.3
4832	**Level of Significance**					0.0398	Adjusted Chi Square Value					312.7
4833												
4834	a Distribution											
4835	hen n>=50))					20.98	when n<50)					21.16
4836												
4837	**normal GOF Test**											
4838	**o Wilk Test Statistic**					0.93	Shapiro Wilk Lognormal GOF Test					
4839	Critical Value					0.92	icance Level					
4840	Test Statistic					0.172	al GOF Test					
4841	Critical Value					0.17	icance Level					
4842	icance Level											
4843												
4844	nal Statistics											
4845	Logged Data					1.686	logged Data					2.85
4846	**um of Logged Data**					3.555	SD of logged Data					0.393
4847												
4848	**Lognormal Distribution**											
4849	95% H-UCL					21.66	MVUE) UCL					23.04
4850	MVUE) UCL					25.04	MVUE) UCL					27.82
4851	**ebyshev (MVUE) UCL**					33.28						

	A	B	C	D	E	F	G	H	I	J	K	L
4852												
4853	**istribution Free UCL Statistics**											
4854	**nible Distribution at 5% Significance Level**											
4855												
4856	n Free UCLs											
4857	% CLT UCL					20.51	ıckknife UCL					20.59
4858	ootstrap UCL					20.43	ıtstrap-t UCL					20.62
4859	ootstrap UCL					20.86	ootstrap UCL					20.38
4860	ootstrap UCL					20.59						
4861	**byshev(Mean, Sd) UCL**					22.19	95% Chebyshev(Mean, Sd) UCL					23.88
4862	**ebyshev(Mean, Sd) UCL**					26.22	99% Chebyshev(Mean, Sd) UCL					30.82
4863												
4864	UCL to Use											
4865	dent's-t UCL					20.59						
4866												
4867	te 95% UCL.											
4868	**on data size, data distribution, and skewness.**											
4869	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
4870	**ta sets; for additional insight the user may want to consult a statistician.**											
4871												
4872												
4873	main 1a|all|)											
4874												
4875	**neral Statistics**											
4876	**mber of Observations**					60	Number of Distinct Observations					27
4877							Number of Missing Observations					0
4878	**Minimum**					5.4	Mean					23.54
4879	**Maximum**					46	Median					23.5
4880	SD					7.544	rror of Mean					0.974
4881	t of Variation					0.321	Skewness					0.0708
4882												
4883	**rmal GOF Test**											
4884	o Wilk Test Statistic					0.99	Shapiro Wilk GOF Test					
4885	hapiro Wilk P Value					0.97	Data appear Normal at 5% Significance Level					
4886	fors Test Statistic					0.078	Lilliefors GOF Test					
4887	iefors Critical Value					0.114	Data appear Normal at 5% Significance Level					
4888	**mal at 5% Significance Level**											
4889												
4890	**g Normal Distribution**											
4891	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
4892	dent's-t UCL					25.16	(Chen-1995)					25.15
4893					95% Modified-t UCL (Johnson-1978)							25.17
4894												
4895	ha GOF Test											
4896	Test Statistic					0.789	ha GOF Test					
4897	Critical Value					0.752	icance Level					
4898	Test Statistic					0.115	ha GOF Test					
4899	Critical Value					0.115	icance Level					
4900	icance Level											
4901												
4902	**mma Statistics**											
4903	**k hat (MLE)**					8.378	k star (bias corrected MLE)					7.971
4904	**heta hat (MLE)**					2.809	Theta star (bias corrected MLE)					2.953
4905	**nu hat (MLE)**					1005	nu star (bias corrected)					956.5
4906	**ean (bias corrected)**					23.54	MLE Sd (bias corrected)					8.337
4907							Approximate Chi Square Value (0.05)					885.7
4908	**Level of Significance**					0.046	Adjusted Chi Square Value					884
4909												
4910	n Distribution											
4911	hen n>=50))					25.42	**Gamma UCL (use when n<50)**					25.47
4912												
4913	**normal GOF Test**											
4914	**p Wilk Test Statistic**					0.926	Shapiro Wilk Lognormal GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L
4915	**apiro Wilk P Value**					0.00129	Data Not Lognormal at 5% Significance Level					
4916	Test Statistic					0.142	al GOF Test					
4917	Critical Value					0.114	icance Level					
4918	icance Level											
4919												
4920	nal Statistics											
4921	Logged Data					1.686	logged Data					3.098
4922	**um of Logged Data**					3.829	SD of logged Data					0.377
4923												
4924	l Distribution											
4925	95% H-UCL					25.94	ebyshev (MVUE) UCL					27.32
4926	MVUE) UCL					28.94	**ebyshev (MVUE) UCL**					31.18
4927	MVUE) UCL					35.59						
4928												
4929	**stribution Free UCL Statistics**											
4930	**nible Distribution at 5% Significance Level**											
4931												
4932	n Free UCLs											
4933	% CLT UCL					25.14	ckknife UCL					25.16
4934	otstrap UCL					25.1	tstrap-t UCL					25.19
4935	**Hall's Bootstrap UCL**					25.24	95% Percentile Bootstrap UCL					25.08
4936	**BCA Bootstrap UCL**					25.18						
4937	ebyshev(Mean, Sd) UCL					26.46	95% Chebyshev(Mean, Sd) UCL					27.78
4938	ebyshev(Mean, Sd) UCL					29.62	99% Chebyshev(Mean, Sd) UCL					33.23
4939												
4940	ested UCL to Use											
4941	Student's-t UCL					25.16						
4942												
4943	e 95% UCL.											
4944	d skewness.											
4945	Lee (2006).											
4946	statistician.											
4947												
4948												
4949	n 1b|aecom|)											
4950												
4951	**neral Statistics**											
4952	**mber of Observations**					14	Number of Distinct Observations					12
4953					Number of Missing Observations							0
4954	Minimum					6.8	Mean					17.61
4955	Maximum					34	Median					16
4956	SD					7.907	rror of Mean					2.113
4957	t of Variation					0.449	Skewness					0.626
4958												
4959	al GOF Test											
4960	**o Wilk Test Statistic**					0.955	Shapiro Wilk GOF Test					
4961	**iro Wilk Critical Value**					0.874	Data appear Normal at 5% Significance Level					
4962	Test Statistic					0.129	rs GOF Test					
4963	Critical Value					0.226	icance Level					
4964	**mal at 5% Significance Level**											
4965												
4966	l Distribution											
4967	Normal UCL					95% UCLs (Adjusted for Skewness)						
4968	dent's-t UCL					21.35	**ed-CLT UCL (Chen-1995)**					21.46
4969						95% Modified-t UCL (Johnson-1978)						21.41
4970												
4971	**mma GOF Test**											
4972	**D Test Statistic**					0.164	Anderson-Darling Gamma GOF Test					
4973	Critical Value					0.738	icance Level					
4974	Test Statistic					0.107	na GOF Test					
4975	Critical Value					0.229	icance Level					
4976	icance Level											
4977												

	A	B	C	D	E	F	G	H	I	J	K	L
4978	**mma Statistics**											
4979	**k hat (MLE)**					5.267	k star (bias corrected MLE)					4.186
4980	ta hat (MLE)					3.343	rected MLE)					4.206
4981	hu hat (MLE)					147.5	s corrected)					117.2
4982	s corrected)					17.61	s corrected)					8.606
4983					Approximate Chi Square Value (0.05)							93.22
4984	Significance					0.0312	quare Value					90.38
4985												
4986	**g Gamma Distribution**											
4987	**Gamma UCL (use when n>=50))**					22.14	**Gamma UCL (use when n<50)**					22.83
4988												
4989	al GOF Test											
4990	Test Statistic					0.976	al GOF Test					
4991	**iro Wilk Critical Value**					0.874	Data appear Lognormal at 5% Significance Level					
4992	**fors Test Statistic**					0.117	Lilliefors Lognormal GOF Test					
4993	**iefors Critical Value**					0.226	Data appear Lognormal at 5% Significance Level					
4994	**ormal at 5% Significance Level**											
4995												
4996	**normal Statistics**											
4997	Logged Data					1.917	logged Data					2.77
4998	**um of Logged Data**					3.526	SD of logged Data					0.47
4999												
5000	Lognormal Distribution											
5001	95% H-UCL					23.15	90% Chebyshev (MVUE) UCL					24.49
5002	ebyshev (MVUE) UCL					27.58	97.5% Chebyshev (MVUE) UCL					31.87
5003	**ebyshev (MVUE) UCL**					40.3						
5004												
5005	**stribution Free UCL Statistics**											
5006	**nible Distribution at 5% Significance Level**											
5007												
5008	n Free UCLs											
5009	% CLT UCL					21.08	ckknife UCL					21.35
5010	otstrap UCL					20.9	tstrap-t UCL					21.8
5011	otstrap UCL					21.61	otstrap UCL					21.15
5012	otstrap UCL					21						
5013	an, Sd) UCL					23.95	an, Sd) UCL					26.82
5014	an, Sd) UCL					30.8	an, Sd) UCL					38.63
5015												
5016	UCL to Use											
5017	**Student's-t UCL**					21.35						
5018												
5019	**are provided to help the user to select the most appropriate 95% UCL.**											
5020	**on data size, data distribution, and skewness.**											
5021	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
5022	**ta sets; for additional insight the user may want to consult a statistician.**											
5023												
5024												
5025	main 1b|all|)											
5026												
5027	ral Statistics											
5028	**mber of Observations**					25	Number of Distinct Observations					19
5029							Number of Missing Observations					0
5030	**Minimum**					6.8	Mean					20.68
5031	Maximum					38	Median					19
5032	SD					9.456	rror of Mean					1.891
5033	t of Variation					0.457	Skewness					0.226
5034												
5035	al GOF Test											
5036	Test Statistic					0.941	ilk GOF Test					
5037	**iro Wilk Critical Value**					0.918	Data appear Normal at 5% Significance Level					
5038	**fors Test Statistic**					0.126	Lilliefors GOF Test					
5039	Critical Value					0.173	**mal at 5% Significance Level**					
5040	icance Level											

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	A	B	C	D	E	F	G	H	I	J	K	L
5041												
5042	l Distribution											
5043	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
5044	**% Student's-t UCL**					23.91	95% Adjusted-CLT UCL (Chen-1995)					23.88
5045							95% Modified-t UCL (Johnson-1978)					23.93
5046												
5047	ha GOF Test											
5048	Test Statistic					0.429	na GOF Test					
5049	Critical Value					0.748	icance Level					
5050	**S Test Statistic**					0.106	Kolmogorov-Smirnov Gamma GOF Test					
5051	**K-S Critical Value**					0.175	Detected data appear Gamma Distributed at 5% Significance Level					
5052	ma Distributed at 5% Significance Level											
5053												
5054	amma Statistics											
5055	k hat (MLE)					4.537	k star (bias corrected MLE)					4.019
5056	heta hat (MLE)					4.557	Theta star (bias corrected MLE)					5.145
5057	hu hat (MLE)					226.8	as corrected)					201
5058	as corrected)					20.68	as corrected)					10.31
5059					Approximate Chi Square Value (0.05)							169.2
5060	Significance					0.0395	quare Value					167.2
5061												
5062	a Distribution											
5063	hen n>=50))					24.56	when n<50)					24.85
5064												
5065	al GOF Test											
5066	**o Wilk Test Statistic**					0.942	Shapiro Wilk Lognormal GOF Test					
5067	**iro Wilk Critical Value**					0.918	Data appear Lognormal at 5% Significance Level					
5068	Test Statistic					0.116	al GOF Test					
5069	Critical Value					0.173	icance Level					
5070	icance Level											
5071												
5072	nal Statistics											
5073	Logged Data					1.917	logged Data					2.915
5074	Logged Data					3.638	logged Data					0.507
5075												
5076	**Lognormal Distribution**											
5077	95% H-UCL					25.71	MVUE) UCL					27.47
5078	MVUE) UCL					30.47	MVUE) UCL					34.62
5079	**ebyshev (MVUE) UCL**					42.79						
5080												
5081	CL Statistics											
5082	icance Level											
5083												
5084	n Free UCLs											
5085	**95% CLT UCL**					23.79	95% Jackknife UCL					23.91
5086	**andard Bootstrap UCL**					23.77	95% Bootstrap-t UCL					23.94
5087	**Hall's Bootstrap UCL**					23.68	95% Percentile Bootstrap UCL					23.9
5088	ootstrap UCL					23.71						
5089	an, Sd) UCL					26.35	an, Sd) UCL					28.92
5090	an, Sd) UCL					32.49	an, Sd) UCL					39.49
5091												
5092	UCL to Use											
5093	**Student's-t UCL**					23.91						
5094												
5095	e 95% UCL.											
5096	d skewness.											
5097	Lee (2006).											
5098	a statistician.											
5099												
5100												
5101	**nickel|domain 2 |all|)**											
5102												
5103	ral Statistics											

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	A	B	C	D	E	F	G	H	I	J	K	L
5104	Observations					6	Observations					6
5105						Number of Missing Observations						0
5106	**Minimum**					7.1	Mean					22.85
5107	**Maximum**					38	Median					23.5
5108	**SD**					11.69	Std. Error of Mean					4.774
5109	**ficient of Variation**					0.512	Skewness					-0.107
5110												
5111	**ata are collected using ISM approach, you should use**											
5112	s of interest.											
5113	**Chebyshev UCL to estimate EPC (ITRC, 2012).**											
5114	the Nonparametric and All UCL Options of ProUCL 5.1											
5115												
5116	rmal GOF Test											
5117	o Wilk Test Statistic					0.975	Shapiro Wilk GOF Test					
5118	**iro Wilk Critical Value**					0.788	Data appear Normal at 5% Significance Level					
5119	**Lilliefors Test Statistic**					0.139	Lilliefors GOF Test					
5120	**iefors Critical Value**					0.325	Data appear Normal at 5% Significance Level					
5121	**mal at 5% Significance Level**											
5122												
5123	l Distribution											
5124	Normal UCL				95% UCLs (Adjusted for Skewness)							
5125	dent's-t UCL					32.47	(Chen-1995)					30.48
5126					95% Modified-t UCL (Johnson-1978)							32.43
5127												
5128	ha GOF Test											
5129	Test Statistic					0.238	ha GOF Test					
5130	Critical Value					0.7	icance Level					
5131	Test Statistic					0.192	ha GOF Test					
5132	**K-S Critical Value**					0.334	Detected data appear Gamma Distributed at 5% Significance Level					
5133	**ma Distributed at 5% Significance Level**											
5134												
5135	**mma Statistics**											
5136	**k hat (MLE)**					3.672	k star (bias corrected MLE)					1.947
5137	**heta hat (MLE)**					6.222	Theta star (bias corrected MLE)					11.73
5138	**nu hat (MLE)**					44.07	nu star (bias corrected)					23.37
5139	as corrected)					22.85	**Sd (bias corrected)**					16.38
5140						Approximate Chi Square Value (0.05)						13.37
5141	Significance					0.0122	**d Chi Square Value**					10.74
5142												
5143	**g Gamma Distribution**											
5144	**Gamma UCL (use when n>=50))**					39.94	95% Adjusted Gamma UCL (use when n<50)					49.71
5145												
5146	al GOF Test											
5147	Test Statistic					0.931	al GOF Test					
5148	Critical Value					0.788	icance Level					
5149	Test Statistic					0.188	al GOF Test					
5150	Critical Value					0.325	icance Level					
5151	icance Level											
5152												
5153	**normal Statistics**											
5154	Logged Data					1.96	**n of logged Data**					2.987
5155	Logged Data					3.638	) of logged Data					0.629
5156												
5157	l Distribution											
5158	**95% H-UCL**					55.76	90% Chebyshev (MVUE) UCL					41.18
5159	**ebyshev (MVUE) UCL**					49.29	97.5% Chebyshev (MVUE) UCL					60.54
5160	**ebyshev (MVUE) UCL**					82.64						
5161												
5162	CL Statistics											
5163	icance Level											
5164												
5165	**ic Distribution Free UCLs**											
5166	**95% CLT UCL**					30.7	95% Jackknife UCL					32.47

