PFAS Detailed Site Investigation

Gladstone Fire Station, 5-9 Breslin Street, Gladstone, Queensland

Queensland Fire and Emergency Services

13 February 2020

60609758
Revision 0 - Final

PFAS Detailed Site Investigation

Client: Queensland Fire and Emergency Services

ABN: 93 035 163 778

Prepared by

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street, PO Box 1307, Fortitude Valley QLD 4006, Australia
T +61 7 3553 2000 F +61 7 3553 2050 www.aecom.com
ABN 20 093 846 925

13-Feb-2020

Job No.: 60609758

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document PFAS Detailed Site Investigation

Ref 60609758

Date 13-Feb-2020

Prepared by Camden McCosker

Reviewed by James Peachey

Revision History

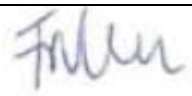
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	06-Dec-2019	Draft	Frances Lee Project Director	
B	12-Feb-2020	Draft	Frances Lee Project Director	
0	13-Feb-2020	Final	Frances Lee Project Director	

Table of Contents

List of Tables (in text)

List of Figures (in Appendix A)

List of Tables (in Appendix B)

Abbreviations

AFFF	Aqueous film forming foam
AHD	Australian height datum
ASC NEPM	Assessment of Site Contamination National Environment Protection Measure 1999 (as amended 2013)
ASRIS	Australian Soil Resources Information System
ASS	Acid sulfate soil
CLA	Contaminated Land Auditor
CLID	Contaminated land investigation document
CLR	Contaminated Land Register
COPC	Contaminants of potential concern
CSM	Conceptual site model
DES	Department of Environment and Science
DO	Dissolved oxygen
DQO	Data quality objectives
DQI	Data quality indicator
DSI	Detailed site investigation
EC	Electrical Conductivity
EMR	Environmental Management Register
EPP	Environmental Protection Policy
ESA	Environmentally Sensitive Areas
EV	Environmental Values
GDE	Groundwater Dependent Ecosystems
HEPA	Heads of Environmental Protection Agencies Australia and New Zealand
LOR	Limits of reporting
mbgl	Metres below ground level
mbtoc	Metres below top of casing
NATA	National Association of Testing Authorities
NDD	Non-destructive drilling
NEMP	National Environmental Management Plan
NEPC	National Environment Protection Council
NMI	National Measurement Institute
NRME	[Department of] Natural Resourcing, Mining and Energy
ORP	Oxidation reduction potential
PFAS	Per- and poly-fluoroalkyl substances
PFHxS	Perfluorohexanesulfonic acid
PFOA	Perfluorooctanoic acid

PFOS	Perfluorooctanesulfonic acid
PSI	Preliminary site investigation
QA/QC	Quality assurance / quality control
QFES	Queensland Fire and Emergency Services
SAQP	Sampling analysis and quality plan
SIR	Site investigation report
SOP	Standard operating procedure
SWL	Static water level
TDS	Total dissolved solids
TOPA	Total oxidisable precursor assay
USCS	Unified soil classification system
USEPA	United States Environmental Protection Agency

Glossary of Terms

Term	Definition
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic or significant quantities of water.
Bore	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
Borehole	A hole produced in the ground by drilling for the investigation and assessment of soil and rock profiles.
Discharge	A release of water from a particular source.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Finished Foam	Finshed foam is formed following aeration of the foam concentrate.
Groundwater	Water located within an aquifer; that is, held in the rocks and soil beneath the earth's surface.
Groundwater monitoring well	A bore which has been specifically constructed to allow groundwater measurements to be taken and groundwater samples to be collected.
Groundwater recharge	A hydrologic process by which water enters the aquifer by moving downwards from surface water to groundwater.
Hydrogeology	The study of subsurface water in its geological context.
Hydrology	The study of rainfall and surface water runoff processes.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Pollutant / contaminant	Any matter that is not naturally present in the environment.
Primary Source	A primary source is a storage vessel or area where there is the potential for a contaminant to be directly released to ground (e.g. by leaks or spills or by direct release).
Runoff	The portion of water that drains away as surface flow.
Saturated zone	This portion of the subsurface below the groundwater table in which all pores in the soil and rock are completely filled with water.
Secondary Source	A secondary source is an area impacted by a primary source that has the potential for ongoing release of contaminants. For example, contaminants adsorbed to soil could act as a source of contamination to groundwater.
Stormwater	Water that travels through drains following precipitation events.
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape.
Tributary	A river or stream flowing into a larger river or lake.
Unsaturated zone	The portion of the subsurface above the groundwater table. The soil and rock in this zone contain air as well as water in its pores.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.

Executive Summary

Background

AECOM Australia Pty Ltd (AECOM) was engaged by Queensland Fire and Emergency Services (QFES) to undertake an evaluation of the concentration and distribution of per- and poly- fluoroalkyl substances (PFAS) at Gladstone Fire Station, located at 5 to 9 Breslin Street, Gladstone, QLD 4680 (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

QFES is conducting the PFAS environmental investigation at Gladstone Fire Station using a staged approach. Stage 1 consisted of a preliminary site investigation (PSI) and sampling, analysis and quality plan (SAQP), which was completed in April 2019 (AECOM, 2019). Under Stage 2 of the project, a Queensland Contaminated Land Auditor (CLA) reviewed and endorsed the works completed in Stage 1. Following completion of Stages 1 and 2, QFES has engaged AECOM to undertake Stage 3 of the project, which is the delivery of the PFAS detailed site investigation (DSI) to implement the scope of work identified in the SAQP.

This report forms the Site Investigation Report (SIR) for the DSI and is consistent with the requirements of a Contaminated Land Investigation Document (CLID).

Key Findings of the PSI

The PSI (AECOM, 2019) was completed to understand the potential for PFAS contamination to be present at the fire station based on a review of the site and environmental setting and historical operations and practices. The PSI identified that the fire station was built in approximately 1973 with foam concentrates present on the site since 1976 with foam types including protein type foams, aqueous film forming foam (AFFF) and fluorine-free foams. Firefighting training using foam concentrate took place in the western portion of the site. This area was formerly grassed, but now is partly occupied by an engine shed that was built between 2007 and 2014. No infrastructure (e.g. tanks) is known to have stored foam on site. Historically, the fire station has been used to stockpile foam concentrate for supply to the greater Gladstone region. The areas used for firefighting training exercises and foam storage were identified as potential PFAS source areas.

Objectives

The objectives of the works were to characterise potential PFAS impacts in soil and groundwater, including concentration and distribution, within and at the boundaries of the Gladstone Fire Station to assess the potential risks to human health and the environment and to update the PFAS conceptual site model (CSM) for the site.

Investigation Scope

The DSI was completed between July and August 2019. The DSI scope of work was completed in accordance with the SAQP (AECOM, 2019) and included the drilling of six soil bores on the site (drilled to between 7.0 and 7.4 metres below ground level, mbgl) that were converted to groundwater monitoring wells, advancement of four soil bores up to 0.5 mbgl and collection of soil and groundwater samples from the bores/monitoring wells and collection of sediment and surface water samples from on-site surface water drains. Laboratory analysis was undertaken for PFAS followed by preparation of this interpretative report.

Key Findings of the DSI

The key findings of the PFAS DSI are presented below.

- All six soil bores were drilled to bedrock, which was encountered between 7.0 and 7.4 mbgl. Fill, consisting of silty and sandy clay and gravel was present up to approximately 1.8 mbgl, which is underlain by silty, sandy and gravelly clay which overlies the bedrock. The geology of the bedrock is not known but may be mudstone or sandstone.
- During drilling, groundwater was encountered at approximately 4.5 mbgl with stabilised depth to groundwater reported between 1.47 and 2.38 m below top of casing. This indicates the presence of a semi-confined aquifer, which is confined by the clay layer that overlies the bedrock. Groundwater was inferred to locally flow toward the northwest. This flow direction is consistent

with the expected regional groundwater flow direction, which is inferred to be to the northwest towards the Auckland Inlet, approximately 950 m away.

- Elevated PFAS concentrations were detected in soil samples with the highest concentrations detected in near-surface fill materials (0 to 0.5 m depth interval) in and near the former foam training area in the western portion of the site. The main PFAS compound detected in the near surface soil was perfluorooctanesulfonic acid (PFOS). The highest sum of perfluorohexanesulfonic acid (PFHxS) and PFOS (4.1 mg/kg[1] in GS_BH02 at 0.5 mbgl) was detected in a sample from a bore located adjacent to the northern site boundary. PFHxS and PFOS concentrations decreased with increased depth, which may reflect sorption of PFAS onto clay. The presence of near-surface impacts is consistent with surface-based sources, such as direct application of foam to unsealed ground or spills.
- None of the ∑(PFHxS+PFOS), and perfluorooctanoic acid (PFOA) concentrations in the 23 soil samples collected and analysed from the soil bores exceeded the National Environmental Management Plan (NEMP) (Heads of Environmental Protection Agencies [HEPA], 2018) health guideline values for a commercial land use. Six exceedances of the NEMP (HEPA, 2018) PFOS interim soil ecological guideline value for indirect exposure for a commercial land use, were reported in shallow soils (<0.5 mbgl) within the foam training area, indicating a potential risk to terrestrial ecological receptors. However, this is likely to be mitigated by the lack of open space, the extensive paving which will prevent access to the subsurface soils and the minimal vegetation to be ingested and consumed by higher order predators.
- The primary PFAS compounds detected in the groundwater samples analysed were PFHxS and PFOS. The groundwater samples with the highest concentrations (267 µg/L and 105 µg/L ∑(PFHxS+PFOS)) were located within the foam training area (GS_MW02 and GS_MW01, respectively). The next highest concentration (2.5 µg/L ∑(PFHxS+PFOS)) was reported in GS_MW03 located hydraulically down-gradient of the former foam store. This suggests the two main sources of PFAS in groundwater on site are the foam training area and the former foam store.
- ∑(PFHxS+PFOS) concentrations exceeding the NEMP (HEPA, 2018) drinking water guideline value were reported in groundwater samples from all six monitoring wells (GS_MW01 to GS_MW06). The drinking water guideline value for PFOA was also exceeded in two of the groundwater samples (from GS_MW01 and GS_MW02). Groundwater samples from three monitoring wells (GS_MW01, GS_MW02 and GS_MW03) also reported ∑(PFHxS+PFOS) concentrations exceeding the National Health Medical Research Council (2019) human health recreational water guideline value. The concentration of PFOS in all six groundwater samples exceeded the NEMP (HEPA, 2018) ecological guideline values for 99% species protection for fresh water. Four of the samples (GS_MW01 to GS_MW04) also exceeded the adopted ecological investigation level for 99% freshwater species protection value identified in Batley et. al (2018). There were no exceedances of the adopted ecological guideline values for PFOA.
- As the monitoring wells with the highest PFAS concentrations in groundwater are located adjacent to the hydraulically down-gradient site boundary, it is considered likely that PFAS impacts in groundwater (in particular, PFHxS, PFOS and PFOA) extend off-site at concentrations that exceed the human health and ecological guidelines (HEPA, 2018 and NHMRC, 2019). As groundwater samples from all on-site monitoring wells exceeded human health and ecological guideline values, the lateral extent of PFAS in groundwater has not been characterised in any direction.
- The monitoring well screens were all installed in the clay deposits overlying bedrock. As no monitoring wells are screened below 7.4 mbgl, the vertical extent of PFAS deeper in the aquifer is not known. If a fractured rock is present (such as mudstone or sandstone), there is the potential for PFAS to be transported through permeable fractures. It is uncertain when foams containing PFAS first started to be used at Gladstone Fire Station. As the potential for foam use containing PFAS could have occurred for 10 years or more, the potential for PFAS to have migrated at distance beyond the site boundary cannot be discounted. The local groundwater flows towards

[1] Quality assurance samples were analysed for soil sample GS_BH02 0.5 m with ∑PFHxS+PFOS in the primary sample reporting 4.1 mg/kg, the intra-laboratory (duplicate) sample reporting 5.2 mg/kg and the inter-laboratory (triplicate) sample reporting 5.3 mg/kg. The results indicate variability in the samples, possible due to heterogeneity.

the Auckland Inlet, which is the main hydrological feature located approximately 950 m to the northwest. No registered bores for water supply have been identified hydraulically down-gradient of the site.