	A	B	C	D	E	F	G	H	I	J	K	L
5167	andard Bootstrap UCL					29.78	95% Bootstrap-t UCL					32.72
5168	Hall's Bootstrap UCL					30.13	95% Percentile Bootstrap UCL					29.85
5169	BCA Bootstrap UCL					30.02						
5170	ebyshev(Mean, Sd) UCL					37.17	95% Chebyshev(Mean, Sd) UCL					43.66
5171	ebyshev(Mean, Sd) UCL					52.66	99% Chebyshev(Mean, Sd) UCL					70.35
5172												
5173	UCL to Use											
5174	dent's-t UCL					32.47						
5175												
5176	e 95% UCL.											
5177	d skewness.											
5178	Lee (2006).											
5179	a statistician.											
5180												
5181	**limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
5182	**provide adjustments for positvely skewed data sets.**											
5183												
5184												
5185	in 2|aecom|)											
5186												
5187	ral Statistics											
5188	Observations					5	Observations					5
5189					Number of Missing Observations							0
5190	**Minimum**					6.6	Mean					13.52
5191	**Maximum**					22	Median					11
5192	SD					7.046	rror of Mean					3.151
5193	t of Variation					0.521	Skewness					0.436
5194												
5195	**ata are collected using ISM approach, you should use**											
5196	s of interest.											
5197	TRC, 2012).											
5198	ProUCL 5.1											
5199												
5200	**rmal GOF Test**											
5201	**o Wilk Test Statistic**					0.868	Shapiro Wilk GOF Test					
5202	**iro Wilk Critical Value**					0.762	Data appear Normal at 5% Significance Level					
5203	Test Statistic					0.24	rs GOF Test					
5204	Critical Value					0.343	icance Level					
5205	icance Level											
5206												
5207	l Distribution											
5208	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
5209	**% Student's-t UCL**					20.24	95% Adjusted-CLT UCL (Chen-1995)					19.36
5210					95% Modified-t UCL (Johnson-1978)							20.34
5211												
5212	ma GOF Test											
5213	Test Statistic					0.391	ma GOF Test					
5214	Critical Value					0.681	icance Level					
5215	**S Test Statistic**					0.252	Kolmogorov-Smirnov Gamma GOF Test					
5216	**K-S Critical Value**					0.358	Detected data appear Gamma Distributed at 5% Significance Level					
5217	**ma Distributed at 5% Significance Level**											
5218												
5219	ma Statistics											
5220	k hat (MLE)					4.549	rrected MLE)					1.953
5221	**heta hat (MLE)**					2.972	Theta star (bias corrected MLE)					6.924
5222	**nu hat (MLE)**					45.49	nu star (bias corrected)					19.53
5223	**ean (bias corrected)**					13.52	MLE Sd (bias corrected)					9.675
5224							Approximate Chi Square Value (0.05)					10.5
5225	**Level of Significance**					0.0086	Adjusted Chi Square Value					7.777
5226												
5227	a Distribution											
5228	**Gamma UCL (use when n>=50))**					25.14	95% Adjusted Gamma UCL (use when n<50)					33.95
5229												

	A	B	C	D	E	F	G	H	I	J	K	L
5230	normal GOF Test											
5231	o Wilk Test Statistic					0.901	Shapiro Wilk Lognormal GOF Test					
5232	piro Wilk Critical Value					0.762	Data appear Lognormal at 5% Significance Level					
5233	**fors Test Statistic**					0.226	Lilliefors Lognormal GOF Test					
5234	**5% Lilliefors Critical Value**					0.343	Data appear Lognormal at 5% Significance Level					
5235	**ormal at 5% Significance Level**											
5236												
5237	nal Statistics											
5238	Logged Data					1.887	logged Data					2.49
5239	Logged Data					3.091	logged Data					0.538
5240												
5241	l Distribution											
5242	95% H-UCL					31.85	MVUE) UCL					23.17
5243	MVUE) UCL					27.54	MVUE) UCL					33.61
5244	MVUE) UCL					45.53						
5245												
5246	CL Statistics											
5247	**nible Distribution at 5% Significance Level**											
5248												
5249	**ic Distribution Free UCLs**											
5250	**95% CLT UCL**					1.87E+01	95% Jackknife UCL					20.24
5251	**andard Bootstrap UCL**					18.16	95% Bootstrap-t UCL					29.47
5252	**Hall's Bootstrap UCL**					27.55	95% Percentile Bootstrap UCL					18.52
5253	**BCA Bootstrap UCL**					18.6						
5254	an, Sd) UCL					22.97	**byshev(Mean, Sd) UCL**					27.26
5255	an, Sd) UCL					33.2	byshev(Mean, Sd) UCL					44.87
5256												
5257	UCL to Use											
5258	**Student's-t UCL**					20.24						
5259												
5260	**are provided to help the user to select the most appropriate 95% UCL.**											
5261	d skewness.											
5262	Lee (2006).											
5263	a statistician.											
5264												
5265												
5266	omain 2|all|)											
5267												
5268	**neral Statistics**											
5269	Observations					5	**f Distinct Observations**					5
5270							Number of Missing Observations					0
5271	Minimum					6.6	**Mean**					13.52
5272	Maximum					22	Median					11
5273	**SD**					7.046	Std. Error of Mean					3.151
5274	**ficient of Variation**					0.521	Skewness					0.436
5275												
5276	u should use											
5277	s of interest.											
5278	TRC, 2012).											
5279	ProUCL 5.1											
5280												
5281	**rmal GOF Test**											
5282	o Wilk Test Statistic					0.868	Shapiro Wilk GOF Test					
5283	piro Wilk Critical Value					0.762	Data appear Normal at 5% Significance Level					
5284	fors Test Statistic					0.24	Lilliefors GOF Test					
5285	iefors Critical Value					0.343	Data appear Normal at 5% Significance Level					
5286	rmal at 5% Significance Level											
5287												
5288	l Distribution											
5289	Normal UCL				95% UCLs (Adjusted for Skewness)							
5290	dent's-t UCL					20.24	(Chen-1995)					19.36
5291					95% Modified-t UCL (Johnson-1978)							20.34
5292												

	A	B	C	D	E	F	G	H	I	J	K	L
5293	na GOF Test											
5294	Test Statistic					0.391	na GOF Test					
5295	Critical Value					0.681	icance Level					
5296	**S Test Statistic**					0.252	Kolmogorov-Smirnov Gamma GOF Test					
5297	**K-S Critical Value**					0.358	Detected data appear Gamma Distributed at 5% Significance Level					
5298	icance Level											
5299												
5300	ma Statistics											
5301	k hat (MLE)					4.549	rrected MLE)					1.953
5302	ta hat (MLE)					2.972	rrected MLE)					6.924
5303	hu hat (MLE)					45.49	as corrected)					19.53
5304	as corrected)					13.52	as corrected)					9.675
5305							Approximate Chi Square Value (0.05)					10.5
5306	**Level of Significance**					0.0086	Adjusted Chi Square Value					7.777
5307												
5308	a Distribution											
5309	**Gamma UCL (use when n>=50))**					25.14	95% Adjusted Gamma UCL (use when n<50)					33.95
5310												
5311	al GOF Test											
5312	Test Statistic					0.901	ilk Lognormal GOF Test					
5313	Critical Value					0.762	**ormal at 5% Significance Level**					
5314	Test Statistic					0.226	Lognormal GOF Test					
5315	**iefors Critical Value**					0.343	Data appear Lognormal at 5% Significance Level					
5316	**ormal at 5% Significance Level**											
5317												
5318	nal Statistics											
5319	Logged Data					1.887	logged Data					2.49
5320	Logged Data					3.091	logged Data					0.538
5321												
5322	l Distribution											
5323	**95% H-UCL**					31.85	90% Chebyshev (MVUE) UCL					2317.00%
5324	**ebyshev (MVUE) UCL**					27.54	97.5% Chebyshev (MVUE) UCL					33.61
5325	MVUE) UCL					45.53						
5326												
5327	CL Statistics											
5328	icance Level											
5329												
5330	**ic Distribution Free UCLs**											
5331	**95% CLT UCL**					18.7	95% Jackknife UCL					20.24
5332	**andard Bootstrap UCL**					18.16	**% Bootstrap-t UCL**					29.87
5333	ootstrap UCL					25.82	ootstrap UCL					18.52
5334	ootstrap UCL					18.52						
5335	an, Sd) UCL					22.97	an, Sd) UCL					27.26
5336	**byshev(Mean, Sd) UCL**					33.2	99% Chebyshev(Mean, Sd) UCL					44.87
5337												
5338	**ested UCL to Use**											
5339	**Student's-t UCL**					20.24						
5340												
5341	**are provided to help the user to select the most appropriate 95% UCL.**											
5342	d skewness.											
5343	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
5344	ata sets; for additional insight the user may want to consult a statistician.											
5345												
5346	ilver|ambient|aecom|)											
5347												
5348	**neral Statistics**											
5349	**Total Number of Observations**					14	Number of Distinct Observations					1
5350	**mber of Detects**					0	Number of Non-Detects					14
5351	**r of Distinct Detects**					0	Number of Distinct Non-Detects					1
5352												
5353	also be NDs!											
5354	etection limit!											
5355	EPC, BTV).											

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	A	B	C	D	E	F	G	H	I	J	K	L
5356												
5357	t processed!											
5358												
5359												
5360	n 1a|aecom|)											
5361												
5362	**neral Statistics**											
5363	**mber of Observations**					26	Number of Distinct Observations					1
5364	**mber of Detects**					0	Number of Non-Detects					26
5365	**r of Distinct Detects**					0	Number of Distinct Non-Detects					1
5366												
5367	**s), therefore all statistics and estimates should also be NDs!**											
5368	**r statistics are also NDs lying below the largest detection limit!**											
5369	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
5370												
5371	**silver|domain 1a|aecom|) was not processed!**											
5372												
5373												
5374	main 1a|all|)											
5375												
5376	ral Statistics											
5377	**mber of Observations**					60	Number of Distinct Observations					3
5378	**mber of Detects**					11	Number of Non-Detects					49
5379	**r of Distinct Detects**					2	Number of Distinct Non-Detects					2
5380	imum Detect					0.1	n Non-Detect					0.1
5381	imum Detect					0.2	n Non-Detect					0.5
5382	ance Detects					9.09E-04	Non-Detects					81.67%
5383	ean Detects					0.109	SD Detects					0.0302
5384	dian Detects					0.1	CV Detects					0.276
5385	ness Detects					3.317	tosis Detects					11
5386	**of Logged Detects**					-2.24	SD of Logged Detects					0.209
5387												
5388	**F Test on Detects Only**											
5389	**o Wilk Test Statistic**					0.345	Shapiro Wilk GOF Test					
5390	**iro Wilk Critical Value**					0.85	Detected Data Not Normal at 5% Significance Level					
5391	Test Statistic					0.528	rs GOF Test					
5392	Critical Value					0.251	icance Level					
5393	icance Level											
5394												
5395	**mal Critical Values and other Nonparametric UCLs**											
5396	**KM Mean**					0.103	KM Standard Error of Mean					0.00304
5397	KM SD					0.0169	95% KM (BCA) UCL					N/A
5398	5% KM (t) UCL					0.108	95% KM (Percentile Bootstrap) UCL					N/A
5399	5% KM (z) UCL					0.108	95% KM Bootstrap t UCL					N/A
5400	KM Chebyshev UCL					0.112	95% KM Chebyshev UCL					0.116
5401	KM Chebyshev UCL					0.122	99% KM Chebyshev UCL					0.133
5402												
5403	vations Only											
5404	Test Statistic					3.697	ng GOF Test					
5405	Critical Value					0.729	icance Level					
5406	Test Statistic					0.534	mirnov GOF					
5407	Critical Value					0.255	icance Level					
5408	icance Level											
5409												
5410	ed Data Only											
5411	**k hat (MLE)**					21	k star (bias corrected MLE)					15.33
5412	**heta hat (MLE)**					0.00519	Theta star (bias corrected MLE)					0.00711
5413	nu hat (MLE)					462	as corrected)					337.3
5414	ean (detects)					0.109						
5415												
5416	Non-Detects											
5417	multiple DLs											
5418	e.g., <15-20)											

	A	B	C	D	E	F	G	H	I	J	K	L
5419	Ls and BTVs											
5420	**e when the sample size is small.**											
5421	**Ls may be computed using gamma distribution on KM estimates**											
5422	Minimum					0.01	Mean					0.0665
5423	Maximum					0.2	Median					0.0632
5424	**SD**					0.0365	CV					0.55
5425	**k hat (MLE)**					2.865	k star (bias corrected MLE)					2.733
5426	ta hat (MLE)					0.0232	**r (bias corrected MLE)**					0.0243
5427	hu hat (MLE)					343.8	ar (bias corrected)					327.9
5428	nificance (β)					0.046						
5429	e (327.92, α)					287	Square Value (327.92, β)					286
5430	**ximate UCL (use when n>=50)**					0.076	95% Gamma Adjusted UCL (use when n<50)					0.0762
5431												
5432	**Parameters using KM Estimates**											
5433	Mean (KM)					0.103	SD (KM)					0.0169
5434	ariance (KM)					2.85E-04	f Mean (KM)					0.00304
5435	k hat (KM)					37.12	k star (KM)					35.28
5436	nu hat (KM)					4455	nu star (KM)					4233
5437	eta hat (KM)					0.00277	eta star (KM)					0.00292
5438	**mma percentile (KM)**					0.117	90% gamma percentile (KM)					0.126
5439	**mma percentile (KM)**					0.133	99% gamma percentile (KM)					0.147
5440												
5441	M) Statistics											
5442	alue (N/A, α)					4083	alue (N/A, β)					4079
5443	when n>=50)					0.107	when n<50)					0.107
5444												
5445	**t on Detected Observations Only**											
5446	**o Wilk Test Statistic**					0.345	Shapiro Wilk GOF Test					
5447	**iro Wilk Critical Value**					0.85	**gnormal at 5% Significance Level**					
5448	Test Statistic					0.528	rs GOF Test					
5449	Critical Value					0.251	icance Level					
5450	icance Level											
5451												
5452	**istics Using Imputed Non-Detects**											
5453	**n in Original Scale**					0.0799	Mean in Log Scale					-2.57
5454	**in Original Scale**					0.0256	SD in Log Scale					0.292
5455	**sumes normality of ROS data)**					0.0854	95% Percentile Bootstrap UCL					0.0855
5456	**BCA Bootstrap UCL**					0.086	95% Bootstrap t UCL					0.0863
5457	L (Log ROS)					0.0851						
5458												
5459	gged Data and Assuming Lognormal Distribution											
5460	M Mean (logged)					-2.282	KM Geo Mean					0.102
5461	M SD (logged)					0.117	95% Critical H Value (KM-Log)					1.7
5462	d Error of Mean (logged)					0.0211	95% H-UCL (KM -Log)					0.105
5463	**M SD (logged)**					0.117	95% Critical H Value (KM-Log)					1.7
5464	**KM Standard Error of Mean (logged)**					0.0211						
5465												
5466	**L/2 Statistics**											
5467	DL/2 Normal					DL/2 Log-Transformed						
5468	riginal Scale					0.148	in Log Scale					-2.16
5469	riginal Scale					0.0936	in Log Scale					0.738
5470	**CL (Assumes normality)**					0.168	95% H-Stat UCL					0.185
5471	**provided for comparisons and historical reasons**											
5472												
5473	**stribution Free UCL Statistics**											
5474	**ible Distribution at 5% Significance Level**											
5475												
5476	**ested UCL to Use**											
5477	**95% KM (t) UCL**					0.108	KM H-UCL					0.105
5478	**s KM (BCA) UCL**					N/A						
5479	**Recommended UCL(s) not available!**											
5480												
5481	e 95% UCL.											

	A	B	C	D	E	F	G	H	I	J	K	L
5482	d skewness.											
5483	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
5484	**ta sets; for additional insight the user may want to consult a statistician.**											
5485												
5486	**ver|domain 1b|aecom|)**											
5487												
5488	**neral Statistics**											
5489	**mber of Observations**					14	Number of Distinct Observations					1
5490	**mber of Detects**					0	Number of Non-Detects					14
5491	**Number of Distinct Detects**					0	Number of Distinct Non-Detects					1
5492												
5493	**s), therefore all statistics and estimates should also be NDs!**											
5494	tection limit!											
5495	EPC, BTV).											
5496												
5497	t processed!											
5498												
5499												
5500	main 1b|all|)											
5501												
5502	ral Statistics											
5503	Observations					25	Observations					3
5504	**mber of Detects**					0	Number of Non-Detects					25
5505	**r of Distinct Detects**					0	Number of Distinct Non-Detects					3
5506												
5507	**s), therefore all statistics and estimates should also be NDs!**											
5508	**statistics are also NDs lying below the largest detection limit!**											
5509	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
5510												
5511	**(|silver|domain 1b|all|) was not processed!**											
5512												
5513												
5514	**silver|domain 2 |all|)**											
5515												
5516	ral Statistics											
5517	Observations					6	**f Distinct Observations**					1
5518	er of Detects					0	ber of Non-Detects					6
5519	**r of Distinct Detects**					0	Number of Distinct Non-Detects					1
5520												
5521	**s), therefore all statistics and estimates should also be NDs!**											
5522	tection limit!											
5523	EPC, BTV).											
5524												
5525	t processed!											
5526												
5527												
5528	**ver|domain 2|aecom|)**											
5529												
5530	**neral Statistics**											
5531	**mber of Observations**					5	Number of Distinct Observations					1
5532	**mber of Detects**					0	Number of Non-Detects					5
5533	tinct Detects					0	Non-Detects					1
5534												
5535	also be NDs!											
5536	tection limit!											
5537	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
5538												
5539	|silver|domain 2|aecom|) was not processed!											
5540												
5541												
5542	|silver|domain 2|all|)											
5543												
5544	ral Statistics											

	A	B	C	D	E	F	G	H	I	J	K	L
5545	Observations					5	Observations					1
5546	er of Detects					0	Non-Detects					5
5547	tinct Detects					0	Non-Detects					1
5548												
5549	also be NDs!											
5550	etection limit!											
5551	EPC, BTV).											
5552												
5553	**: (silver|domain 2|all|) was not processed!**											
5554												
5555												
5556	main 1b|all|)											
5557												
5558	ral Statistics											
5559	Observations					2	Observations					1
5560	er of Detects					0	Non-Detects					2
5561	tinct Detects					0	Non-Detects					1
5562												
5563	**a set only has 2 observations!**											
5564	d estimates!											
5565	t processed!											
5566												
5567	**observations before using these statistical methods!**											
5568	tical results.											
5569												
5570												
5571	main 1a|all|)											
5572												
5573	**neral Statistics**											
5574	**mber of Observations**					33	Number of Distinct Observations					17
5575	er of Detects					29	Non-Detects					4
5576	tinct Detects					16	Non-Detects					1
5577	imum Detect					0.4	Non-Detect					0.1
5578	imum Detect					4.8	Non-Detect					0.1
5579	ance Detects					0.914	Non-Detects					12.12%
5580	**Mean Detects**					1.655	SD Detects					0.956
5581	**edian Detects**					1.6	CV Detects					0.578
5582	ness Detects					1.738	tosis Detects					4.141
5583	gged Detects					0.361	gged Detects					0.55
5584												
5585	Detects Only											
5586	Test Statistic					0.836	ilk GOF Test					
5587	**iro Wilk Critical Value**					0.926	Detected Data Not Normal at 5% Significance Level					
5588	**fors Test Statistic**					0.164	Lilliefors GOF Test					
5589	**iefors Critical Value**					0.161	**Normal at 5% Significance Level**					
5590	icance Level											
5591												
5592	metric UCLs											
5593	**KM Mean**					1.467	KM Standard Error of Mean					0.18
5594	**KM SD**					1.016	95% KM (BCA) UCL					1.77
5595	**5% KM (t) UCL**					1.772	95% KM (Percentile Bootstrap) UCL					1.761
5596	**5% KM (z) UCL**					1.763	95% KM Bootstrap t UCL					1.834
5597	**M Chebyshev UCL**					2.007	95% KM Chebyshev UCL					2.252
5598	**KM Chebyshev UCL**					2.591	99% KM Chebyshev UCL					3.258
5599												
5600	**on Detected Observations Only**											
5601	D Test Statistic					0.596	Anderson-Darling GOF Test					
5602	A-D Critical Value					0.751	Detected data appear Gamma Distributed at 5% Significance Level					
5603	S Test Statistic					0.117	Kolmogorov-Smirnov GOF					
5604	K-S Critical Value					0.164	Detected data appear Gamma Distributed at 5% Significance Level					
5605	**ma Distributed at 5% Significance Level**											
5606												
5607	**tics on Detected Data Only**											

	A	B	C	D	E	F	G	H	I	J	K	L
5608	**k hat (MLE)**					3.646	k star (bias corrected MLE)					3.292
5609	ta hat (MLE)					0.454	rected MLE)					0.503
5610	hu hat (MLE)					211.5	as corrected)					190.9
5611	ean (detects)					1.655						
5612												
5613	tics using Imputed Non-Detects											
5614	> 50% NDs with many tied observations at multiple DLs											
5615	uch as <1.0, especially when the sample size is small (e.g., <15-20)											
5616	l may yield incorrect values of UCLs and BTVs											
5617	e when the sample size is small.											
5618	Ls may be computed using gamma distribution on KM estimates											
5619	**Minimum**					0.01	Mean					1.472
5620	**Maximum**					4.8	Median					1.5
5621	**SD**					1.026	CV					0.697
5622	**k hat (MLE)**					1.485	k star (bias corrected MLE)					1.37
5623	ta hat (MLE)					0.991	rected MLE)					1.074
5624	hu hat (MLE)					97.98	as corrected)					90.41
5625	nificance (β)					0.0419						
5626	ue (90.41, α)					69.48	ue (90.41, β)					68.54
5627	when n>=50)					1.915	when n<50)					1.941
5628												
5629	M Estimates											
5630	Mean (KM)					1.467	SD (KM)					1.016
5631	ariance (KM)					1.033	f Mean (KM)					0.18
5632	k hat (KM)					2.082	k star (KM)					1.913
5633	**nu hat (KM)**					137.4	nu star (KM)					126.3
5634	**heta hat (KM)**					0.704	theta star (KM)					0.767
5635	**mma percentile (KM)**					2.207	90% gamma percentile (KM)					2.883
5636	**mma percentile (KM)**					3.528	99% gamma percentile (KM)					4.965
5637												
5638	**lan-Meier (KM) Statistics**											
5639	**hi Square Value (126.26, α)**					101.3	Adjusted Chi Square Value (126.26, β)					100.2
5640	when n>=50)					1.828	**sted KM-UCL (use when n<50)**					1.849
5641												
5642	vations Only											
5643	Test Statistic					0.959	iro Wilk GOF Test					
5644	**iro Wilk Critical Value**					0.926	Detected Data appear Lognormal at 5% Significance Level					
5645	**fors Test Statistic**					0.153	Lilliefors GOF Test					
5646	**iefors Critical Value**					0.161	Detected Data appear Lognormal at 5% Significance Level					
5647	icance Level											
5648												
5649	Non-Detects											
5650	riginal Scale					1.505	in Log Scale					0.21
5651	riginal Scale					0.984	in Log Scale					0.662
5652	of ROS data)					1.796	ootstrap UCL					1.798
5653	**BCA Bootstrap UCL**					1.856	95% Bootstrap t UCL					1.86
5654	**H-UCL (Log ROS)**					1.957						
5655												
5656	l Distribution											
5657	ean (logged)					0.0377	**KM Geo Mean**					1.038
5658	SD (logged)					1.006	tical H Value (KM-Log)					2.446
5659	**d Error of Mean (logged)**					0.178	95% H-UCL (KM -Log)					2.661
5660	**M SD (logged)**					1.006	95% Critical H Value (KM-Log)					2.446
5661	**d Error of Mean (logged)**					0.178						
5662												
5663	L/2 Statistics											
5664	DL/2 Normal						DL/2 Log-Transformed					
5665	riginal Scale					1.461	in Log Scale					-0.0463
5666	**in Original Scale**					1.041	SD in Log Scale					1.225
5667	**CL (Assumes normality)**					1.767	95% H-Stat UCL					3.651
5668	, provided for comparisons and historical reasons											
5669												
5670	istribution Free UCL Statistics											

	A	B	C	D	E	F	G	H	I	J	K	L
5671	ma Distributed at 5% Significance Level											
5672												
5673	UCL to Use											
5674	Gamma UCL					1.849	Gamma UCL					1.941
5675												
5676	e 95% UCL.											
5677	d skewness.											
5678	Lee (2006).											
5679	statistician.											
5680												
5681	main 1b|all|)											
5682												
5683	**neral Statistics**											
5684	Observations					9	Observations					7
5685	er of Detects					7	Non-Detects					2
5686	tinct Detects					6	Non-Detects					1
5687	imum Detect					0.3	n Non-Detect					0.1
5688	imum Detect					2.6	n Non-Detect					0.1
5689	nce Detects					0.68	Non-Detects					22.22%
5690	lean Detects					1	SD Detects					0.825
5691	**edian Detects**					0.6	CV Detects					0.825
5692	**ewness Detects**					1.52	Kurtosis Detects					1.739
5693	gged Detects					-0.254	gged Detects					0.749
5694												
5695	**ata are collected using ISM approach, you should use**											
5696	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
5697	TRC, 2012).											
5698	ProUCL 5.1											
5699												
5700	Detects Only											
5701	**o Wilk Test Statistic**					0.815	Shapiro Wilk GOF Test					
5702	**iro Wilk Critical Value**					0.803	Detected Data appear Normal at 5% Significance Level					
5703	**fors Test Statistic**					0.263	Lilliefors GOF Test					
5704	Critical Value					0.304	icance Level					
5705	icance Level											
5706												
5707	metric UCLs											
5708	KM Mean					0.8	rror of Mean					0.277
5709	**KM SD**					0.77	95% KM (BCA) UCL					1.256
5710	**5% KM (t) UCL**					1.316	95% KM (Percentile Bootstrap) UCL					1.256
5711	KM (z) UCL					1.256	otstrap t UCL					1.977
5712	byshev UCL					1.632	byshev UCL					2.009
5713	byshev UCL					2.532	byshev UCL					3.559
5714												
5715	vations Only											
5716	**D Test Statistic**					0.411	Anderson-Darling GOF Test					
5717	**A-D Critical Value**					0.715	Detected data appear Gamma Distributed at 5% Significance Level					
5718	**S Test Statistic**					0.244	**gorov-Smirnov GOF**					
5719	Critical Value					0.315	icance Level					
5720	icance Level											
5721												
5722	**tics on Detected Data Only**											
5723	**k hat (MLE)**					2.117	k star (bias corrected MLE)					1.305
5724	**heta hat (MLE)**					0.472	Theta star (bias corrected MLE)					0.766
5725	**nu hat (MLE)**					29.64	nu star (bias corrected)					18.27
5726	**lean (detects)**					1						
5727												
5728	Non-Detects											
5729	**> 50% NDs with many tied observations at multiple DLs**											
5730	such as <1.0, especially when the sample size is small (e.g., <15-20)											
5731	d may yield incorrect values of UCLs and BTVs											
5732	ue when the sample size is small.											
5733	CLs may be computed using gamma distribution on KM estimates											

	A	B	C	D	E	F	G	H	I	J	K	L
5734	**Minimum**					0.01	Mean					0.78
5735	**Maximum**					2.6	Median					0.5
5736	**SD**					0.837	CV					1.073
5737	**k hat (MLE)**					0.631	k star (bias corrected MLE)					0.494
5738	ta hat (MLE)					1.237	rected MLE)					1.578
5739	hu hat (MLE)					11.35	s corrected)					8.9
5740	nificance (β)					0.0231						
5741	lue (8.90, α)					3.267	lue (8.90, β)					2.589
5742	when n>=50)					2.125	when n<50)					2.681
5743												
5744	M Estimates											
5745	Mean (KM)					0.8	SD (KM)					0.77
5746	ariance (KM)					0.593	f Mean (KM)					0.277
5747	k hat (KM)					1.079	k star (KM)					0.793
5748	**nu hat (KM)**					19.42	nu star (KM)					14.28
5749	**heta hat (KM)**					0.742	theta star (KM)					1.009
5750	**mma percentile (KM)**					1.308	90% gamma percentile (KM)					1.949
5751	**mma percentile (KM)**					2.603	99% gamma percentile (KM)					414.80%
5752												
5753	**lan-Meier (KM) Statistics**											
5754	**hi Square Value (14.28, α)**					6.762	Adjusted Chi Square Value (14.28, β)					5.707
5755	when n>=50)					1.689	**usted KM-UCL (use when n<50)**					2.001
5756												
5757	vations Only											
5758	Test Statistic					0.943	iro Wilk GOF Test					
5759	**iro Wilk Critical Value**					0.803	Detected Data appear Lognormal at 5% Significance Level					
5760	**fors Test Statistic**					0.205	Lilliefors GOF Test					
5761	**iefors Critical Value**					0.304	Detected Data appear Lognormal at 5% Significance Level					
5762	icance Level											
5763												
5764	Non-Detects											
5765	riginal Scale					0.805	in Log Scale					-0.673
5766	riginal Scale					0.813	in Log Scale					1.061
5767	f ROS data)					1.308	ootstrap UCL					1.26
5768	**BCA Bootstrap UCL**					1.338	95% Bootstrap t UCL					1.909
5769	**H-UCL (Log ROS)**					3.174						
5770												
5771	l Distribution											
5772	ean (logged)					-0.71	**M Geo Mean**					0.492
5773	SD (logged)					1.048	tical H Value (KM-Log)					3.347
5774	**d Error of Mean (logged)**					0.377	95% H-UCL (KM -Log)					2.945
5775	**M SD (logged)**					1.048	95% Critical H Value (KM-Log)					3.347
5776	**d Error of Mean (logged)**					0.377						
5777												
5778	L/2 Statistics											
5779	DL/2 Normal						DL/2 Log-Transformed					
5780	riginal Scale					0.789	in Log Scale					-0.864
5781	**in Original Scale**					0.828	SD in Log Scale					1.372
5782	**CL (Assumes normality)**					1.302	95% H-Stat UCL					7.96
5783	, provided for comparisons and historical reasons											
5784												
5785	istribution Free UCL Statistics											
5786	mal Distributed at 5% Significance Level											
5787												
5788	UCL to Use											
5789	KM (t) UCL					1.316						
5790												
5791	e 95% UCL.											
5792	d skewness.											
5793	Lee (2006).											
5794	statistician.											
5795												
5796												

	A	B	C	D	E	F	G	H	I	J	K	L
5797	**hic carbon (toc)|domain 2 |all|)**											
5798												
5799	ral Statistics											
5800	Observations					5	Observations					4
5801					Number of Missing Observations							0
5802	Minimum					0.1	Mean					0.42
5803	Maximum					7.00E-01	Median					0.5
5804	SD					0.228	rror of Mean					0.102
5805	t of Variation					0.543	Skewness					-0.405
5806												
5807	**ata are collected using ISM approach, you should use**											
5808	s of interest.											
5809	TRC, 2012).											
5810	**he Nonparametric and All UCL Options of ProUCL 5.1**											
5811												
5812	al GOF Test											
5813	Test Statistic					0.961	iro Wilk GOF Test					
5814	Critical Value					0.762	**mal at 5% Significance Level**					
5815	Test Statistic					0.237	iefors GOF Test					
5816	**iefors Critical Value**					0.343	Data appear Normal at 5% Significance Level					
5817	**mal at 5% Significance Level**											
5818												
5819	l Distribution											
5820	Normal UCL				95% UCLs (Adjusted for Skewness)							
5821	dent's-t UCL					0.637	(Chen-1995)					0.568
5822					95% Modified-t UCL (Johnson-1978)							0.634
5823												
5824	**mma GOF Test**											
5825	**D Test Statistic**					0.386	Anderson-Darling Gamma GOF Test					
5826	Critical Value					0.683	icance Level					
5827	Test Statistic					0.291	ıa GOF Test					
5828	Critical Value					0.36	icance Level					
5829	icance Level											
5830												
5831	**mma Statistics**											
5832	**k hat (MLE)**					2.897	k star (bias corrected MLE)					1.292
5833	**heta hat (MLE)**					0.145	**r (bias corrected MLE)**					0.325
5834	hu hat (MLE)					28.97	as corrected)					12.92
5835	as corrected)					0.42	as corrected)					0.369
5836					Approximate Chi Square Value (0.05)							5.84
5837	**Level of Significance**					0.0086	Adjusted Chi Square Value					3.941
5838												
5839	**g Gamma Distribution**											
5840	**Gamma UCL (use when n>=50))**					0.929	95% Adjusted Gamma UCL (use when n<50)					1.377
5841												
5842	**normal GOF Test**											
5843	Test Statistic					0.862	al GOF Test					
5844	**iro Wilk Critical Value**					0.762	Data appear Lognormal at 5% Significance Level					
5845	fors Test Statistic					0.28	Lilliefors Lognormal GOF Test					
5846	iefors Critical Value					0.343	Data appear Lognormal at 5% Significance Level					
5847	ormal at 5% Significance Level											
5848												
5849	**normal Statistics**											
5850	**um of Logged Data**					-2.303	Mean of logged Data					-1.05
5851	**Maximum of Logged Data**					-0.357	SD of logged Data					0.763
5852												
5853	**Lognormal Distribution**											
5854	95% H-UCL					2.081	MVUE) UCL					0.876
5855	MVUE) UCL					1.075	MVUE) UCL					1.35
5856	MVUE) UCL					1.891						
5857												
5858	CL Statistics											
5859	icance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
5860												
5861	**ic Distribution Free UCLs**											
5862	**95% CLT UCL**					0.588	95% Jackknife UCL					0.637
5863	**ndard Bootstrap UCL**					N/A	95% Bootstrap-t UCL					N/A
5864	**Hall's Bootstrap UCL**					N/A	95% Percentile Bootstrap UCL					N/A
5865	**BCA Bootstrap UCL**					N/A						
5866	**byshev(Mean, Sd) UCL**					0.726	95% Chebyshev(Mean, Sd) UCL					0.865
5867	an, Sd) UCL					1.057	**byshev(Mean, Sd) UCL**					1.435
5868												
5869	UCL to Use											
5870	dent's-t UCL					0.637						
5871												
5872	**are provided to help the user to select the most appropriate 95% UCL.**											
5873	**on data size, data distribution, and skewness.**											
5874	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
5875	a statistician.											
5876												
5877	**limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
5878	**provide adjustments for positvely skewed data sets.**											
5879												
5880												
5881	ient|aecom|)											
5882												
5883	**neral Statistics**											
5884	**mber of Observations**					14	Number of Distinct Observations					12
5885							Number of Missing Observations					0
5886	Minimum					1200	Mean					3800
5887	Maximum					6400	Median					3700
5888	SD					2010	rror of Mean					537.3
5889	t of Variation					0.529	Skewness					-0.0331
5890												
5891	al GOF Test											
5892	**o Wilk Test Statistic**					0.876	Shapiro Wilk GOF Test					
5893	**iro Wilk Critical Value**					0.874	Data appear Normal at 5% Significance Level					
5894	Test Statistic					0.172	rs GOF Test					
5895	**iefors Critical Value**					0.226	Data appear Normal at 5% Significance Level					
5896	**mal at 5% Significance Level**											
5897												
5898	l Distribution											
5899	Normal UCL						**95% UCLs (Adjusted for Skewness)**					
5900	dent's-t UCL					4752	ed-CLT UCL (Chen-1995)					4679
5901							95% Modified-t UCL (Johnson-1978)					4751
5902												
5903	**mma GOF Test**											
5904	Test Statistic					0.715	na GOF Test					
5905	Critical Value					0.742	icance Level					
5906	**S Test Statistic**					0.186	Kolmogorov-Smirnov Gamma GOF Test					
5907	**K-S Critical Value**					0.23	Detected data appear Gamma Distributed at 5% Significance Level					
5908	icance Level											
5909												
5910	ma Statistics											
5911	**k hat (MLE)**					3.193	k star (bias corrected MLE)					2.556
5912	**heta hat (MLE)**					1190	Theta star (bias corrected MLE)					1487
5913	**nu hat (MLE)**					89.39	nu star (bias corrected)					71.57
5914	**ean (bias corrected)**					3800	MLE Sd (bias corrected)					2377
5915							Approximate Chi Square Value (0.05)					53.09
5916	Significance					0.0312	quare Value					50.98
5917												
5918	a Distribution											
5919	hen n>=50))					5123	when n<50)					5334
5920												
5921	al GOF Test											
5922	**o Wilk Test Statistic**					0.867	Shapiro Wilk Lognormal GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L
5923	iro Wilk Critical Value					0.874	Data Not Lognormal at 5% Significance Level					
5924	Test Statistic					0.185	al GOF Test					
5925	iefors Critical Value					0.226	Data appear Lognormal at 5% Significance Level					
5926	e Lognormal at 5% Significance Level											
5927												
5928	normal Statistics											
5929	um of Logged Data					7.09	Mean of logged Data					8.078
5930	um of Logged Data					8.764	SD of logged Data					0.632
5931												
5932	Lognormal Distribution											
5933	95% H-UCL					5842	90% Chebyshev (MVUE) UCL					5915
5934	ebyshev (MVUE) UCL					6841	97.5% Chebyshev (MVUE) UCL					8126
5935	99% Chebyshev (MVUE) UCL					10651						
5936												
5937	istribution Free UCL Statistics											
5938	icance Level											
5939												
5940	n Free UCLs											
5941	95% CLT UCL					4684	95% Jackknife UCL					4752
5942	andard Bootstrap UCL					4647	95% Bootstrap-t UCL					4770
5943	Hall's Bootstrap UCL					4615	95% Percentile Bootstrap UCL					4686
5944	BCA Bootstrap UCL					4621						
5945	byshev(Mean, Sd) UCL					5412	95% Chebyshev(Mean, Sd) UCL					6142
5946	ebyshev(Mean, Sd) UCL					7155	99% Chebyshev(Mean, Sd) UCL					9146
5947												
5948	ested UCL to Use											
5949	95% Student's-t UCL					4752						
5950												
5951	are provided to help the user to select the most appropriate 95% UCL.											
5952	d skewness.											
5953	Lee (2006).											
5954	a statistician.											
5955												
5956	limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
5957	provide adjustments for positvely skewed data sets.											
5958												
5959												
5960	nic carbon|disposal|aecom|)											
5961												
5962	General Statistics											
5963	mber of Observations					6	Number of Distinct Observations					6
5964							Number of Missing Observations					0
5965	Minimum					6300	Mean					7183
5966	Maximum					8200	Median					7050
5967	SD					736	rror of Mean					300.5
5968	t of Variation					0.102	Skewness					0.395
5969												
5970	u should use											
5971	s of interest.											
5972	TRC, 2012).											
5973	ProUCL 5.1											
5974												
5975	rmal GOF Test											
5976	o Wilk Test Statistic					0.94	Shapiro Wilk GOF Test					
5977	iro Wilk Critical Value					0.788	Data appear Normal at 5% Significance Level					
5978	fors Test Statistic					0.212	Lilliefors GOF Test					
5979	iefors Critical Value					0.325	Data appear Normal at 5% Significance Level					
5980	mal at 5% Significance Level											
5981												
5982	g Normal Distribution											
5983	5% Normal UCL						95% UCLs (Adjusted for Skewness)					
5984	% Student's-t UCL					7789	95% Adjusted-CLT UCL (Chen-1995)					7729
5985							95% Modified-t UCL (Johnson-1978)					7797