- The laboratory analytical technique for total oxidisable precursor assay (TOPA) is used to detect certain harder to analyse PFAS precursor compounds that may be present. The results of TOPA analysis on one soil and one groundwater sample did not indicate the presence of PFAS precursors. The results indicated a degraded PFAS product that is unlikely to significantly increase or alter through bio-transformation or oxidation processes.
- A surface water sample (GS_SW03) was collected from the concrete lined drainage pit located on the external western wall of the workshop, which was an area noted to collect runoff from the concrete slab in the centre of the site. The sample reported a PFOS concentration of 0.043 µg/L which exceeded the NEMP HEPA, 2018 ecological guidelines for 99% freshwater species protection. It is noted that this surface water drain discharges towards the north of the site.
- Sum of 28 PFAS concentration in the sediment sample from the drain located in the grassed area in the north of the site (GS_SED01) was reported as 0.42 mg/kg. This concentration is similar to concentrations reported for surface (<0.5 mbgl) soils in the foam training area and indicates that sediment has the potential to migrate offsite via surface drainage. The main compounds present were long chain PFAS (perfluoroundecanoic acid [PFUnDA] and perfluorotridecanoic acid [PFTrDA]). Due to the presence of shallow soil and sediment impacts at the site, there is the potential for leaching of PFAS to surface water, which may enter the stormwater drainage system in the northern portion of the site, and drain into the stormwater channel to the north of Breslin Street.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered likely to be related to the historical firefighting training practices at the fire station, and spills from storage containers, product transfer and other maintenance activities.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possibly complete exposure pathways for PFAS sourced from the fire station to impact off-site human and ecological receptors have been identified. The significance of these potentially complete source-pathway-receptor linkages is uncertain and further investigation is required to understand the potential risks to off-site receptors.

1.0 Introduction

1.1 General

AECOM Australia Pty Ltd (AECOM) was engaged by Queensland Fire and Emergency Services (QFES) to undertake an evaluation of the concentration and distribution of per- and poly- fluoroalkyl substances (PFAS) at Gladstone Fire Station, located at 5 at 9 Breslin Street, Gladstone, QLD 4680 (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

Historical practices and operations at QFES facilities including Gladstone Fire Station may have involved using firefighting foam containing PFAS. PFAS are an emerging family of compounds that are highly soluble, persistent and bio-accumulative in the environment. Following release to ground, they can be readily mobilised from soil source zones, and migrate significant distances in surface water and groundwater.

1.2 Background

QFES is conducting the environmental investigation at Gladstone Fire Station using the following staged approach:

- Stage 1: Development of the preliminary site investigation (PSI) and sampling, analysis and quality plan (SAQP). This stage was completed in April 2019 (AECOM, 2019).
- Stage 2: Review and endorsement of the PSI and SAQP by a Queensland Contaminated Land Auditor (CLA). This stage was completed in April 2019.
- Stage 3: Implementation of the scope of works identified in the SAQP by conducting a detailed site investigation (DSI) and completion of a draft site investigation report (SIR).
- Stage 4: Review and endorsement of the SIR report by a CLA.
- Stage 5: Provide the final SIR to the regulator (DES) and subject to any further requirements, procure a suitable environmental consultant to design an investigation plan to measure and assess off-site impacts.
- Stage 6: Engage an appropriately qualified third party CLA to audit the suitability of any offsite investigation plan to meet the requirements of DES prior to implementation.

This report forms the SIR for the Stage 3 DSI and has been prepared to meet the requirements of a Contaminated Land Investigation Document (CLID).

1.3 Objectives

The objectives of the works were to characterise potential PFAS impacts in soil and groundwater, including concentration and distribution, within and at the boundaries of the Gladstone Fire Station, to assess the potential risks to human health and the environment and to update the PFAS conceptual site model (CSM) for the site.

The key outcomes / deliverables of the Stage 3 works were as follows:

- Undertaking soil and groundwater sampling at Gladstone Fire Station, in accordance with the SAQP.
- Preparation of a draft SIR detailing the implementation of the DSI, in accordance with Australian guidance for investigation of sites potentially impacted by PFAS including the National Environmental Protection Council (NEPC), National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (1999, as amended 2013) (NEPC, 2013) and the PFAS National Environmental Management Plan (Heads of Environmental Protection Agencies (HEPA), 2018).

The Stage 4 deliverable will be a final SIR that incorporates any comments/ corrections from the QFES review and inclusion of all the requirements of the audit by the CLA.

1.4 Scope of Works

The scope of work undertaken to meet the objectives of the PFAS DSI were as follows:

- Completion of fieldwork in accordance with the CLA-endorsed SAQP (AECOM, 2019) which included the following activities:
    - Drilling of six soil bores (GS_BH01 to GS_BH06) to approximately 7.0 metres below ground level (mbgl), which were converted to groundwater monitoring wells (GS_MW01 to GS_MW06). Collection of soil samples at approximately 1.0m intervals. Development of groundwater monitoring wells.
    - Collection of soil samples from three shallow soil bores (GS_SS1 to GS_SS3) in the grassed area in the western portion of the site in the former foam training area. Two bores were originally proposed to be advanced to 0.5 mbgl, however due to the presence of hard ground conditions GS_SS1 was terminated at 0.15 mbgl. GS_SS3 was therefore installed as an additional shallow soil sampling location. An additional surface soil sample (GS_SS4) was collected from an area adjacent to the truck washdown area.
    - Collection of co-located surface water and sediment samples from drainage pits on site.
    - Collection of groundwater samples from the six new groundwater monitoring wells.
    - Surveying of the top of the casing at each monitoring well to MGA94 coordinates and Australian Height Datum (AHD).
    - Laboratory analysis of soil, sediment, surface water and groundwater for PFAS, with groundwater analysed for trace level concentrations.
- Preparation of an SIR (this report), which includes an update of the PFAS CSM.

1.5 PFAS Analysis

Aqueous film forming foam (AFFF) manufactured over the last 50 years are estimated to contain between 200 and 600 possible PFAS compounds of varying signatures / composition (NEMP, HEPA, 2018[2]). However, at present, Australian commercial analytical laboratories, using National Association of Testing Authority (NATA) accredited methods, are currently able to analyse for around 28 PFAS (see **Table 1**). This analytical limitation is not considered significantly influential as the current PFAS laboratory analytical schedule includes the compounds that have guidelines available. These compounds were also the primary ingredients of AFFF and are more likely to be encountered where AFFF was used, stored and/or discharged.

[2] Noting that the Draft NEMP Version 2.0 is currently out for public comment until June 2019 with expected publication in early 2020.