ProUCL Output
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	A	B	C	D	E	F	G	H	I	J	K	L
5986												
5987	**mma GOF Test**											
5988	**D Test Statistic**					0.277	Anderson-Darling Gamma GOF Test					
5989	Critical Value					0.696	icance Level					
5990	Test Statistic					0.204	na GOF Test					
5991	Critical Value					0.332	icance Level					
5992	icance Level											
5993												
5994	ma Statistics											
5995	**k hat (MLE)**					115.7	k star (bias corrected MLE)					57.98
5996	**heta hat (MLE)**					62.07	Theta star (bias corrected MLE)					123.9
5997	**nu hat (MLE)**					1389	nu star (bias corrected)					695.7
5998	**ean (bias corrected)**					7183	MLE Sd (bias corrected)					943.4
5999							Approximate Chi Square Value (0.05)					635.5
6000	Significance					0.0122	quare Value					614.5
6001												
6002	a Distribution											
6003	hen n>=50))					7864	when n<50)					8133
6004												
6005	**hormal GOF Test**											
6006	Test Statistic					0.947	al GOF Test					
6007	Critical Value					0.788	icance Level					
6008	Test Statistic					0.195	al GOF Test					
6009	Critical Value					0.325	icance Level					
6010	icance Level											
6011												
6012	nal Statistics											
6013	**um of Logged Data**					8.748	Mean of logged Data					8.875
6014	**um of Logged Data**					9.012	SD of logged Data					0.102
6015												
6016	l Distribution											
6017	95% H-UCL					7853	MVUE) UCL					8077
6018	**ebyshev (MVUE) UCL**					8482	97.5% Chebyshev (MVUE) UCL					9044
6019	**ebyshev (MVUE) UCL**					10149						
6020												
6021	**stribution Free UCL Statistics**											
6022	**nible Distribution at 5% Significance Level**											
6023												
6024	n Free UCLs											
6025	% CLT UCL					7678	ckknife UCL					7789
6026	otstrap UCL					7635	tstrap-t UCL					8123
6027	otstrap UCL					8393	otstrap UCL					7633
6028	**BCA Bootstrap UCL**					7650						
6029	**byshev(Mean, Sd) UCL**					8085	95% Chebyshev(Mean, Sd) UCL					8493
6030	an, Sd) UCL					9060	an, Sd) UCL					10173
6031												
6032	UCL to Use											
6033	dent's-t UCL					7789						
6034												
6035	**are provided to help the user to select the most appropriate 95% UCL.**											
6036	**on data size, data distribution, and skewness.**											
6037	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
6038	a statistician.											
6039												
6040												
6041	**hic carbon|domain 1a|aecom|)**											
6042												
6043	**neral Statistics**											
6044	**mber of Observations**					11	Number of Distinct Observations					8
6045							Number of Missing Observations					0
6046	**Minimum**					7200	Mean					13627
6047	Maximum					21000	Median					14000
6048	SD					3985	rror of Mean					1202

	A	B	C	D	E	F	G	H	I	J	K	L
6049	**ficient of Variation**					0.292	Skewness					0.137
6050												
6051	rmal GOF Test											
6052	o Wilk Test Statistic					0.98	Shapiro Wilk GOF Test					
6053	iro Wilk Critical Value					0.85	Data appear Normal at 5% Significance Level					
6054	fors Test Statistic					0.113	Lilliefors GOF Test					
6055	**iefors Critical Value**					0.251	Data appear Normal at 5% Significance Level					
6056	**Data appear Normal at 5% Significance Level**											
6057												
6058	**g Normal Distribution**											
6059	Normal UCL				95% UCLs (Adjusted for Skewness)							
6060	dent's-t UCL					15805	(Chen-1995)					15657
6061					95% Modified-t UCL (Johnson-1978)							15813
6062												
6063	ha GOF Test											
6064	Test Statistic					0.21	ha GOF Test					
6065	Critical Value					0.729	icance Level					
6066	Test Statistic					0.123	ha GOF Test					
6067	Critical Value					0.255	icance Level					
6068	icance Level											
6069												
6070	**mma Statistics**											
6071	**k hat (MLE)**					12.08	k star (bias corrected MLE)					8.846
6072	**heta hat (MLE)**					1128	Theta star (bias corrected MLE)					1541
6073	**nu hat (MLE)**					265.8	nu star (bias corrected)					194.6
6074	**ean (bias corrected)**					13627	MLE Sd (bias corrected)					4582
6075							Approximate Chi Square Value (0.05)					163.3
6076	Significance					0.0278	**d Chi Square Value**					158.7
6077												
6078	a Distribution											
6079	hen n>=50))					16237	Gamma UCL (use when n<50)					16714
6080												
6081	**normal GOF Test**											
6082	**o Wilk Test Statistic**					0.964	Shapiro Wilk Lognormal GOF Test					
6083	Critical Value					0.85	icance Level					
6084	Test Statistic					0.133	al GOF Test					
6085	Critical Value					0.251	icance Level					
6086	icance Level											
6087												
6088	nal Statistics											
6089	**um of Logged Data**					8.882	Mean of logged Data					9.478
6090	**um of Logged Data**					9.952	SD of logged Data					0.312
6091												
6092	l Distribution											
6093	95% H-UCL					16641	**ebyshev (MVUE) UCL**					17538
6094	MVUE) UCL					19297	ebyshev (MVUE) UCL					21738
6095	**ebyshev (MVUE) UCL**					26533						
6096												
6097	**stribution Free UCL Statistics**											
6098	icance Level											
6099												
6100	n Free UCLs											
6101	% CLT UCL					15604	ckknife UCL					15805
6102	**andard Bootstrap UCL**					15519	95% Bootstrap-t UCL					15862
6103	**Hall's Bootstrap UCL**					15978	95% Percentile Bootstrap UCL					15545
6104	BCA Bootstrap UCL					15636						
6105	ebyshev(Mean, Sd) UCL					17232	95% Chebyshev(Mean, Sd) UCL					18865
6106	ebyshev(Mean, Sd) UCL					21131	99% Chebyshev(Mean, Sd) UCL					25582
6107												
6108	ested UCL to Use											
6109	dent's-t UCL					15805						
6110												
6111	e 95% UCL.											

	A	B	C	D	E	F	G	H	I	J	K	L
6112	d skewness.											
6113	Lee (2006).											
6114	statistician.											
6115												
6116												
6117	main 1a|all|)											
6118												
6119	**neral Statistics**											
6120	Observations					11	Observations					8
6121					Number of Missing Observations							0
6122	Minimum					7200	Mean					13627
6123	Maximum					21000	Median					14000
6124	SD					3985	rror of Mean					1202
6125	t of Variation					0.292	Skewness					0.137
6126												
6127	**rmal GOF Test**											
6128	**o Wilk Test Statistic**					0.98	Shapiro Wilk GOF Test					
6129	Critical Value					0.85	icance Level					
6130	Test Statistic					0.113	rs GOF Test					
6131	**iefors Critical Value**					0.251	Data appear Normal at 5% Significance Level					
6132	**mal at 5% Significance Level**											
6133												
6134	l Distribution											
6135	Normal UCL					**95% UCLs (Adjusted for Skewness)**						
6136	dent's-t UCL					15805	ed-CLT UCL (Chen-1995)					15657
6137							95% Modified-t UCL (Johnson-1978)					15813
6138												
6139	**mma GOF Test**											
6140	Test Statistic					0.21	na GOF Test					
6141	Critical Value					0.729	icance Level					
6142	Test Statistic					0.123	na GOF Test					
6143	Critical Value					0.255	icance Level					
6144	icance Level											
6145												
6146	**mma Statistics**											
6147	k hat (MLE)					12.08	rrected MLE)					8.846
6148	ta hat (MLE)					1128	rrected MLE)					1541
6149	hu hat (MLE)					265.8	as corrected)					194.6
6150	as corrected)					13627	as corrected)					4582
6151					Approximate Chi Square Value (0.05)							163.3
6152	**Level of Significance**					0.0278	Adjusted Chi Square Value					158.7
6153												
6154	**g Gamma Distribution**											
6155	hen n>=50))					16237	when n<50)					16714
6156												
6157	al GOF Test											
6158	**o Wilk Test Statistic**					0.964	Shapiro Wilk Lognormal GOF Test					
6159	**iro Wilk Critical Value**					0.85	Data appear Lognormal at 5% Significance Level					
6160	**fors Test Statistic**					0.133	Lilliefors Lognormal GOF Test					
6161	**iefors Critical Value**					0.251	Data appear Lognormal at 5% Significance Level					
6162	**ormal at 5% Significance Level**											
6163												
6164	nal Statistics											
6165	**um of Logged Data**					8.882	Mean of logged Data					9.478
6166	um of Logged Data					9.952	SD of logged Data					0.312
6167												
6168	Lognormal Distribution											
6169	95% H-UCL					16641	90% Chebyshev (MVUE) UCL					17538
6170	**ebyshev (MVUE) UCL**					19297	97.5% Chebyshev (MVUE) UCL					21738
6171	**99% Chebyshev (MVUE) UCL**					26533						
6172												
6173	**stribution Free UCL Statistics**											
6174	icance Level											

ProUCL Output
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	A	B	C	D	E	F	G	H	I	J	K	L
6175												
6176	n Free UCLs											
6177	% CLT UCL					15604	ıckknife UCL					15805
6178	ootstrap UCL					15507	ıtstrap-t UCL					15989
6179	ootstrap UCL					15853	ootstrap UCL					15545
6180	ootstrap UCL					15564						
6181	an, Sd) UCL					17232	an, Sd) UCL					18865
6182	an, Sd) UCL					21131	an, Sd) UCL					25582
6183												
6184	**ested UCL to Use**											
6185	**Student's-t UCL**					15805						
6186												
6187	**are provided to help the user to select the most appropriate 95% UCL.**											
6188	**on data size, data distribution, and skewness.**											
6189	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
6190	**ta sets; for additional insight the user may want to consult a statistician.**											
6191												
6192												
6193	n 1b|aecom|)											
6194												
6195	**neral Statistics**											
6196	**mber of Observations**					9	Number of Distinct Observations					9
6197							Number of Missing Observations					0
6198	Minimum					1400	Mean					6744
6199	Maximum					21000	Median					6700
6200	SD					5896	rror of Mean					1965
6201	t of Variation					0.874	Skewness					1.979
6202												
6203	u should use											
6204	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
6205	**Chebyshev UCL to estimate EPC (ITRC, 2012).**											
6206	ProUCL 5.1											
6207												
6208	al GOF Test											
6209	Test Statistic					0.733	iro Wilk GOF Test					
6210	**iro Wilk Critical Value**					0.829	Data Not Normal at 5% Significance Level					
6211	**fors Test Statistic**					0.358	Lilliefors GOF Test					
6212	**iefors Critical Value**					0.274	Data Not Normal at 5% Significance Level					
6213	icance Level											
6214												
6215	l Distribution											
6216	Normal UCL				95% UCLs (Adjusted for Skewness)							
6217	**% Student's-t UCL**					10399	95% Adjusted-CLT UCL (Chen-1995)					11362
6218							95% Modified-t UCL (Johnson-1978)					10615
6219												
6220	mma GOF Test											
6221	D Test Statistic					0.715	Anderson-Darling Gamma GOF Test					
6222	A-D Critical Value					0.732	Detected data appear Gamma Distributed at 5% Significance Level					
6223	S Test Statistic					0.256	Kolmogorov-Smirnov Gamma GOF Test					
6224	Critical Value					0.283	icance Level					
6225	icance Level											
6226												
6227	ma Statistics											
6228	k hat (MLE)					1.743	rrected MLE)					1.236
6229	ta hat (MLE)					3870	rrected MLE)					5457
6230	nu hat (MLE)					31.37	as corrected)					22.25
6231	as corrected)					6744	as corrected)					6067
6232					Approximate Chi Square Value (0.05)							12.52
6233	**Level of Significance**					0.0231	Adjusted Chi Square Value					11.02
6234												
6235	a Distribution											
6236	when n>=50)					11981	when n<50)					13621
6237												

	A	B	C	D	E	F	G	H	I	J	K	L
6238	al GOF Test											
6239	Test Statistic					0.87	al GOF Test					
6240	Critical Value					0.829	icance Level					
6241	Test Statistic					0.299	al GOF Test					
6242	**lefors Critical Value**					0.274	Data Not Lognormal at 5% Significance Level					
6243	**e Lognormal at 5% Significance Level**											
6244												
6245	nal Statistics											
6246	**um of Logged Data**					7.244	Mean of logged Data					8.503
6247	**um of Logged Data**					9.952	SD of logged Data					0.864
6248												
6249	l Distribution											
6250	95% H-UCL					17583	**ebyshev (MVUE) UCL**					12850
6251	MVUE) UCL					15593	ebyshev (MVUE) UCL					19399
6252	**ebyshev (MVUE) UCL**					26875						
6253												
6254	**istribution Free UCL Statistics**											
6255	icance Level											
6256												
6257	n Free UCLs											
6258	% CLT UCL					9977	ckknife UCL					10399
6259	otstrap UCL					9834	tstrap-t UCL					12650
6260	**Hall's Bootstrap UCL**					24070	95% Percentile Bootstrap UCL					10022
6261	**BCA Bootstrap UCL**					11056						
6262	an, Sd) UCL					12640	an, Sd) UCL					15311
6263	an, Sd) UCL					19017	an, Sd) UCL					26299
6264												
6265	UCL to Use											
6266	Gamma UCL					13621						
6267												
6268	**are provided to help the user to select the most appropriate 95% UCL.**											
6269	**on data size, data distribution, and skewness.**											
6270	Lee (2006).											
6271	a statistician.											
6272												
6273												
6274	**anic carbon|domain 1b|all|)**											
6275												
6276	**neral Statistics**											
6277	**mber of Observations**					9	Number of Distinct Observations					9
6278							Number of Missing Observations					0
6279	Minimum					1400	Mean					6744
6280	**Maximum**					21000	Median					6700
6281	SD					5896	Std. Error of Mean					1965
6282	ficient of Variation					0.874	Skewness					1.979
6283												
6284	data are collected using ISM approach, you should use											
6285	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
6286	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
6287	**he Nonparametric and All UCL Options of ProUCL 5.1**											
6288												
6289	al GOF Test											
6290	Test Statistic					0.733	ilk GOF Test					
6291	Critical Value					0.829	icance Level					
6292	Test Statistic					0.358	rs GOF Test					
6293	Critical Value					0.274	icance Level					
6294	icance Level											
6295												
6296	l Distribution											
6297	Normal UCL				95% UCLs (Adjusted for Skewness)							
6298	dent's-t UCL					10399	(Chen-1995)					11362
6299							95% Modified-t UCL (Johnson-1978)					10615
6300												