Table 1 Compounds Analysed in the PFAS Suite

PFAS Group	Compound	Abbreviation	CAS No.
Perfluoroalkyl Sulfonic Acids	Perfluorobutane sulfonic acid	PFBS	375-73-5
	Perfluoropentane sulfonic acid	PFPeS	2706-91-4
	Perfluorohexane sulfonic acid	PFHxS	355-46-4
	Perfluoroheptane sulfonic acid	PFHpS	375-92-8
	Perfluorooctane sulfonic acid	PFOS	1763-23-1
	Perfluorodecane sulfonic acid	PFDS	335-77-3
Perfluoroalkyl Carboxylic Acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnDA	2058-94-8
	Perfluorododecanoic acid	PFDoDA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluoroalkyl Sulfonamides	Perfluorooctane sulphonamide	FOSA	754-91-6
	N-Methyl perfluorooctane sulfonamide	MeFOSA	31506-32-8
	N-Ethyl perfluorooctane sulfonamide	EtFOSA	4151-50-2
	N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE	2448-09-7
	N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2
	N-Methyl perfluorooctane sulfonamidoacetic acid	MeFOSAA	2355-31-9
	N-Ethyl perfluorooctane sulfonamidoacetic acid	EtFOSAA	2991-50-6
Fluorotelomer Sulfonic Acids	4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4
	10:2 Fluorotelomer sulfonic acid	10:2 FTS	120226-60-0

1.6 Relevant Regulation and Guidance

This PFAS DSI has been developed considering the following legislation and guidance.

- *DES, Queensland Auditor Handbook for Contaminated Land, Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports (2018)*
- *Environmental Protection Act, 1994*
- HEPA (2018) *PFAS National Environmental Management Plan (NEMP)*
- NEPC (1999) *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013) (ASC NEPM 2013):*
  - *Schedule A- Recommended general process for assessment of site contamination*
  - *Schedule B1 Guideline on Investigation Levels for Soil and Groundwater*
  - *Schedule B2 Guideline on Site Characterisation*
  - *Schedule B3 Guideline on Laboratory Analysis of Potentially Contaminated Soils*
- Standards Australia (AS4482.1-2005) *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*
- Standards Australia (AS 4482.2-1999) *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile Substances.*

A summary of guideline values adopted for this investigation is presented in **Section 5.0**.

2.0 Site Setting

2.1 Site Identification

Gladstone Fire Station is located in central Gladstone and is accessed via Tenth Avenue or Eleventh Avenue. Site identification details as identified in the PSI (AECOM, 2019) are shown in **Table 2**.

Table 2 Gladstone Fire Station Site Identification

Item	Details
Site Address	5-9 Breslin Street, Gladstone, 4680
Registered Site Owner	The State of Queensland (Represented by the Department of Community Safety, now the Public Safety Business Agency).
Registered Address of Site Owner	Public Safety Business Agency, L13 Makerston House, 30 Makerston Street, Brisbane, Queensland, 4000
Site Occupier	QFES
Local Government Area	Gladstone Regional Council
Zoning	Lot 5 on RP606760 is zoned Low Density Residential Lots 6 to 10 on RP606760 is zoned Community Facilities
Future Zoning	As above
Lot and Plan	Lot 5 to 10 on RP606760
Tenure	Freehold
Latitude / Longitude	-23.858260, 151.249317
Site Area	4,630m^2
Current / Future Site Use	Current and future site use is as a fire station (i.e. commercial/industrial land use).
Environmental Management Register (EMR) / Contaminated Land Register (CLR)	A search of the DES EMR and CLR for Lots 5 to 10 on RP606760 (see **Appendix C**) indicated that these lots are not included on either the EMR or CLR.

2.2 Site Layout and Features

The site layout is detailed on **Figure 2**, **Appendix A**. The PSI (AECOM, 2019) identified that the fire station was built in about 1973 with foam concentrate present at the site since 1976 with the foam type changing several times with protein-type foams, AFFF (3M Lightwater) and Solberg foams used at the site. The infrastructure at the site is summarised below:

- Approximately 70% of the site is sealed by concrete, the remainder is occupied by grass
- Three engine bays housing five fire appliances, one operational support unit, one rescue, two firefighting and one aerial appliance
- Five-storey training tower
- A 1,000 L underground storage tank (UST) connected to a bowser. During the PSI (AECOM, 2019) the tank was observed to be filled with water
- General administration building
- Former automotive workshop with below ground vehicle servicing pit

- Training hut and foam storage building
- Undercover car parking
- Grassed area in western portion of site formerly used as a foam training area, now partly occupied by a new fire engine shed
- Waste laydown area for temporary storage of general waste, cardboard, waste oils and batteries.

During the PSI (AECOM, 2019), it was identified that the current inventory stored at the site was 8,380 L of non-fluorinated foam (Solberg foam, which is PFAS-free[3]), consisting of:

- 4 x 1000 L IBCs of Solberg 3x6 ATC Class B foam
- 132 x 20 L pails of Solberg 3x6 ATC Class B foam
- 20 x 20 L pails of Solberg Firebreak Class A foam
- 16 x 20 L pails of Solberg HX foam.

Foam concentrate is stored in the new shed in the western portion of the site. The 20 L containers are stored on pallets. Historically, foam was stored in the training hut (identified as 'training/foam store' on **Figure 2**) and the small building in the southern portion of the site (identified as 'former foam store' in **Figure 2**). The foam concentrate stored at the site is stockpile supply for use in the greater Gladstone region (Agnes Waters to Mt Larcom and west to the range at Calliope).

It is noted that the area currently occupied by grass and the new fire engine shed was identified by QFES as the former foam training area during the PSI (AECOM, 2019). Anecdotal information from QFES suggested that the lot to the west (Lot 4, RP606760) was formerly a part of the QFES site and may also have been part of the fire station before being subdivided from the current site footprint.

Site surface water run-off flows in drains from the property in the central portion of the northern boundary, to the north under Breslin Street and into the culvert adjacent to Kooyong Park and then through an old landfill (now sports fields) into Auckland Inlet located approximately 950 m to the northwest of the site.

A concrete inground water tank (Case 4 Pit) with a capacity of 8,630 L, was formerly in operation, which was located in the northeastern portion of the site. The Case 4 Pit was decommissioned sometime between 2016 and 2018 and backfilled with sand.

A decommissioned well is present adjacent to the former workshop which was reported to be 6 to 7 m deep. The well was formerly used to supply water during training exercises and has now been decommissioned by infilling with concrete.

An unused 1,000 L UST is connected to an old fuel bowser. During the PSI inspection (AECOM, 2019), the tank was reported to contain mostly water, with faint unleaded fuel odour. A service pit is present in the former workshop to provide maintenance access under vehicles. It was reported in the PSI that water occasionally seeps into the service pit, indicating that the groundwater table is shallow.

A number of underground services are present at the site including sewer lines, electrical and communications cables, main hydrant water lines and town water connections to buildings (refer to **Figure 2**, **Appendix A**), which includes service information from Dial-Before-you Dig plans. The material used to infill around these services is likely to consist of bedding sands which have the potential to act as preferential pathways for contaminant migration in the unsaturated zone. Backfill around the decommissioned Case 4 Pit and UST also have the potential to act as a preferential pathway. It is noted that no information was identified in the PSI (AECOM, 2019) on the emplacement of fill at the fire station.