ProUCL Output
(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
6301	**mma GOF Test**											
6302	**D Test Statistic**					0.715	Anderson-Darling Gamma GOF Test					
6303	**A-D Critical Value**					0.732	Detected data appear Gamma Distributed at 5% Significance Level					
6304	**S Test Statistic**					0.256	Kolmogorov-Smirnov Gamma GOF Test					
6305	**K-S Critical Value**					0.283	Detected data appear Gamma Distributed at 5% Significance Level					
6306	icance Level											
6307												
6308	ma Statistics											
6309	k hat (MLE)					1.743	bias corrected MLE)					1.236
6310	**heta hat (MLE)**					3870	Theta star (bias corrected MLE)					5457
6311	**nu hat (MLE)**					31.37	nu star (bias corrected)					22.25
6312	**ean (bias corrected)**					6744	MLE Sd (bias corrected)					6067
6313					Approximate Chi Square Value (0.05)							12.52
6314	Significance					0.0231	quare Value					11.02
6315												
6316	a Distribution											
6317	when n>=50)					11981	when n<50)					13621
6318												
6319	**normal GOF Test**											
6320	**o Wilk Test Statistic**					0.87	Shapiro Wilk Lognormal GOF Test					
6321	Critical Value					0.829	**ormal at 5% Significance Level**					
6322	Test Statistic					0.299	Lognormal GOF Test					
6323	Critical Value					0.274	**mal at 5% Significance Level**					
6324	icance Level											
6325												
6326	**normal Statistics**											
6327	**um of Logged Data**					7.244	Mean of logged Data					8.503
6328	Logged Data					9.952	logged Data					0.864
6329												
6330	l Distribution											
6331	95% H-UCL					17583	MVUE) UCL					12850
6332	**ebyshev (MVUE) UCL**					15593	97.5% Chebyshev (MVUE) UCL					19399
6333	**ebyshev (MVUE) UCL**					26875						
6334												
6335	istribution Free UCL Statistics											
6336	rnible Distribution at 5% Significance Level											
6337												
6338	ric Distribution Free UCLs											
6339	% CLT UCL					9977	ckknife UCL					10399
6340	ootstrap UCL					9671	tstrap-t UCL					12701
6341	ootstrap UCL					24093	ootstrap UCL					9933
6342	ootstrap UCL					10967						
6343	an, Sd) UCL					12640	an, Sd) UCL					15311
6344	an, Sd) UCL					19017	an, Sd) UCL					26299
6345												
6346	UCL to Use											
6347	Gamma UCL					13621						
6348												
6349	**are provided to help the user to select the most appropriate 95% UCL.**											
6350	d skewness.											
6351	Lee (2006).											
6352	a statistician.											
6353												
6354												
6355	in 2|aecom|)											
6356												
6357	**neral Statistics**											
6358	**mber of Observations**					5	Number of Distinct Observations					5
6359					Number of Missing Observations							0
6360	Minimum					1200	Mean					2360
6361	**Maximum**					5200	Median					2000
6362	**SD**					1638	Std. Error of Mean					732.5
6363	t of Variation					0.694	**Skewness**					1.905

ProUCL Output
(version 5.1.002)

	A	B	C	D	E	F	G	H	I	J	K	L
6364												
6365	u should use											
6366	s of interest.											
6367	**Chebyshev UCL to estimate EPC (ITRC, 2012).**											
6368	**he Nonparametric and All UCL Options of ProUCL 5.1**											
6369												
6370	al GOF Test											
6371	Test Statistic					0.758	ilk GOF Test					
6372	Critical Value					0.762	icance Level					
6373	Test Statistic					0.363	rs GOF Test					
6374	Critical Value					0.343	icance Level					
6375	**al at 5% Significance Level**											
6376												
6377	l Distribution											
6378	Normal UCL				95% UCLs (Adjusted for Skewness)							
6379	dent's-t UCL					3922	(Chen-1995)					4232
6380					95% Modified-t UCL (Johnson-1978)							4026
6381												
6382	**mma GOF Test**											
6383	**D Test Statistic**					0.51	Anderson-Darling Gamma GOF Test					
6384	**A-D Critical Value**					0.682	**ma Distributed at 5% Significance Level**					
6385	Test Statistic					0.312	a GOF Test					
6386	Critical Value					0.359	icance Level					
6387	icance Level											
6388												
6389	**mma Statistics**											
6390	**k hat (MLE)**					3.426	k star (bias corrected MLE)					1.504
6391	**heta hat (MLE)**					688.8	Theta star (bias corrected MLE)					1569
6392	**nu hat (MLE)**					34.26	nu star (bias corrected)					15.04
6393	**ean (bias corrected)**					2360	MLE Sd (bias corrected)					1924
6394					Approximate Chi Square Value (0.05)							7.288
6395	**Level of Significance**					0.0086	Adjusted Chi Square Value					5.106
6396												
6397	g Gamma Distribution											
6398	Gamma UCL (use when n>=50)					4870	95% Adjusted Gamma UCL (use when n<50)					6950
6399												
6400	**normal GOF Test**											
6401	**Shapiro Wilk Test Statistic**					0.873	Shapiro Wilk Lognormal GOF Test					
6402	**iro Wilk Critical Value**					0.762	Data appear Lognormal at 5% Significance Level					
6403	**fors Test Statistic**					0.275	Lilliefors Lognormal GOF Test					
6404	Critical Value					0.343	icance Level					
6405	icance Level											
6406												
6407	nal Statistics											
6408	Logged Data					7.09	logged Data					7.613
6409	Logged Data					8.556	logged Data					0.583
6410												
6411	l Distribution											
6412	95% H-UCL					6154	MVUE) UCL					4102
6413	MVUE) UCL					4912	MVUE) UCL					6036
6414	**ebyshev (MVUE) UCL**					8244						
6415												
6416	**stribution Free UCL Statistics**											
6417	**nible Distribution at 5% Significance Level**											
6418												
6419	**ic Distribution Free UCLs**											
6420	**95% CLT UCL**					3565	95% Jackknife UCL					3922
6421	ootstrap UCL					3450	**% Bootstrap-t UCL**					6417
6422	ootstrap UCL					9193	rcentile Bootstrap UCL					3760
6423	ootstrap UCL					3800						
6424	an, Sd) UCL					4558	ebyshev(Mean, Sd) UCL					5553
6425	**ebyshev(Mean, Sd) UCL**					6935	99% Chebyshev(Mean, Sd) UCL					9649
6426												

	A	B	C	D	E	F	G	H	I	J	K	L
6427	**ested UCL to Use**											
6428	Gamma UCL					6950						
6429												
6430	observation											
6431												
6432	e 95% UCL.											
6433	d skewness.											
6434	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
6435	**ta sets; for additional insight the user may want to consult a statistician.**											
6436												
6437												
6438	omain 2|all|)											
6439												
6440	**neral Statistics**											
6441	**mber of Observations**					5	Number of Distinct Observations					5
6442							Number of Missing Observations					0
6443	Minimum					1200	Mean					2360
6444	Maximum					5200	Median					2000
6445	SD					1638	rror of Mean					732.5
6446	t of Variation					0.694	Skewness					1.905
6447												
6448	**ata are collected using ISM approach, you should use**											
6449	e on ISM (ITRC, 2012) to compute statistics of interest.											
6450	Chebyshev UCL to estimate EPC (ITRC, 2012).											
6451	the Nonparametric and All UCL Options of ProUCL 5.1											
6452												
6453	rmal GOF Test											
6454	Test Statistic					0.758	ilk GOF Test					
6455	Critical Value					0.762	icance Level					
6456	Test Statistic					0.363	rs GOF Test					
6457	Critical Value					0.343	icance Level					
6458	icance Level											
6459												
6460	l Distribution											
6461	Normal UCL				95% UCLs (Adjusted for Skewness)							
6462	dent's-t UCL					3922	(Chen-1995)					4232
6463							95% Modified-t UCL (Johnson-1978)					4026
6464												
6465	na GOF Test											
6466	Test Statistic					0.51	na GOF Test					
6467	Critical Value					0.682	icance Level					
6468	Test Statistic					0.312	na GOF Test					
6469	Critical Value					0.359	icance Level					
6470	icance Level											
6471												
6472	**mma Statistics**											
6473	**k hat (MLE)**					3.426	k star (bias corrected MLE)					1.504
6474	ta hat (MLE)					688.8	rrected MLE)					1569
6475	nu hat (MLE)					34.26	as corrected)					15.04
6476	**ean (bias corrected)**					2360	MLE Sd (bias corrected)					1924
6477							Approximate Chi Square Value (0.05)					7.288
6478	Significance					0.0086	**d Chi Square Value**					5.106
6479												
6480	a Distribution											
6481	when n>=50)					4870	Gamma UCL (use when n<50)					6950
6482												
6483	**normal GOF Test**											
6484	**o Wilk Test Statistic**					0.873	Shapiro Wilk Lognormal GOF Test					
6485	Critical Value					0.762	icance Level					
6486	Test Statistic					0.275	al GOF Test					
6487	Critical Value					0.343	icance Level					
6488	icance Level											
6489												

	A	B	C	D	E	F	G	H	I	J	K	L
6490	**normal Statistics**											
6491	**um of Logged Data**					7.09	Mean of logged Data					7.613
6492	Logged Data					8.556	logged Data					0.583
6493												
6494	l Distribution											
6495	95% H-UCL					6154	MVUE) UCL					4102
6496	MVUE) UCL					4912	MVUE) UCL					6036
6497	**ebyshev (MVUE) UCL**					8244						
6498												
6499	**istribution Free UCL Statistics**											
6500	icance Level											
6501												
6502	n Free UCLs											
6503	**95% CLT UCL**					3565	95% Jackknife UCL					3922
6504	**andard Bootstrap UCL**					3433	95% Bootstrap-t UCL					6417
6505	**Hall's Bootstrap UCL**					9170	95% Percentile Bootstrap UCL					3760
6506	**BCA Bootstrap UCL**					3800						
6507	**byshev(Mean, Sd) UCL**					4558	95% Chebyshev(Mean, Sd) UCL					5553
6508	**byshev(Mean, Sd) UCL**					6935	99% Chebyshev(Mean, Sd) UCL					9649
6509												
6510	**ested UCL to Use**											
6511	djusted Gamma UCL					6950						
6512												
6513	exceeds the maximum observation											
6514												
6515	**are provided to help the user to select the most appropriate 95% UCL.**											
6516	**Recommendations are based upon data size, data distribution, and skewness.**											
6517	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
6518	**ta sets; for additional insight the user may want to consult a statistician.**											
6519												
6520	main 1a|all|)											
6521												
6522	ral Statistics											
6523	Observations					9	Observations					4
6524	er of Detects					3	Non-Detects					6
6525	tinct Detects					3	Non-Detects					1
6526	imum Detect					0.51	n Non-Detect					0.5
6527	imum Detect					0.71	n Non-Detect					0.5
6528	ance Detects					0.0101	Non-Detects					66.67%
6529	**Mean Detects**					0.617	SD Detects					0.101
6530	**ledian Detects**					0.63	CV Detects					0.163
6531	**ewness Detects**					-0.586	Kurtosis Detects					N/A
6532	**of Logged Detects**					-0.493	SD of Logged Detects					0.168
6533												
6534	**t has only 3 Detected Values.**											
6535	**eaningful or reliable statistics and estimates.**											
6536												
6537												
6538	**ata are collected using ISM approach, you should use**											
6539	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
6540	TRC, 2012).											
6541	ProUCL 5.1											
6542												
6543	Detects Only											
6544	**o Wilk Test Statistic**					0.987	Shapiro Wilk GOF Test					
6545	**iro Wilk Critical Value**					0.767	Detected Data appear Normal at 5% Significance Level					
6546	**fors Test Statistic**					0.219	Lilliefors GOF Test					
6547	Critical Value					0.425	icance Level					
6548	icance Level											
6549												
6550	metric UCLs											
6551	KM Mean					0.539	rror of Mean					0.0297
6552	KM SD					0.0726	l (BCA) UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
6553	**5% KM (t) UCL**					0.594	95% KM (Percentile Bootstrap) UCL					N/A
6554	**5% KM (z) UCL**					0.588	95% KM Bootstrap t UCL					N/A
6555	**M Chebyshev UCL**					0.628	95% KM Chebyshev UCL					0.668
6556	**KM Chebyshev UCL**					0.724	99% KM Chebyshev UCL					0.834
6557												
6558	vations Only											
6559	m GOF Test											
6560												
6561	d Data Only											
6562	**k hat (MLE)**					54.53	k star (bias corrected MLE)					N/A
6563	**heta hat (MLE)**					0.0113	Theta star (bias corrected MLE)					N/A
6564	nu hat (MLE)					327.2	nu star (bias corrected)					N/A
6565	Mean (detects)					0.617						
6566												
6567	stics using Imputed Non-Detects											
6568	> 50% NDs with many tied observations at multiple DLs											
6569	e.g., <15-20)											
6570	Ls and BTVs											
6571	size is small.											
6572	M estimates											
6573	Minimum					0.04	Mean					0.361
6574	Maximum					0.71	Median					0.335
6575	SD					0.224	CV					0.62
6576	k hat (MLE)					2.057	rected MLE)					1.446
6577	ta hat (MLE)					0.175	rected MLE)					0.249
6578	**nu hat (MLE)**					37.03	nu star (bias corrected)					26.02
6579	**evel of Significance (β)**					0.0231						
6580	ue (26.02, α)					15.4	ue (26.02, β)					13.7
6581	when n>=50)					0.61	when n<50)					N/A
6582												
6583	M Estimates											
6584	Mean (KM)					0.539	SD (KM)					0.0726
6585	ariance (KM)					0.00528	f Mean (KM)					0.0297
6586	k hat (KM)					55.04	k star (KM)					36.76
6587	**nu hat (KM)**					990.7	nu star (KM)					661.8
6588	**heta hat (KM)**					0.00979	theta star (KM)					0.0147
6589	rcentile (KM)					0.612	rcentile (KM)					0.655
6590	rcentile (KM)					0.693	rcentile (KM)					0.767
6591												
6592	**lan-Meier (KM) Statistics**											
6593	e (661.77, α)					603.1	**Square Value (661.77, β)**					591.2
6594	when n>=50)					0.591	usted KM-UCL (use when n<50)					0.603
6595												
6596	vations Only											
6597	**o Wilk Test Statistic**					0.975	Shapiro Wilk GOF Test					
6598	**iro Wilk Critical Value**					0.767	Detected Data appear Lognormal at 5% Significance Level					
6599	**fors Test Statistic**					0.239	Lilliefors GOF Test					
6600	Critical Value					0.425	icance Level					
6601	icance Level											
6602												
6603	Non-Detects											
6604	riginal Scale					0.417	in Log Scale					-0.947
6605	**in Original Scale**					0.169	SD in Log Scale					0.402
6606	**umes normality of ROS data)**					0.522	95% Percentile Bootstrap UCL					0.507
6607	otstrap UCL					0.519	otstrap t UCL					0.552
6608	L (Log ROS)					0.57						
6609												
6610	l Distribution											
6611	ean (logged)					-0.626	M Geo Mean					0.535
6612	**M SD (logged)**					0.123	95% Critical H Value (KM-Log)					1.84
6613	**d Error of Mean (logged)**					0.0503	95% H-UCL (KM -Log)					0.584
6614	**M SD (logged)**					0.123	**tical H Value (KM-Log)**					1.84
6615	ean (logged)					0.0503						

	A	B	C	D	E	F	G	H	I	J	K	L
6616												
6617	L/2 Statistics											
6618	**DL/2 Normal**						DL/2 Log-Transformed					
6619	**n in Original Scale**					0.372	Mean in Log Scale					-1.088
6620	**in Original Scale**					0.19	SD in Log Scale					0.455
6621	**CL (Assumes normality)**					0.49	95% H-Stat UCL					0.531
6622	**provided for comparisons and historical reasons**											
6623												
6624	CL Statistics											
6625	**nal Distributed at 5% Significance Level**											
6626												
6627	ested UCL to Use											
6628	5% KM (t) UCL					0.594						
6629												
6630	**are provided to help the user to select the most appropriate 95% UCL.**											
6631	**Recommendations are based upon data size, data distribution, and skewness.**											
6632	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
6633	**ta sets; for additional insight the user may want to consult a statistician.**											
6634												
6635	main 1b|all|)											
6636												
6637	ral Statistics											
6638	Observations					4	Observations					1
6639	er of Detects					0	Non-Detects					4
6640	tinct Detects					0	Non-Detects					1
6641												
6642	also be NDs!											
6643	etection limit!											
6644	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
6645												
6646	**ributyl tin |domain 1b|all|) was not processed!**											
6647												
6648												
6649	**in (as sn)|ambient|aecom|)**											
6650												
6651	ral Statistics											
6652	Observations					14	f Distinct Observations					1
6653	er of Detects					0	**er of Non-Detects**					14
6654	tinct Detects					0	f Distinct Non-Detects					1
6655												
6656	**s), therefore all statistics and estimates should also be NDs!**											
6657	**r statistics are also NDs lying below the largest detection limit!**											
6658	EPC, BTV).											
6659												
6660	t processed!											
6661												
6662												
6663	n 1a|aecom|)											
6664												
6665	**neral Statistics**											
6666	Observations					25	**f Distinct Observations**					4
6667	er of Detects					0	ber of Non-Detects					25
6668	tinct Detects					0	**f Distinct Non-Detects**					4
6669												
6670	**s), therefore all statistics and estimates should also be NDs!**											
6671	**r statistics are also NDs lying below the largest detection limit!**											
6672	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
6673												
6674	t processed!											
6675												
6676												
6677	**ltin (as sn)|domain 1a|all|)**											
6678												

	A	B	C	D	E	F	G	H	I	J	K	L
6679	eneral Statistics											
6680	mber of Observations					25	Number of Distinct Observations					4
6681	mber of Detects					0	Number of Non-Detects					25
6682	r of Distinct Detects					0	Number of Distinct Non-Detects					4
6683												
6684	also be NDs!											
6685	tection limit!											
6686	EPC, BTV).											
6687												
6688	t processed!											
6689												
6690												
6691	n 1b|aecom|)											
6692												
6693	**neral Statistics**											
6694	**mber of Observations**					14	Number of Distinct Observations					2
6695	er of Detects				0		Non-Detects					14
6696	tinct Detects				0		Non-Detects					2
6697												
6698	also be NDs!											
6699	tection limit!											
6700	EPC, BTV).											
6701												
6702	**ltin (as sn)|domain 1b|aecom|) was not processed!**											
6703												
6704												
6705	main 1b|all|)											
6706												
6707	**neral Statistics**											
6708	Observations				14		**f Distinct Observations**					2
6709	er of Detects				0		ber of Non-Detects					14
6710	tinct Detects				0		**f Distinct Non-Detects**					2
6711												
6712	**s), therefore all statistics and estimates should also be NDs!**											
6713	**r statistics are also NDs lying below the largest detection limit!**											
6714	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
6715												
6716	t processed!											
6717												
6718												
6719	in 2|aecom|)											
6720												
6721	**neral Statistics**											
6722	Observations				6		Observations					2
6723	er of Detects				0		Non-Detects					6
6724	tinct Detects				0		Non-Detects					2
6725												
6726	also be NDs!											
6727	**r statistics are also NDs lying below the largest detection limit!**											
6728	**cific values to estimate environmental parameters (e.g., EPC, BTV).**											
6729												
6730	t processed!											
6731												
6732												
6733	**ltin (as sn)|domain 2|all|)**											
6734												
6735	**neral Statistics**											
6736	**mber of Observations**					6	Number of Distinct Observations					2
6737	**mber of Detects**					0	Number of Non-Detects					6
6738	**r of Distinct Detects**					0	Number of Distinct Non-Detects					2
6739												
6740	**s), therefore all statistics and estimates should also be NDs!**											
6741	er statistics are also NDs lying below the largest detection limit!											

	A	B	C	D	E	F	G	H	I	J	K	L
6742	ecific values to estimate environmental parameters (e.g., EPC, BTV).											
6743												
6744	utyltin (as sn)|domain 2|all|) was not processed!											
6745												
6746												
6747												
6748	**inc|ambient|aecom|)**											
6749												
6750	ral Statistics											
6751	Observations					14	Observations					12
6752						Number of Missing Observations						0
6753	Minimum					5.3	Mean					15.34
6754	Maximum					32	Median					13
6755	SD					8.438	rror of Mean					2.255
6756	t of Variation					0.55	Skewness					0.634
6757												
6758	al GOF Test											
6759	**o Wilk Test Statistic**					0.914	Shapiro Wilk GOF Test					
6760	**iro Wilk Critical Value**					0.874	Data appear Normal at 5% Significance Level					
6761	**fors Test Statistic**					0.181	Lilliefors GOF Test					
6762	**iefors Critical Value**					0.226	Data appear Normal at 5% Significance Level					
6763	**mal at 5% Significance Level**											
6764												
6765	**g Normal Distribution**											
6766	Normal UCL					**95% UCLs (Adjusted for Skewness)**						
6767	dent's-t UCL					19.34	ed-CLT UCL (Chen-1995)					19.46
6768						**95% Modified-t UCL (Johnson-1978)**						19.4
6769												
6770	**mma GOF Test**											
6771	**D Test Statistic**					0.367	Anderson-Darling Gamma GOF Test					
6772	**A-D Critical Value**					0.741	Detected data appear Gamma Distributed at 5% Significance Level					
6773	Test Statistic					0.172	na GOF Test					
6774	Critical Value					0.23	icance Level					
6775	icance Level											
6776												
6777	ma Statistics											
6778	k hat (MLE)					3.543	rrected MLE)					2.831
6779	**heta hat (MLE)**					4.331	Theta star (bias corrected MLE)					5.419
6780	**nu hat (MLE)**					99.2	nu star (bias corrected)					79.27
6781	as corrected)					15.34	**Sd (bias corrected)**					9.118
6782						Approximate Chi Square Value (0.05)						59.76
6783	Significance					0.0312	**d Chi Square Value**					57.52
6784												
6785	**g Gamma Distribution**											
6786	**Gamma UCL (use when n>=50))**					20.35	95% Adjusted Gamma UCL (use when n<50)					21.15
6787												
6788	al GOF Test											
6789	Test Statistic					0.948	al GOF Test					
6790	Critical Value					0.874	icance Level					
6791	Test Statistic					0.169	al GOF Test					
6792	**iefors Critical Value**					0.226	Data appear Lognormal at 5% Significance Level					
6793	**ormal at 5% Significance Level**											
6794												
6795	normal Statistics											
6796	um of Logged Data					1.668	Mean of logged Data					2.583
6797	um of Logged Data					3.466	SD of logged Data					0.575
6798												
6799	l Distribution											
6800	95% H-UCL					21.97	MVUE) UCL					22.77
6801	MVUE) UCL					26.11	MVUE) UCL					30.73
6802	MVUE) UCL					39.83						
6803												
6804	CL Statistics											

	A	B	C	D	E	F	G	H	I	J	K	L
6805	icance Level											
6806												
6807	n Free UCLs											
6808	**95% CLT UCL**					19.05	95% Jackknife UCL					19.34
6809	**andard Bootstrap UCL**					18.87	95% Bootstrap-t UCL					19.86
6810	ootstrap UCL					19.21	ootstrap UCL					19.09
6811	ootstrap UCL					18.87						
6812	an, Sd) UCL					22.11	an, Sd) UCL					25.17
6813	an, Sd) UCL					29.43	an, Sd) UCL					37.78
6814												
6815	UCL to Use											
6816	dent's-t UCL					19.34						
6817												
6818	**are provided to help the user to select the most appropriate 95% UCL.**											
6819	d skewness.											
6820	Lee (2006).											
6821	**ta sets; for additional insight the user may want to consult a statistician.**											
6822												
6823												
6824	h 1a|aecom|)											
6825												
6826	ral Statistics											
6827	**mber of Observations**					26	Number of Distinct Observations					24
6828							Number of Missing Observations					0
6829	**Minimum**					8	Mean					60.77
6830	Maximum					140	Median					57.5
6831	SD					35.66	rror of Mean					6.993
6832	t of Variation					0.587	Skewness					0.35
6833												
6834	al GOF Test											
6835	**o Wilk Test Statistic**					0.962	Shapiro Wilk GOF Test					
6836	**iro Wilk Critical Value**					0.92	Data appear Normal at 5% Significance Level					
6837	Test Statistic					0.0923	rs GOF Test					
6838	Critical Value					0.17	icance Level					
6839	icance Level											
6840												
6841	l Distribution											
6842	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
6843	**% Student's-t UCL**					72.71	95% Adjusted-CLT UCL (Chen-1995)					72.78
6844							**95% Modified-t UCL (Johnson-1978)**					72.79
6845												
6846	ha GOF Test											
6847	Test Statistic					0.535	ha GOF Test					
6848	**A-D Critical Value**					0.755	Detected data appear Gamma Distributed at 5% Significance Level					
6849	**S Test Statistic**					0.139	Kolmogorov-Smirnov Gamma GOF Test					
6850	**K-S Critical Value**					0.173	Detected data appear Gamma Distributed at 5% Significance Level					
6851	**ma Distributed at 5% Significance Level**											
6852												
6853	**mma Statistics**											
6854	k hat (MLE)					2.345	rrected MLE)					2.1
6855	**heta hat (MLE)**					25.91	Theta star (bias corrected MLE)					28.94
6856	nu hat (MLE)					121.9	nu star (bias corrected)					109.2
6857	ean (bias corrected)					60.77	MLE Sd (bias corrected)					41.93
6858							Approximate Chi Square Value (0.05)					86.09
6859	Level of Significance					0.0398	Adjusted Chi Square Value					84.73
6860												
6861	**Assuming Gamma Distribution**											
6862	**Gamma UCL (use when n>=50))**					77.09	95% Adjusted Gamma UCL (use when n<50)					78.32
6863												
6864	al GOF Test											
6865	Test Statistic					0.912	al GOF Test					
6866	Critical Value					0.92	icance Level					
6867	Test Statistic					0.181	al GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L
6868	Critical Value					0.17	icance Level					
6869	icance Level											
6870												
6871	nal Statistics											
6872	Logged Data					2.079	logged Data					3.879
6873	Logged Data					4.942	logged Data					0.767
6874												
6875	**Lognormal Distribution**											
6876	**95% H-UCL**					91.4	90% Chebyshev (MVUE) UCL					95.54
6877	**ebyshev (MVUE) UCL**					109.8	97.5% Chebyshev (MVUE) UCL					129.6
6878	**ebyshev (MVUE) UCL**					168.6						
6879												
6880	**istribution Free UCL Statistics**											
6881	icance Level											
6882												
6883	n Free UCLs											
6884	% CLT UCL					72.27	% Jackknife UCL					72.71
6885	**andard Bootstrap UCL**					72.33	95% Bootstrap-t UCL					73.38
6886	**Hall's Bootstrap UCL**					72.96	95% Percentile Bootstrap UCL					71.77
6887	**BCA Bootstrap UCL**					71.62						
6888	an, Sd) UCL					81.75	an, Sd) UCL					9125.00%
6889	an, Sd) UCL					104.4	an, Sd) UCL					130.3
6890												
6891	UCL to Use											
6892	dent's-t UCL					72.71						
6893												
6894	**are provided to help the user to select the most appropriate 95% UCL.**											
6895	**on data size, data distribution, and skewness.**											
6896	Lee (2006).											
6897	a statistician.											
6898												
6899												
6900	**zinc|domain 1a|all|)**											
6901												
6902	**neral Statistics**											
6903	Observations					60	Observations					43
6904					Number of Missing Observations							0
6905	Minimum					8	Mean					69.15
6906	Maximum					160	Median					70
6907	**SD**					35.42	Std. Error of Mean					4.572
6908	**ficient of Variation**					0.512	Skewness					0.169
6909												
6910	rmal GOF Test											
6911	o Wilk Test Statistic					0.965	Shapiro Wilk GOF Test					
6912	hapiro Wilk P Value					0.183	Data appear Normal at 5% Significance Level					
6913	fors Test Statistic					0.07	Lilliefors GOF Test					
6914	Critical Value					0.114	icance Level					
6915	icance Level											
6916												
6917	l Distribution											
6918	Normal UCL				95% UCLs (Adjusted for Skewness)							
6919	dent's-t UCL					76.79	(Chen-1995)					76.78
6920					95% Modified-t UCL (Johnson-1978)							76.81
6921												
6922	ma GOF Test											
6923	**D Test Statistic**					1.138	Anderson-Darling Gamma GOF Test					
6924	**A-D Critical Value**					0.758	Data Not Gamma Distributed at 5% Significance Level					
6925	Test Statistic					0.115	ma GOF Test					
6926	Critical Value					0.116	icance Level					
6927	icance Level											
6928												
6929	ma Statistics											
6930	k hat (MLE)					2.959	rrected MLE)					2.822

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	A	B	C	D	E	F	G	H	I	J	K	L
6931	ta hat (MLE)					23.37	rrected MLE)					24.5
6932	**nu hat (MLE)**					355.1	nu star (bias corrected)					338.6
6933	**ean (bias corrected)**					69.15	MLE Sd (bias corrected)					41.16
6934					Approximate Chi Square Value (0.05)							297
6935	Significance					0.046	quare Value					296
6936												
6937	**g Gamma Distribution**											
6938	hen n>=50))					78.85	**Gamma UCL (use when n<50)**					79.1
6939												
6940	al GOF Test											
6941	Test Statistic					0.905	ilk Lognormal GOF Test					
6942	**apiro Wilk P Value**					8.40E-05	Data Not Lognormal at 5% Significance Level					
6943	**fors Test Statistic**					0.145	Lilliefors Lognormal GOF Test					
6944	**iefors Critical Value**					0.114	Data Not Lognormal at 5% Significance Level					
6945	icance Level											
6946												
6947	nal Statistics											
6948	Logged Data					2.079	logged Data					4.058
6949	Logged Data					5.075	logged Data					0.672
6950												
6951	**Lognormal Distribution**											
6952	95% H-UCL					86.48	MVUE) UCL					92.62
6953	MVUE) UCL					101.9	MVUE) UCL					114.8
6954	MVUE) UCL					140						
6955												
6956	CL Statistics											
6957	**nible Distribution at 5% Significance Level**											
6958												
6959	**ic Distribution Free UCLs**											
6960	% CLT UCL					76.67	ckknife UCL					76.79
6961	otstrap UCL					76.65	tstrap-t UCL					77.39
6962	otstrap UCL					76.8	otstrap UCL					76.52
6963	**BCA Bootstrap UCL**					76.58						
6964	**byshev(Mean, Sd) UCL**					82.87	95% Chebyshev(Mean, Sd) UCL					89.08
6965	**ebyshev(Mean, Sd) UCL**					97.7	99% Chebyshev(Mean, Sd) UCL					114.6
6966												
6967	**ested UCL to Use**											
6968	**Student's-t UCL**					76.79						
6969												
6970	**are provided to help the user to select the most appropriate 95% UCL.**											
6971	on data size, data distribution, and skewness.											
6972	he simulation studies summarized in Singh, Maichle, and Lee (2006).											
6973	ata sets; for additional insight the user may want to consult a statistician.											
6974												
6975												
6976	**Conc (|zinc|domain 1b|aecom|)**											
6977												
6978	**neral Statistics**											
6979	Observations					14	Observations					12
6980						Number of Missing Observations						0
6981	Minimum					8.2	Mean					22.88
6982	Maximum					37	Median					23.5
6983	SD					10.86	rror of Mean					2.902
6984	t of Variation					0.475	Skewness					-0.0998
6985												
6986	al GOF Test											
6987	Test Statistic					0.896	ilk GOF Test					
6988	Critical Value					0.874	icance Level					
6989	**fors Test Statistic**					0.168	Lilliefors GOF Test					
6990	**iefors Critical Value**					0.226	Data appear Normal at 5% Significance Level					
6991	**mal at 5% Significance Level**											
6992												
6993	**g Normal Distribution**											

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	A	B	C	D	E	F	G	H	I	J	K	L
6994	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
6995	**% Student's-t UCL**					28.02	95% Adjusted-CLT UCL (Chen-1995)					27.57
6996						**95% Modified-t UCL (Johnson-1978)**						28.01
6997												
6998	ha GOF Test											
6999	Test Statistic					0.671	arling Gamma GOF Test					
7000	**A-D Critical Value**					0.74	Detected data appear Gamma Distributed at 5% Significance Level					
7001	**S Test Statistic**					0.193	Kolmogorov-Smirnov Gamma GOF Test					
7002	**K-S Critical Value**					0.23	Detected data appear Gamma Distributed at 5% Significance Level					
7003	icance Level											
7004												
7005	ma Statistics											
7006	k hat (MLE)					3.991	rected MLE)					3.183
7007	ta hat (MLE)					5.733	rected MLE)					7.187
7008	hu hat (MLE)					111.7	as corrected)					89.13
7009	**ean (bias corrected)**					22.88	MLE Sd (bias corrected)					12.82
7010							Approximate Chi Square Value (0.05)					68.36
7011	Significance					0.0312	**d Chi Square Value**					65.95
7012												
7013	a Distribution											
7014	hen n>=50))					29.83	Gamma UCL (use when n<50)					30.92
7015												
7016	**normal GOF Test**											
7017	**o Wilk Test Statistic**					0.868	Shapiro Wilk Lognormal GOF Test					
7018	Critical Value					0.874	icance Level					
7019	Test Statistic					0.201	al GOF Test					
7020	Critical Value					0.226	icance Level					
7021	icance Level											
7022												
7023	**normal Statistics**											
7024	um of Logged Data					2.104	Mean of logged Data					3
7025	um of Logged Data					3.611	SD of logged Data					0.561
7026												
7027	Lognormal Distribution											
7028	95% H-UCL					32.62	90% Chebyshev (MVUE) UCL					34
7029	MVUE) UCL					38.9	MVUE) UCL					45.68
7030	MVUE) UCL					59.02						
7031												
7032	CL Statistics											
7033	icance Level											
7034												
7035	n Free UCLs											
7036	% CLT UCL					27.65	ckknife UCL					28.02
7037	otstrap UCL					27.46	tstrap-t UCL					28.07
7038	**Hall's Bootstrap UCL**					27.18	95% Percentile Bootstrap UCL					27.36
7039	**BCA Bootstrap UCL**					27.64						
7040	an, Sd) UCL					31.59	an, Sd) UCL					35.53
7041	an, Sd) UCL					41	an, Sd) UCL					51.76
7042												
7043	UCL to Use											
7044	dent's-t UCL					28.02						
7045												
7046	e 95% UCL.											
7047	**on data size, data distribution, and skewness.**											
7048	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
7049	a statistician.											
7050												
7051	**limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
7052	**provide adjustments for positvely skewed data sets.**											
7053												
7054												
7055	main 1b|all|)											
7056												