There is minimal vegetation on the site, with grassed areas present in the western portion of the site in around the new engine shed (the former foam training area) and on the northern boundary of the site adjacent to Breslin Street.

[3] Reported by the manufacturer at https://www.solbergfoam.com/Foam-Concentrates/RE-HEALING-Foam.aspx

2.3 Surrounding Land Use

The site is within an urban area and is surrounded by residential and commercial / industrial businesses. Breslin Street is located on the northern site boundary. Details of surrounding land uses are provided in **Table 3** below.

Table 3 Gladstone Fire Station Surrounding Land Use

Direction	Land Use
North	Immediately north of the site is a roadway (Breslin Street) beyond which is Kooyong Park and residential properties (50 m). A concrete-lined channel is present in the southern portion of the park and runs east to west adjacent to the northern side of Breslin Street. Beyond the park are more residential properties and a childcare centre (approximately 100 m distance). The Breslin and Charles Street junction is present to the northeast of the site with residential properties beyond.
East	Adjacent east of the site is Charles Street followed by residential properties (20 m), beyond which is Quoin Street and Gladstone West State School. Commercial properties are located 300 m east of the site on the northern side of Breslin Street. Residential properties are present to the southeast of the site.
South	Adjacent south of the site are residential properties, a roadway (Walters Avenue) and a commercial property (a Motor Inn). Residential properties are present to the southwest of the site.
West	Adjacent west of the site is a commercial office building, beyond which are residential properties (20 m), a commercial retail property, the Dawson Highway and the North Coast Railway Line (approximately 145 m distance). On the western side of the rail line is Glen Creek Park, a former landfill converted into sports fields. To the northwest of the site, beyond the Dawson Highway and the rail line are residential properties (approximately 150 m distance) and Auckland Inlet (950 m distance).

2.4 Previous Environmental Investigation

A PFAS PSI was completed in April 2019 (AECOM, 2019). The key findings of the PSI are summarised below.

- Based on aerial photographs and anecdotal information, the fire station has been present since 1973 (approximately 46 years) and was previously undeveloped. The site is located in a predominantly residential area with some commercial properties. Anecdotal evidence indicated the potential for the fire station to have formerly occupied the lot to the west (Lot 4 on RP606760) prior to subdivision.
- Based on the interview information and a QFES report (QFES, 2016), different firefighting foams have been used at the site including 3M Lightwater, which is known to contain PFAS. The period of AFFF use and use of other types of foam that potentially contained PFAS is not known.
- The inventory of foam concentrate in February 2019 was 8,380 L of Solberg foam stored in IBCs and additional Solberg foam stored 20 L containers. The foam concentrate stored at Gladstone Fire Station is stockpile supply for the greater Gladstone region.
- Firefighting training using foam has occurred on-site in the grassed area in the western portion of the site. The volume of foam used during training events and the frequency of the training events have not been specified. It was not identified how out of date foam concentrate is disposed of however no inadvertent releases of foam concentrate were identified.
- PFAS was identified in water samples collected in 2016 (QFES, 2016) from the Case 4 Pit (now decommissioned) with ∑(PFHxS+PFOS) (41.9 µg/L), and PFOA (1.4 µg/L) detected. Two samples of tap water were also analysed and PFAS was not detected.

- A high-level review of the area within 4 km of the site has identified the potential for off-site sources of PFAS with the possible off-site land uses including:
  - Glen Creek Park (former landfill), located approximately 280 m west
  - Sewage pump station located approximately 770 m to the south
  - Former fuel depot located approximately 815 m to the west
  - Former Esso fuel depot located approximately 1.6 km to the southwest
  - BP depot and adjoining BP depot located approximately 1.7 km to the west-northwest
  - Industrial area beyond the Auckland Inlet, approximately 2.0 km west of the site, which includes a fuel depot, mechanical repairs depot and a waste management
  - Railyards are present 2.1 km to the southwest of the site
  - Metal fabrication plant located approximately 2.1 km to the northwest
  - Landfill located approximately 2.4 km to the northwest and adjoining new waste transfer plant
  - The Port of Gladstone is located 2.5 km southeast
  - Gladstone Airport is located 2.8 km southwest
  - Gladstone Power Station is located approximately 3 km to the west
  - Gladstone wastewater treatment plant located approximately 3.1 km to the northwest
  - Former Ampol fuel depot and adjoining fuel dept (Tropic) located approximately 3.5 km to the southwest
  - Queensland Alumina (QAL) plant 4 km to the east.
- Groundwater is present at shallow depth beneath the site as indicated by the groundwater seepages into the service pit. Regional groundwater flow was identified as being potentially towards Auckland Inlet located 950 m to the northwest.
- Stormwater run-off from the property enters underground drainage, which runs under Breslin Street (to the north of the site) and into the culvert adjacent to Kooyong Park. This culvert then flows west to the north of Glen Creek Park, a closed landfill converted into sports fields and into Auckland Inlet.

3.0 Environmental Setting

3.1 Climate

A summary of the monthly climate statistics is presented in **Table 4** below, based on information available on the Australian Government Bureau of Meteorology website[4] for the nearest weather station (Gladstone Radar [site number 039123]) for the period 1958 to 2019. Gladstone has a humid sub-tropical climate, characteristic of distinct wet and dry seasons. The wet season occurs between December and April. Mean annual rainfall is 893.8mm.

Table 4 Summary of Monthly Climate at Gladstone Radar – 1958 to 2019

Month	Mean maximum temperature (ºC)	Mean minimum temperature (ºC)	Mean rainfall (mm)
January	31.4	22.6	148.3
February	31.1	22.5	140.0
March	30.2	21.6	105.8
April	28.4	19.7	47.1
May	25.7	17.0	55.0
June	23.3	14.4	37.0
July	23.0	13.5	34.2
August	24.3	14.3	30.7
September	26.6	16.5	26.1
October	28.5	18.8	60.8
November	30.1	20.6	67.6
December	31.1	21.9	125.4

3.2 Site Topography

Gladstone Regional Council online interactive mapping accessed during the PSI (AECOM, 2019) indicates the site is relatively flat at elevation of between 10 and 20 mAHD, gently sloping from the southern boundary towards the north / northwestern boundary.

3.3 Soil Type and Acid Sulfate Soils (ASS)

Mapping from Queensland Globe indicates the soil types underlying the site and surrounding area are hard pedal mottled-yellow duplex soils.