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	A	B	C	D	E	F	G	H	I	J	K	L
7057	**neral Statistics**											
7058	**mber of Observations**					25	Number of Distinct Observations					19
7059							Number of Missing Observations					0
7060	Minimum					8.2	Mean					24.65
7061	Maximum					40	Median					27
7062	SD					10.02	rror of Mean					2.004
7063	t of Variation					0.406	Skewness					-0.214
7064												
7065	**rmal GOF Test**											
7066	**o Wilk Test Statistic**					0.935	Shapiro Wilk GOF Test					
7067	Critical Value					0.918	icance Level					
7068	Test Statistic					0.119	rs GOF Test					
7069	Critical Value					0.173	icance Level					
7070	icance Level											
7071												
7072	**g Normal Distribution**											
7073	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
7074	**% Student's-t UCL**					28.08	**ed-CLT UCL (Chen-1995)**					27.86
7075					95% Modified-t UCL (Johnson-1978)							28.07
7076												
7077	ha GOF Test											
7078	**D Test Statistic**					0.786	Anderson-Darling Gamma GOF Test					
7079	**A-D Critical Value**					0.747	Data Not Gamma Distributed at 5% Significance Level					
7080	**S Test Statistic**					0.159	Kolmogorov-Smirnov Gamma GOF Test					
7081	**K-S Critical Value**					0.175	Detected data appear Gamma Distributed at 5% Significance Level					
7082	**mma Distribution at 5% Significance Level**											
7083												
7084	ma Statistics											
7085	**k hat (MLE)**					5.139	k star (bias corrected MLE)					4.549
7086	heta hat (MLE)					4.797	Theta star (bias corrected MLE)					5.42
7087	nu hat (MLE)					256.9	nu star (bias corrected)					227.4
7088	ean (bias corrected)					24.65	MLE Sd (bias corrected)					11.56
7089							Approximate Chi Square Value (0.05)					193.5
7090	**Level of Significance**					0.0395	Adjusted Chi Square Value					191.4
7091												
7092	**g Gamma Distribution**											
7093	**Gamma UCL (use when n>=50))**					28.97	95% Adjusted Gamma UCL (use when n<50)					29.29
7094												
7095	al GOF Test											
7096	Test Statistic					0.89	al GOF Test					
7097	Critical Value					0.918	icance Level					
7098	Test Statistic					0.172	al GOF Test					
7099	Critical Value					0.173	icance Level					
7100	icance Level											
7101												
7102	nal Statistics											
7103	Logged Data					2.104	logged Data					3.104
7104	**um of Logged Data**					3.689	SD of logged Data					0.488
7105												
7106	**Lognormal Distribution**											
7107	**95% H-UCL**					30.51	90% Chebyshev (MVUE) UCL					32.6
7108	**ebyshev (MVUE) UCL**					36.05	97.5% Chebyshev (MVUE) UCL					40.83
7109	**ebyshev (MVUE) UCL**					50.24						
7110												
7111	CL Statistics											
7112	icance Level											
7113												
7114	n Free UCLs											
7115	**95% CLT UCL**					27.95	95% Jackknife UCL					28.08
7116	**andard Bootstrap UCL**					27.85	95% Bootstrap-t UCL					28.01
7117	**Hall's Bootstrap UCL**					27.88	95% Percentile Bootstrap UCL					27.85
7118	ootstrap UCL					27.72						
7119	an, Sd) UCL					30.66	an, Sd) UCL					33.39

	A	B	C	D	E	F	G	H	I	J	K	L
7120	an, Sd) UCL					37.17	an, Sd) UCL					44.59
7121												
7122	UCL to Use											
7123	dent's-t UCL					28.08						
7124												
7125	**are provided to help the user to select the most appropriate 95% UCL.**											
7126	d skewness.											
7127	Lee (2006).											
7128	a statistician.											
7129												
7130	**limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
7131	**provide adjustments for positvely skewed data sets.**											
7132												
7133												
7134	omain 2 |all|)											
7135												
7136	ral Statistics											
7137	**mber of Observations**					6	Number of Distinct Observations					6
7138							Number of Missing Observations					0
7139	Minimum					7.8	Mean					28.3
7140	Maximum					42	Median					28.5
7141	SD					12.47	Std. Error of Mean					5.091
7142	ficient of Variation					0.441	Skewness					-0.71
7143												
7144	u should use											
7145	s of interest.											
7146	TRC, 2012).											
7147	ProUCL 5.1											
7148												
7149	al GOF Test											
7150	Test Statistic					0.939	ilk GOF Test					
7151	Critical Value					0.788	icance Level					
7152	Test Statistic					0.169	rs GOF Test					
7153	**iefors Critical Value**					0.325	Data appear Normal at 5% Significance Level					
7154	**mal at 5% Significance Level**											
7155												
7156	l Distribution											
7157	Normal UCL				95% UCLs (Adjusted for Skewness)							
7158	dent's-t UCL					38.56	(Chen-1995)					35.1
7159					95% Modified-t UCL (Johnson-1978)							38.31
7160												
7161	ma GOF Test											
7162	**D Test Statistic**					0.442	Anderson-Darling Gamma GOF Test					
7163	**A-D Critical Value**					0.7	Detected data appear Gamma Distributed at 5% Significance Level					
7164	Test Statistic					0.237	ma GOF Test					
7165	Critical Value					0.333	icance Level					
7166	**ma Distributed at 5% Significance Level**											
7167												
7168	ma Statistics											
7169	k hat (MLE)					4.192	bias corrected MLE)					2.207
7170	ta hat (MLE)					6.751	**r (bias corrected MLE)**					12.82
7171	hu hat (MLE)					50.3	ar (bias corrected)					26.48
7172	**ean (bias corrected)**					28.3	MLE Sd (bias corrected)					19.05
7173							Approximate Chi Square Value (0.05)					15.75
7174	**Level of Significance**					0.0122	Adjusted Chi Square Value					12.86
7175												
7176	a Distribution											
7177	hen n>=50))					47.58	when n<50)					58.27
7178												
7179	al GOF Test											
7180	**o Wilk Test Statistic**					0.822	Shapiro Wilk Lognormal GOF Test					
7181	**iro Wilk Critical Value**					0.788	Data appear Lognormal at 5% Significance Level					
7182	Test Statistic					0.279	al GOF Test					

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	A	B	C	D	E	F	G	H	I	J	K	L
7183	Critical Value					0.325	icance Level					
7184	icance Level											
7185												
7186	nal Statistics											
7187	**um of Logged Data**					2.054	Mean of logged Data					3.219
7188	**um of Logged Data**					3.738	SD of logged Data					0.615
7189												
7190	l Distribution											
7191	95% H-UCL					67.71	MVUE) UCL					51.09
7192	MVUE) UCL					61.02	MVUE) UCL					74.8
7193	**ebyshev (MVUE) UCL**					101.9						
7194												
7195	**stribution Free UCL Statistics**											
7196	**nible Distribution at 5% Significance Level**											
7197												
7198	**ic Distribution Free UCLs**											
7199	% CLT UCL					36.67	ıckknife UCL					38.56
7200	**andard Bootstrap UCL**					35.94	95% Bootstrap-t UCL					38.07
7201	Hall's Bootstrap UCL					37.01	95% Percentile Bootstrap UCL					35.83
7202	BCA Bootstrap UCL					34.67						
7203	ebyshev(Mean, Sd) UCL					43.57	95% Chebyshev(Mean, Sd) UCL					50.49
7204	ebyshev(Mean, Sd) UCL					60.09	99% Chebyshev(Mean, Sd) UCL					78.95
7205												
7206	**Suggested UCL to Use**											
7207	**Student's-t UCL**					38.56						
7208												
7209	e 95% UCL.											
7210	d skewness.											
7211	Lee (2006).											
7212	a statistician.											
7213												
7214	) may not be											
7215	ed data sets.											
7216												
7217												
7218	in 2|aecom|)											
7219												
7220	**neral Statistics**											
7221	**mber of Observations**					5	Number of Distinct Observations					5
7222							Number of Missing Observations					0
7223	**Minimum**					8	Mean					15.8
7224	**Maximum**					33	Median					12
7225	**SD**					10.06	Std. Error of Mean					4.499
7226	**ficient of Variation**					0.637	Skewness					1.786
7227												
7228	**ata are collected using ISM approach, you should use**											
7229	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
7230	TRC, 2012).											
7231	ProUCL 5.1											
7232												
7233	al GOF Test											
7234	**o Wilk Test Statistic**					0.806	Shapiro Wilk GOF Test					
7235	**iro Wilk Critical Value**					0.762	Data appear Normal at 5% Significance Level					
7236	**fors Test Statistic**					0.292	Lilliefors GOF Test					
7237	Critical Value					0.343	icance Level					
7238	icance Level											
7239												
7240	l Distribution											
7241	Normal UCL				95% UCLs (Adjusted for Skewness)							
7242	dent's-t UCL					25.39	(Chen-1995)					27.04
7243							95% Modified-t UCL (Johnson-1978)					25.99
7244												
7245	**mma GOF Test**											

	A	B	C	D	E	F	G	H	I	J	K	L
7246	**D Test Statistic**					0.392	Anderson-Darling Gamma GOF Test					
7247	**A-D Critical Value**					0.681	Detected data appear Gamma Distributed at 5% Significance Level					
7248	Test Statistic					0.236	na GOF Test					
7249	Critical Value					0.359	icance Level					
7250	icance Level											
7251												
7252	**mma Statistics**											
7253	**k hat (MLE)**					3.924	k star (bias corrected MLE)					1.703
7254	heta hat (MLE)					4.027	Theta star (bias corrected MLE)					9.278
7255	nu hat (MLE)					39.24	nu star (bias corrected)					17.03
7256	ean (bias corrected)					15.8	MLE Sd (bias corrected)					12.11
7257							Approximate Chi Square Value (0.05)					8.693
7258	Level of Significance					0.0086	Adjusted Chi Square Value					6.261
7259												
7260	Distribution											
7261	hen n>=50))					30.95	when n<50)					42.97
7262												
7263	al GOF Test											
7264	Test Statistic					0.926	al GOF Test					
7265	Critical Value					0.762	icance Level					
7266	Test Statistic					0.202	al GOF Test					
7267	Critical Value					0.343	icance Level					
7268	**ormal at 5% Significance Level**											
7269												
7270	nal Statistics											
7271	Logged Data					2.079	logged Data					2.627
7272	Logged Data					3.497	logged Data					0.548
7273												
7274	l Distribution											
7275	95% H-UCL					37.67	MVUE) UCL					26.89
7276	MVUE) UCL					32.02	MVUE) UCL					39.14
7277	**ebyshev (MVUE) UCL**					53.13						
7278												
7279	CL Statistics											
7280	icance Level											
7281												
7282	**ic Distribution Free UCLs**											
7283	5% CLT UCL					23.2	**% Jackknife UCL**					25.39
7284	ootstrap UCL					22.27	% Bootstrap-t UCL					44.97
7285	ootstrap UCL					55.29	**rcentile Bootstrap UCL**					23
7286	ootstrap UCL					25						
7287	**byshev(Mean, Sd) UCL**					29.3	95% Chebyshev(Mean, Sd) UCL					35.41
7288	**ebyshev(Mean, Sd) UCL**					43.9	99% Chebyshev(Mean, Sd) UCL					60.56
7289												
7290	UCL to Use											
7291	dent's-t UCL					25.39						
7292												
7293	e 95% UCL.											
7294	d skewness.											
7295	**he simulation studies summarized in Singh, Maichle, and Lee (2006).**											
7296	**ta sets; for additional insight the user may want to consult a statistician.**											
7297												
7298												
7299	omain 2|all|)											
7300												
7301	ral Statistics											
7302	**mber of Observations**					5	Number of Distinct Observations					5
7303							Number of Missing Observations					0
7304	**Minimum**					8	**Mean**					15.8
7305	Maximum					33	Median					12
7306	SD					10.06	rror of Mean					4.499
7307	t of Variation					0.637	Skewness					1.786
7308												

	A	B	C	D	E	F	G	H	I	J	K	L
7309	**ata are collected using ISM approach, you should use**											
7310	**e on ISM (ITRC, 2012) to compute statistics of interest.**											
7311	**Chebyshev UCL to estimate EPC (ITRC, 2012).**											
7312	**he Nonparametric and All UCL Options of ProUCL 5.1**											
7313												
7314	al GOF Test											
7315	**o Wilk Test Statistic**					0.806	Shapiro Wilk GOF Test					
7316	iro Wilk Critical Value					0.762	Data appear Normal at 5% Significance Level					
7317	fors Test Statistic					0.292	Lilliefors GOF Test					
7318	iefors Critical Value					0.343	Data appear Normal at 5% Significance Level					
7319	rmal at 5% Significance Level											
7320												
7321	**Assuming Normal Distribution**											
7322	**5% Normal UCL**						95% UCLs (Adjusted for Skewness)					
7323	**% Student's-t UCL**					25.39	95% Adjusted-CLT UCL (Chen-1995)					27.04
7324					95% Modified-t UCL (Johnson-1978)							25.99
7325												
7326	ha GOF Test											
7327	Test Statistic					0.392	ha GOF Test					
7328	Critical Value					0.681	icance Level					
7329	Test Statistic					0.236	ha GOF Test					
7330	Critical Value					0.359	icance Level					
7331	icance Level											
7332												
7333	ma Statistics											
7334	**k hat (MLE)**					3.924	k star (bias corrected MLE)					1.703
7335	**heta hat (MLE)**					4.027	Theta star (bias corrected MLE)					9.278
7336	**nu hat (MLE)**					39.24	nu star (bias corrected)					17.03
7337	**ean (bias corrected)**					15.8	MLE Sd (bias corrected)					12.11
7338							Approximate Chi Square Value (0.05)					8.693
7339	**Level of Significance**					0.0086	Adjusted Chi Square Value					6.261
7340												
7341	a Distribution											
7342	hen n>=50))					30.95	Gamma UCL (use when n<50)					42.97
7343												
7344	al GOF Test											
7345	**o Wilk Test Statistic**					0.926	Shapiro Wilk Lognormal GOF Test					
7346	**iro Wilk Critical Value**					0.762	Data appear Lognormal at 5% Significance Level					
7347	**fors Test Statistic**					0.202	Lilliefors Lognormal GOF Test					
7348	Critical Value					0.343	icance Level					
7349	icance Level											
7350												
7351	nal Statistics											
7352	Logged Data					2.079	logged Data					2.627
7353	Logged Data					3.497	logged Data					0.548
7354												
7355	**Lognormal Distribution**											
7356	95% H-UCL					37.67	**ebyshev (MVUE) UCL**					26.89
7357	MVUE) UCL					32.02	ebyshev (MVUE) UCL					39.14
7358	MVUE) UCL					53.13						
7359												
7360	**stribution Free UCL Statistics**											
7361	**nible Distribution at 5% Significance Level**											
7362												
7363	n Free UCLs											
7364	% CLT UCL					23.2	ckknife UCL					25.39
7365	otstrap UCL					22.39	tstrap-t UCL					44.97
7366	otstrap UCL					60.14	otstrap UCL					23
7367	**BCA Bootstrap UCL**					24.6						
7368	**byshev(Mean, Sd) UCL**					29.3	95% Chebyshev(Mean, Sd) UCL					35.41
7369	ebyshev(Mean, Sd) UCL					43.9	99% Chebyshev(Mean, Sd) UCL					60.56
7370												
7371	ested UCL to Use											

	A	B	C	D	E	F	G	H	I	J	K	L
7372	Student's-t UCL					25.39						
7373												
7374	e 95% UCL.											
7375	d skewness.											
7376	Lee (2006).											
7377	statistician.											
7378												