Mapping from ASRIS indicates site has an extremely low probability of ASS occurrence. However, mapping from the Gladstone Regional Council interactive mapping tool indicates the site is located within an area of ASS, 5 to 20 mAHD.

The presence of acidic soil conditions may inhibit the sorption of PFAS onto organic matter, thus increasing mobility (CRC CARE 2018).

[4] http://www.bom.gov.au/climate/averages/tables/cw_039123.shtml

3.4 Geology

The 1:100,000 series Gladstone geological map Sheet 9150 (Queensland Department of Mines, 1988) indicates the site is underlain by Early Carboniferous Wandilla Formation of the Curtis Island Group, which consists of mudstone, arenite (sandstone) and chert. The rocks were formed on the continental slope and are likely to be part of an accretionary wedge which resulted during a subduction of the oceanic crust beneath the Australian shield. During its formation, deposition of muds and silica rich organisms (which form cherts) were interrupted by periodic turbidity flows depositing arenaceous material.

The geology reported in a registered bore (RN136123) located 325 m to the southeast of the site reported clay and gravel layers to 17.1 mbgl underlain by shale clay (identified as Wandilla Formation). The geology reported in a second registered bore (RN136127) located 710 m to the south of the site to the south indicated sand and gravel (Quaternary deposits) were present to 20 mbgl.

3.5 Hydrology

The closest hydrological feature to the site is a concrete-lined channel, located approximately 45 m to the north of the site boundary. This runs west to east along the northern side of Breslin Street adjacent to Kooyong Park. The channel runs to the west towards Auckland Inlet which is located 950 m west and northwest of the site. Auckland Inlet subsequently discharged into Port Curtis, approximately 2.8 km north of the site. A lake, Happy Valley Creek, is present 1 km to the northeast of the site. Port Curtis is also present approximately 2.8 km to the east of the site.

Gladstone Regional Council interactive mapping accessed during the PSI (AECOM, 2019) indicates a stormwater pit midway along the northern boundary and a stormwater pipe adjacent to the northern boundary of the site. Another stormwater pit is located on Charles Street at the entrance to the fire station. Gladstone Regional Council online interactive mapping indicated the site and adjacent land is not within a flood risk area.

3.6 Hydrogeology

The Groundwater Resources of Queensland 1:2,500,000 mapping indicates the aquifer beneath the site to be within metamorphic rocks, with a yield of <5 L/s and salinity of <1500 mg/L, the groundwater is noted to be suitable for most purposes, marginal for human consumption and low salt tolerant crops.

As the main hydrological feature of the area is Auckland Inlet, approximately 950 m northwest of the site, it is considered likely that the regional groundwater flow will be to the northwest towards this feature.

A search of the Department of Natural Resources, Mines and Energy (NRME) registered groundwater bore database was completed in January 2019 (AECOM, 2019) which identified two bores within 1 km of the site. The registered bore locations are shown on **Figure 1, Appendix A**. Bore logs were included in the PSI report (AECOM, 2019). As **Table 5** shows, both bores are located to the south (i.e. hydraulically upgradient of the inferred regional groundwater flow) of the site with RN136123 noted as potable for water supply.

Table 5 Registered groundwater bores within 1 km of Gladstone Fire Station

Bore ID	Distance and Direction	Screened Depth	Additional Comments / Use if Known
RN136123	325 m south	13 – 17m within silty gravel (Wandilla Formation)	Standing water level (SWL) noted as 11.1 metres below ground level (mbgl), quality noted as potable, yield 1 L/s. Installed in 2005, role for water supply
RN136127	710 m south	17 – 19.7m within coarse gravel (Quaternary undefined)	Abandoned but still useable, SWL noted as 12.7m depth, installed in 2002. Quality noted as TDS 6000 mg/L, yield 2.53 L/s

3.7 Environmental Values

The site is present within the Curtis Island, Calliope River and Boyne River Basins Environmental Values and Water Quality Objectives (Department of Environment and Heritage Protection (DEHP), 2014). The Environmental Values (EV) listed for estuarine water in the Auckland Inlet (part of Calliope River Basin) and groundwater within the Calliope River Basin are identified in **Table 6**.

Table 6 Surface Water Environmental Values for the Calliope River Basin

Waterway Name	Aquatic Ecosystems	Irrigation	Farm Supply/Use	Stock water	Aquaculture	Human Consumer	Primary Recreation	Secondary Recreation	Visual Recreation	Drinking Water	Industrial Use	Cultural and Spiritual Values
Auckland Inlet	X				X	X		X	X		X	X
Groundwaters	X	X	X	X		X				X	X	X

3.8 Groundwater Dependent Ecosystems (GDE) and Environmentally Sensitive Areas

A search of the Groundwater Dependent Ecosystems (GDE) database[5] indicated the following aquatic ecosystems are present within 4 km of the site: Wetland at Calliope River – moderate to high potential GDE. No subterranean and terrestrial GDEs were identified.

A search of the Environmentally Sensitive Areas (ESAs) database[6] indicated that the site is within a river improvement area (Category C). Areas along the Auckland Inlet are classed as Category B endangered regional ecosystems (biodiversity status) and marine plants (Category B).

[5] http://www.bom.gov.au/water/groundwater/gde/map.shtml
[6] https://environment.des.qld.gov.au/licences-permits/maps_of_environmentally_sensitive_areas.php

4.0 Fieldwork- DSI

4.1 Overview

Fieldwork was completed between July and August 2019 in accordance with the SAQP dated April 2019 (AECOM, 2019). Details of the tasks completed are shown in **Table 7**.

Table 7 Summary of Fieldwork

Activity	Dates
Service clearance survey at proposed soil bore locations	31 July 2019
Drilling of six soil bores (GS_BH01 to GS_BH06), collection of soil samples, conversion to groundwater monitoring wells (GS_MW01 to GS_MW06), well development	01 August 2019
Advancement of three shallow soil bores (GS_SS1 to GS_SS3) and collection of soil samples	
Gauging and collection of groundwater samples from the six newly installed wells (GS_MW01 to GS_MW06)	12 – 13 August 2019
Collection of sediment sample (GS_SED01), surface water sample (GS_SW03) and a surface soil sample (GS_SS4)	
Surveying of the groundwater monitoring wells	13 August 2019

Changes from the SAQP are identified below:

- Co-located surface water and sediment samples were to be collected from two on-site drainage channels, however, water samples GS_SW01 and GS_SW02 could not be collected as no water was present during the sampling. A third location was identified and sampled in replacement (GS_SW03). One sediment sample was collected from a drainage line (GS_SED01) and a soil sample (GS_SS04) was collected from adjacent to the truck washdown area, where waste water flows overland to the drain.
- A water sample of the seepage of groundwater into the service pit (SEEP1) was planned, however, could not be collected due to access issues.
- Due to the hardness of the ground, the target depth (0.5 mbgs) of the shallow soil bore GS_SS1 could not be reached. In replacement an additional soil bore was drilled (GS_SS3).

4.2 Sampling Rationale

An overview of the rationale for sampling locations is presented in **Table 8**. The sampling locations are shown on **Figure 2**, **Appendix A**. The coordinates of sampling positions are shown in **Table T1**, **Appendix B**. Photographs taken during the fieldworks are shown in **Appendix D**.

Table 8 Sampling Rationale

Location ID	Location/Rationale
GS_BH01 / GS_MW01	To investigate PFAS in soil and groundwater within the former foam training area. Located on the western site boundary, which is potentially hydraulically down-gradient of site features.
GS_BH02 / GS_MW02	To investigate PFAS in soil and groundwater within the former foam training area. Located in the northern portion of the former foam training area, potentially along the hydraulically down-gradient boundary.
GS_BH03 / GS_MW03	To investigate PFAS in soil and groundwater in the southern portion of the site, potentially hydraulically downgradient of the former foam store.
GS_BH04 / GS_MW04	To investigate PFAS in soil and groundwater in the northern portion of the site, potentially hydraulically down-gradient of site activities including the waste laydown area.
GS_BH05 / GS_MW05	To investigate PFAS in soil and groundwater in the northern portion of the site, potentially hydraulically down-gradient of the training tower and training foam store.
GS_BH06 / GS_MW06	To investigate PFAS in soil and groundwater in the northwestern corner of the site, which is potentially hydraulically cross or up-gradient of site features.
GS_SS1	To investigate PFAS in soil in the former foam training area.
GS_SS2	To investigate PFAS in soil in the former foam training area.
GS_SS3	To investigate PFAS in soil in the former foam training area.
GS_SS4	To investigate PFAS in soil adjacent to the truck washdown area.
GS_SED01	Sediment sample from drainage pit in northern portion of the site which may have received waste foam. Collected to investigate the potential for residual PFAS impacts in sediment.
GS_SW03	Water sample from drainage line along the external western side of the workshop. Collected to investigate the potential for residual PFAS impacts.

Due to the ubiquity of PFAS used in a variety of everyday products and the potential for cross-contamination during sampling activities, the recommended mitigation practices identified in the NEMP (HEPA, 2018) and Western Australia's Department of Environmental Regulation (2017) were implemented during the sampling program as stipulated in the SAQP (AECOM, 2019). Further details on the QA/QC practices employed are provided in **Appendix H**.

4.2.1 Soil Investigation

Sampling methodologies and details relating to laboratory analysis of samples are described in the SAQP (AECOM, 2019). The soil investigation methodology is described in **Table 9**.

Table 9 Soil Investigation Methodology

Activity/Item	Details
Service location	AECOM obtained on-site utility plans and Dial-Before-You-Dig service plans before the start of the works. A contractor (CQ Locating) conducted service location and cleared proposed bore locations for services. Concrete coring was conducted at one location (GS_BH03). All soil bores were advanced by non-destructive digging (vacuum extraction using a water lance) to 1.5 mbgl (where possible) to confirm the absence / presence of underground utilities.
Drilling method and target depth	Soil bores (for conversion to groundwater monitoring wells) were advanced by a contractor (Proactive Drilling Services Pty Ltd) with a Geoprobe drilling rig using solid stem augers to the target depth (approximately 7.0 to 7.4 mbgl). GS_SS2 and GS_SS3 were advanced using a hand auger to the target depth of 0.5 mbgl. GS_SS1 and GS_SS4 were surface samples only (approximately 0.15 mbgl) collected with a hand auger and by hand, respectively.
Soil logging	Soil logging was in accordance with the unified soil classification system (USCS) and AS1726-2016. The soil profile(s) encountered are provided in bore logs in **Appendix E**.
Soil sampling	During drilling, samples were obtained at the depths specified in the SAQP. To reduce the likelihood of cross-contamination, soil samples were collected using new nitrile gloves and placed into laboratory supplied sample containers. Sample jars were filled to the top and securely sealed. The field quality assurance / quality control (QA/QC) samples comprised intra-laboratory duplicate samples, inter-laboratory duplicate samples and rinsate blank samples.
Soil sample preservation	During collection in the field, soil samples were placed in eskies kept cool with bagged ice prior to air transport to the laboratory. Samples were submitted with chain of custody documentation to a laboratory NATA accredited for the analyses performed.
Decontamination procedures	The decontamination procedures were performed before initial use of re-useable equipment and after each subsequent use. All reusable sampling equipment was decontaminated between each sample by scrubbing in a solution of Liquinox[7] and potable water before being rinsed in PFAS free distilled water. For each day of sampling, following decontamination procedures, a rinsate blank was completed by running laboratory prepared rinsate water over the reusable sampling equipment for collection directly into laboratory prepared sampling containers for analysis. At each sample location, a new set of disposable nitrile gloves was used to directly collect soil samples from the reusable sampling equipment for placement into the laboratory prepared sampling containers.
Disposal of waste	Waste soil generated during the drilling was disposed of into 205 L drums for temporarily storage in an area nominated by QFES.

[7] Further information on PFAS-free status of Liquinox is provided at http://technotes.alconox.com/industry/laboratory/manual-lab-cleaning/pfoa-pfos-pfas-alconox-cleaners/

4.2.2 Groundwater Investigation

The groundwater investigation methodology is described in **Table 10**.