1	**UCL Statistics for Uncensored Full Data Sets**											
2												
3	User Selected Options											
4	Date/Time of Computation	ProUCL 5.116/10/2021 1:45:15 PM										
5	From File	WorkSheet_a.xls										
6	Full Precision	OFF										
7	Confidence Coefficient	95%										
8	Number of Bootstrap Operations	2000										
9												
10												
11	**PAHs (AECOM data)**											
12												
13	**General Statistics**											
14	Total Number of Observations	25			Number of Distinct Observations	20						
15					Number of Missing Observations	0						
16	Minimum	0.005			Mean	0.124						
17	Maximum	0.385			Median	0.1						
18	SD	0.114			Std. Error of Mean	0.0228						
19	Coefficient of Variation	0.919			Skewness	0.866						
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic	0.893			**Shapiro Wilk GOF Test**							
23	5% Shapiro Wilk Critical Value	0.918			Data Not Normal at 5% Significance Level							
24	Lilliefors Test Statistic	0.148			**Lilliefors GOF Test**							
25	5% Lilliefors Critical Value	0.173			Data appear Normal at 5% Significance Level							
26	**Data appear Approximate Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**							
30	95% Student's-t UCL	0.163			95% Adjusted-CLT UCL (Chen-1995)	0.166						
31					95% Modified-t UCL (Johnson-1978)	0.164						
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic	0.808			**Anderson-Darling Gamma GOF Test**							
35	5% A-D Critical Value	0.781			Data Not Gamma Distributed at 5% Significance Level							
36	K-S Test Statistic	0.172			**Kolmogorov-Smirnov Gamma GOF Test**							
37	5% K-S Critical Value	0.181			Detected data appear Gamma Distributed at 5% Significance Level							
38	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)	0.799			k star (bias corrected MLE)	0.73						
42	Theta hat (MLE)	0.155			Theta star (bias corrected MLE)	0.17						
43	nu hat (MLE)	39.97			nu star (bias corrected)	36.51						
44	MLE Mean (bias corrected)	0.124			MLE Sd (bias corrected)	0.145						
45					Approximate Chi Square Value (0.05)	23.68						
46	Adjusted Level of Significance	0.0395			Adjusted Chi Square Value	22.97						
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))	0.191			95% Adjusted Gamma UCL (use when n<50)	0.197						
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic	0.835			**Shapiro Wilk Lognormal GOF Test**							
53	5% Shapiro Wilk Critical Value	0.918			Data Not Lognormal at 5% Significance Level							
54	Lilliefors Test Statistic	0.202			**Lilliefors Lognormal GOF Test**							
55	5% Lilliefors Critical Value	0.173			Data Not Lognormal at 5% Significance Level							

56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59						Minimum of Logged Data	-5.298			Mean of logged Data	-2.83	
60						Maximum of Logged Data	-0.954			SD of logged Data	1.552	
61												
62	**Assuming Lognormal Distribution**											
63						95% H-UCL	0.554			90% Chebyshev (MVUE) UCL	0.386	
64						95% Chebyshev (MVUE) UCL	0.479			97.5% Chebyshev (MVUE) UCL	0.609	
65						99% Chebyshev (MVUE) UCL	0.865					
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71						95% CLT UCL	0.161			95% Jackknife UCL	0.163	
72						95% Standard Bootstrap UCL	0.161			95% Bootstrap-t UCL	0.167	
73						95% Hall's Bootstrap UCL	0.168			95% Percentile Bootstrap UCL	0.163	
74						95% BCA Bootstrap UCL	0.169					
75						90% Chebyshev(Mean, Sd) UCL	0.192			95% Chebyshev(Mean, Sd) UCL	0.223	
76						97.5% Chebyshev(Mean, Sd) UCL	0.266			99% Chebyshev(Mean, Sd) UCL	0.351	
77												
78	**Suggested UCL to Use**											
79						95% Student's-t UCL	0.163					
80												
81	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
82	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
83												
84	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
85	Recommendations are based upon data size, data distribution, and skewness.											
86	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
87	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
88												
89												
90	**PAHs (AECOM & Coffey data)**											
91												
92	**General Statistics**											
93						Total Number of Observations	49			Number of Distinct Observations	37	
94										Number of Missing Observations	3	
95						Minimum	0.0025			Mean	0.154	
96						Maximum	0.66			Median	0.12	
97						SD	0.153			Std. Error of Mean	0.0218	
98						Coefficient of Variation	0.99			Skewness	1.622	
99												
100	**Normal GOF Test**											
101						Shapiro Wilk Test Statistic	0.838			**Shapiro Wilk GOF Test**		
102						5% Shapiro Wilk Critical Value	0.947			Data Not Normal at 5% Significance Level		
103						Lilliefors Test Statistic	0.16			**Lilliefors GOF Test**		
104						5% Lilliefors Critical Value	0.126			Data Not Normal at 5% Significance Level		
105	**Data Not Normal at 5% Significance Level**											
106												
107	**Assuming Normal Distribution**											
108	**95% Normal UCL**									**95% UCLs (Adjusted for Skewness)**		
109						95% Student's-t UCL	0.191			95% Adjusted-CLT UCL (Chen-1995)	0.196	
110										95% Modified-t UCL (Johnson-1978)	0.192	

	A	B	C	D	E	F	G	H	I	J	K	L
111												
112	**Gamma GOF Test**											
113	A-D Test Statistic					1.286	**Anderson-Darling Gamma GOF Test**					
114	5% A-D Critical Value					0.793	Data Not Gamma Distributed at 5% Significance Level					
115	K-S Test Statistic					0.14	**Kolmogorov-Smirnov Gamma GOF Test**					
116	5% K-S Critical Value					0.132	Data Not Gamma Distributed at 5% Significance Level					
117	**Data Not Gamma Distributed at 5% Significance Level**											
118												
119	**Gamma Statistics**											
120	k hat (MLE)					0.752	k star (bias corrected MLE)					0.719
121	Theta hat (MLE)					0.205	Theta star (bias corrected MLE)					0.214
122	nu hat (MLE)					73.67	nu star (bias corrected)					70.49
123	MLE Mean (bias corrected)					0.154	MLE Sd (bias corrected)					0.182
124							Approximate Chi Square Value (0.05)					52.16
125	Adjusted Level of Significance					0.0451	Adjusted Chi Square Value					51.69
126												
127	**Assuming Gamma Distribution**											
128	95% Approximate Gamma UCL (use when n>=50))					0.208	95% Adjusted Gamma UCL (use when n<50)					0.21
129												
130	**Lognormal GOF Test**											
131	Shapiro Wilk Test Statistic					0.842	**Shapiro Wilk Lognormal GOF Test**					
132	5% Shapiro Wilk Critical Value					0.947	Data Not Lognormal at 5% Significance Level					
133	Lilliefors Test Statistic					0.216	**Lilliefors Lognormal GOF Test**					
134	5% Lilliefors Critical Value					0.126	Data Not Lognormal at 5% Significance Level					
135	**Data Not Lognormal at 5% Significance Level**											
136												
137	**Lognormal Statistics**											
138	Minimum of Logged Data					-5.991	Mean of logged Data					-2.665
139	Maximum of Logged Data					-0.416	SD of logged Data					1.642
140												
141	**Assuming Lognormal Distribution**											
142	95% H-UCL					0.562	90% Chebyshev (MVUE) UCL					0.495
143	95% Chebyshev (MVUE) UCL					0.605	97.5% Chebyshev (MVUE) UCL					0.758
144	99% Chebyshev (MVUE) UCL					1.057						
145												
146	**Nonparametric Distribution Free UCL Statistics**											
147	**Data do not follow a Discernible Distribution (0.05)**											
148												
149	**Nonparametric Distribution Free UCLs**											
150	95% CLT UCL					0.19	95% Jackknife UCL					0.191
151	95% Standard Bootstrap UCL					0.19	95% Bootstrap-t UCL					0.198
152	95% Hall's Bootstrap UCL					0.202	95% Percentile Bootstrap UCL					0.19
153	95% BCA Bootstrap UCL					0.199						
154	90% Chebyshev(Mean, Sd) UCL					0.22	95% Chebyshev(Mean, Sd) UCL					0.249
155	97.5% Chebyshev(Mean, Sd) UCL					0.291	99% Chebyshev(Mean, Sd) UCL					0.371
156												
157	**Suggested UCL to Use**											
158	95% Chebyshev (Mean, Sd) UCL					0.249						
159												
160	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
161	Recommendations are based upon data size, data distribution, and skewness.											
162	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
163	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
164												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.115/10/2021 3:54:34 PM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFOS (AECOM Data only)

General Statistics

Total Number of Observations	25	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	5.0000E-5	Mean	1.1867E-4
Maximum	3.0000E-4	Median	1.0000E-4
SD	7.3862E-5	Std. Error of Mean	1.4772E-5
Coefficient of Variation	0.622	Skewness	1.029

Normal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	1.4394E-4	95% Adjusted-CLT UCL (Chen-1995)	1.4621E-4
		95% Modified-t UCL (Johnson-1978)	1.4445E-4

Gamma GOF Test

A-D Test Statistic	0.983	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.176	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.005	k star (bias corrected MLE)	2.671
Theta hat (MLE)	3.9486E-5	Theta star (bias corrected MLE)	4.4423E-5
nu hat (MLE)	150.3	nu star (bias corrected)	133.6
MLE Mean (bias corrected)	1.1867E-4	MLE Sd (bias corrected)	7.2605E-5
		Approximate Chi Square Value (0.05)	107.9
Adjusted Level of Significance	0.0395	Adjusted Chi Square Value	106.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.4694E-4	95% Adjusted Gamma UCL (use when n<50)	1.4911E-4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.918	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.173	Data Not Lognormal at 5% Significance Level

56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59						Minimum of Logged Data	-9.903			Mean of logged Data	-9.215	
60						Maximum of Logged Data	-8.112			SD of logged Data	0.6	
61												
62	**Assuming Lognormal Distribution**											
63						95% H-UCL	1.5327E-4			90% Chebyshev (MVUE) UCL	1.6330E-4	
64						95% Chebyshev (MVUE) UCL	1.8370E-4			97.5% Chebyshev (MVUE) UCL	2.1203E-4	
65						99% Chebyshev (MVUE) UCL	2.6766E-4					
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution (0.05)**											
69												
70	**Nonparametric Distribution Free UCLs**											
71						95% CLT UCL	1.4297E-4			95% Jackknife UCL	1.4394E-4	
72						95% Standard Bootstrap UCL	1.4291E-4			95% Bootstrap-t UCL	1.4864E-4	
73						95% Hall's Bootstrap UCL	1.4510E-4			95% Percentile Bootstrap UCL	1.4307E-4	
74						95% BCA Bootstrap UCL	1.4747E-4					
75						90% Chebyshev(Mean, Sd) UCL	1.6298E-4			95% Chebyshev(Mean, Sd) UCL	1.8306E-4	
76						97.5% Chebyshev(Mean, Sd) UCL	2.1092E-4			99% Chebyshev(Mean, Sd) UCL	2.6565E-4	
77												
78	**Suggested UCL to Use**											
79						95% Chebyshev (Mean, Sd) UCL	1.8306E-4					
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	Recommendations are based upon data size, data distribution, and skewness.											
83	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
84	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
85												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.116/10/2021 1:38:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PFOS (AECOM data)

General Statistics

Total Number of Observations	25	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	5.0000E-5	Mean	1.8640E-4
Maximum	5.0000E-4	Median	1.7000E-4
SD	1.4015E-4	Std. Error of Mean	2.8029E-5
Coefficient of Variation	0.752	Skewness	0.851

Normal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2.3435E-4	95% Adjusted-CLT UCL (Chen-1995)	2.3760E-4
		95% Modified-t UCL (Johnson-1978)	2.3515E-4

Gamma GOF Test

A-D Test Statistic	0.861	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.177	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.809	k star (bias corrected MLE)	1.619
Theta hat (MLE)	1.0304E-4	Theta star (bias corrected MLE)	1.1516E-4
nu hat (MLE)	90.45	nu star (bias corrected)	80.93
MLE Mean (bias corrected)	1.8640E-4	MLE Sd (bias corrected)	1.4651E-4
		Approximate Chi Square Value (0.05)	61.2
Adjusted Level of Significance	0.0395	Adjusted Chi Square Value	60.03

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.4649E-4	95% Adjusted Gamma UCL (use when n<50)	2.5129E-4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.918	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.173	Data Not Lognormal at 5% Significance Level

56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59						Minimum of Logged Data	-9.903			Mean of logged Data	-8.889	
60						Maximum of Logged Data	-7.601			SD of logged Data	0.823	
61												
62	**Assuming Lognormal Distribution**											
63						95% H-UCL	2.8389E-4			90% Chebyshev (MVUE) UCL	2.9343E-4	
64						95% Chebyshev (MVUE) UCL	3.4020E-4			97.5% Chebyshev (MVUE) UCL	4.0513E-4	
65						99% Chebyshev (MVUE) UCL	5.3266E-4					
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71						95% CLT UCL	2.3250E-4			95% Jackknife UCL	2.3435E-4	
72						95% Standard Bootstrap UCL	2.3065E-4			95% Bootstrap-t UCL	2.4222E-4	
73						95% Hall's Bootstrap UCL	2.3585E-4			95% Percentile Bootstrap UCL	2.3480E-4	
74						95% BCA Bootstrap UCL	2.3760E-4					
75						90% Chebyshev(Mean, Sd) UCL	2.7049E-4			95% Chebyshev(Mean, Sd) UCL	3.0858E-4	
76						97.5% Chebyshev(Mean, Sd) UCL	3.6144E-4			99% Chebyshev(Mean, Sd) UCL	4.6529E-4	
77												
78	**Suggested UCL to Use**											
79						95% Student's-t UCL	2.3435E-4					
80												
81	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
82	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
83												
84	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
85	Recommendations are based upon data size, data distribution, and skewness.											
86	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
87	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
88												
89												
90	**PFOS (AMA & AECOM)**											
91												
92	**General Statistics**											
93						Total Number of Observations	55			Number of Distinct Observations	18	
94										Number of Missing Observations	0	
95						Minimum	5.0000E-5			Mean	2.2109E-4	
96						Maximum	0.0024			Median	1.0000E-4	
97						SD	3.3115E-4			Std. Error of Mean	4.4652E-5	
98						Coefficient of Variation	1.498			Skewness	5.526	
99												
100	**Normal GOF Test**											
101						Shapiro Wilk Test Statistic	0.455			**Shapiro Wilk GOF Test**		
102						5% Shapiro Wilk P Value	0			Data Not Normal at 5% Significance Level		
103						Lilliefors Test Statistic	0.303			**Lilliefors GOF Test**		
104						5% Lilliefors Critical Value	0.119			Data Not Normal at 5% Significance Level		
105	**Data Not Normal at 5% Significance Level**											
106												
107	**Assuming Normal Distribution**											
108	**95% Normal UCL**									**95% UCLs (Adjusted for Skewness)**		
109						95% Student's-t UCL	2.9582E-4			95% Adjusted-CLT UCL (Chen-1995)	3.3009E-4	
110										95% Modified-t UCL (Johnson-1978)	3.0136E-4	

111												
112	**Gamma GOF Test**											
113					A-D Test Statistic	3.229	**Anderson-Darling Gamma GOF Test**					
114					5% A-D Critical Value	0.771	Data Not Gamma Distributed at 5% Significance Level					
115					K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**					
116					5% K-S Critical Value	0.122	Data Not Gamma Distributed at 5% Significance Level					
117	**Data Not Gamma Distributed at 5% Significance Level**											
118												
119	**Gamma Statistics**											
120					k hat (MLE)	1.378				k star (bias corrected MLE)	1.315	
121					Theta hat (MLE)	1.6039E-4				Theta star (bias corrected MLE)	1.6808E-4	
122					nu hat (MLE)	151.6				nu star (bias corrected)	144.7	
123					MLE Mean (bias corrected)	2.2109E-4				MLE Sd (bias corrected)	1.9277E-4	
124										Approximate Chi Square Value (0.05)	117.9	
125					Adjusted Level of Significance	0.0456				Adjusted Chi Square Value	117.2	
126												
127	**Assuming Gamma Distribution**											
128					95% Approximate Gamma UCL (use when n>=50))	2.7135E-4				95% Adjusted Gamma UCL (use when n<50)	2.7285E-4	
129												
130	**Lognormal GOF Test**											
131					Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk Lognormal GOF Test**					
132					5% Shapiro Wilk P Value	7.5201E-5	Data Not Lognormal at 5% Significance Level					
133					Lilliefors Test Statistic	0.233	**Lilliefors Lognormal GOF Test**					
134					5% Lilliefors Critical Value	0.119	Data Not Lognormal at 5% Significance Level					
135	**Data Not Lognormal at 5% Significance Level**											
136												
137	**Lognormal Statistics**											
138					Minimum of Logged Data	-9.903				Mean of logged Data	-8.822	
139					Maximum of Logged Data	-6.032				SD of logged Data	0.793	
140												
141	**Assuming Lognormal Distribution**											
142					95% H-UCL	2.5387E-4				90% Chebyshev (MVUE) UCL	2.7266E-4	
143					95% Chebyshev (MVUE) UCL	3.0533E-4				97.5% Chebyshev (MVUE) UCL	3.5066E-4	
144					99% Chebyshev (MVUE) UCL	4.3971E-4						
145												
146	**Nonparametric Distribution Free UCL Statistics**											
147	**Data do not follow a Discernible Distribution (0.05)**											
148												
149	**Nonparametric Distribution Free UCLs**											
150					95% CLT UCL	2.9454E-4				95% Jackknife UCL	2.9582E-4	
151					95% Standard Bootstrap UCL	2.9482E-4				95% Bootstrap-t UCL	3.9281E-4	
152					95% Hall's Bootstrap UCL	5.8352E-4				95% Percentile Bootstrap UCL	3.0200E-4	
153					95% BCA Bootstrap UCL	3.4655E-4						
154					90% Chebyshev(Mean, Sd) UCL	3.5505E-4				95% Chebyshev(Mean, Sd) UCL	4.1572E-4	
155					97.5% Chebyshev(Mean, Sd) UCL	4.9994E-4				99% Chebyshev(Mean, Sd) UCL	6.6537E-4	
156												
157	**Suggested UCL to Use**											
158					95% Chebyshev (Mean, Sd) UCL	4.1572E-4						
159												
160	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
161	Recommendations are based upon data size, data distribution, and skewness.											
162	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
163	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
164												