Table 10 Groundwater Investigation Methodology

Activity	Details
Monitoring well installation	Monitoring well construction comprised a 50 mm diameter uPVC screen and casing with screw fittings, installed in an approximately 150 mm diameter bore. All four wells were installed to between 7.0 and 7.4 mbgl. Screen length varied between wells dependent on water strike. Screened sections were installed in a gravel filter pack to 0.5 m above the top of the screen and isolated with a 1 m thick bentonite seal. Each well was fitted with a flush mounted gatic and secured into position with concrete. A water tight enviro-cap was installed on the top of each well casing to prevent accidental blockage of the well.
Well development	Wells were developed following installation using a foot pump. The wells were purged until the extracted water was 'clearing' and field parameters were stabilised. Monitoring well construction details can be found in **Table T1, Appendix B**.
Well gauging	Monitoring wells were gauged using an oil/water interface probe. The results of groundwater level gauging are presented in **Table T2, Appendix B**. The field sheets and calibration certificates are provided in **Appendix F**.
Field Parameters	Groundwater physicochemical properties were to be measured in the field prior to sample collection using a calibrated YSI water quality meter. During the fieldworks, the water quality meter malfunctioned, which meant that field measurements could not be taken during the groundwater sampling.
Groundwater sampling	The groundwater sampling procedure is described in detail in the SAQP (AECOM, 2019). Groundwater samples were collected from each monitoring well using a low flow peristaltic pump in accordance with Australian Standard AS5667.11 (1998) and the AECOM Standard Operating Procedure (SOP). Samples were obtained following stabilisation of field parameters and standing water level. The field QA/QC samples comprised intra-laboratory duplicate samples, inter-laboratory duplicate samples and rinsate blanks.
Sample preservation	During collection in the field, samples were placed into the appropriate laboratory-supplied containers and placed in an esky, which was kept cool with bagged ice before being delivered to the laboratory. Samples were submitted with chain of custody documentation to a laboratory NATA accredited for the analysis requested.
Decontamination procedures	The oil/water interface probe and peristaltic pump were decontaminated by scrubbing in a solution of Liquinox[8] and potable water before rinsing with PFAS-free distilled water between each groundwater well. A rinsate sample was collected from either the interface probe or peristaltic pump each day of sampling. Dedicated tubing was used for during the monitoring of each well to minimise the potential for cross-contamination and appropriate silicone and HDPE tubing was used which is PFAS-free. A new pair of nitrile gloves were used for each well sampled.
Disposal of waste	Purged groundwater was disposed of into a 205 L waste drum, which was temporarily stored in an area nominated by QFES.
Surveying	Surveying of newly installed groundwater wells was completed by Veris Pty Ltd. The surveying report is presented in **Appendix G**.

[8] Further information on PFAS-free status of Liquinox is provided at http://technotes.alconox.com/industry/laboratory/manual-lab-cleaning/pfoa-pfos-pfas-alconox-cleaners/

4.2.3 Sediment Investigation

The sediment sampling methodology is summarised in **Table 11**.

Table 11 Sediment Investigation Methodology

Activity	Details
Sediment sampling	On-site sediment samples were collected using a gloved hand placing the sample directly into laboratory sample jars. At each location the sample jar was filled to the top to ensure no headspace and the cap was immediately applied.
Sample preservation	Samples were placed into the appropriate laboratory-supplied containers and placed in an esky, which was kept cool with bagged ice. Samples were submitted with chain-of-custody documentation to a laboratory NATA accredited for the analysis performed.
Decontamination	A new pair of disposable nitrile gloves was used to collect each sediment sample to avoid the potential for cross contamination.

4.2.4 Surface Water and Tap Water Investigation

The water sampling methodology is summarised in **Table 12**.

Table 12 Surface Water Investigation Methodology

Activity	Details
Surface water sampling	At the drain location, the surface water grab sample was collected by hand by placing the sample bottle in the drain. Care was taken to ensure the water column at the sampling location was not agitated during sampling.
Sample preservation	Samples were placed into the appropriate laboratory-supplied containers and placed in an esky, which was kept cool with bagged ice. Samples were submitted with chain-of-custody documentation to a laboratory NATA accredited for the analysis performed.
Decontamination	A new pair of disposable nitrile gloves was used to collect the surface water sample to avoid the potential for cross-contamination.

4.3 Laboratory Analysis and Quality Assurance / Quality Control

A summary of samples analysed for this DSI are shown in **Table 13**. The laboratory analysis was conducted by Australian Laboratory Services (ALS) (primary laboratory) and National Measurement Institute (NMI) (secondary laboratory).

Table 13 Summary of Laboratory Analyses

Sample Media	Number of primary samples analysed for PFAS	No of duplicate samples	No of triplicate samples	No of rinsate samples
Soil	23	3	3	5
Groundwater / Surface water	6	1	1	
Sediment	1	1	1	

4.3.1 Data Quality Objectives and Analytical Data Validation

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

AECOM has undertaken a review of the laboratory analytical results for quality control purposes; the results of the data validation process are presented in **Appendix H** and the laboratory quality control reports are included in **Appendix I**. In summary, while some non-conformances have been identified, these are considered of minor importance and it is concluded that the dataset presented in this report is suitable for use.

5.0 Assessment Criteria

The guidelines values relevant for the site that have been adopted for this investigation are identified in **Table 14**. The guideline values are considered to provide a suitable level of protection for all EVs identified (refer to **Section 3.7**).

Table 14 Adopted investigation levels for PFAS

Media	Environmental Value	PFAS	Guideline Value
Soil	Human health- industrial / commercial land use	∑PFHxS+PFOS	20 mg/kg[A]
		PFOA	50 mg/kg[A]
	Ecosystems- interim soil – ecological indirect exposure (residential)	PFOS	0.01 mg/kg[A]
	Ecosystems- interim soil – ecological indirect exposure (commercial)		0.140 mg/kg[A]
Groundwater	Human health- drinking water	∑PFHxS+PFOS	0.07 µg/L[A]
		PFOA	0.56 µg/L[A]
Groundwater discharging to surface water / surface water	Aquatic ecosystem protection (99% species protection)	PFOS	0.051 µg/L[B]
		PFOA	19 µg/L[A]
	Human health- recreational contact with waters	∑PFHxS+PFOS	2.0 µg/L[C]
		PFOA	10 µg/L[C]
Sediment	No Criteria	-	-

Notes:

A NEMP (HEPA, 2018)

B It is noted, that the NEMP (HEPA, 2018) 99% species protection guideline value for PFOS (0.00023 µg/L) is below the laboratory limit of reporting (LOR) and that the CSIRO has undertaken work to further review the draft freshwater criteria presented in the HEPA (2018) NEMP. The revised draft guideline values for PFOS were presented in Batley et al., 2018, Application of revised methodologies for default guideline value derivations: PFOS in freshwater at the Society of Environmental Toxicology and Chemistry (SETAC) North America scientific conference in November 2018. AECOM understands, through discussions with CSIRO, that these values are currently being further revised to consider more recent ecotoxicity testing results and the updated statistical interpretation methodology recommended in ANZG (2018). In the interim, both the draft freshwater criteria from the HEPA (2018) NEMP and the draft revised criteria proposed by Batley et al (2018) will be used to evaluate the data.

C Australian Government National Health and Medical Research Council (2019), Guidance on Per and Polyfluoroalkyl substances in Recreational Water. Values are for recreational activities in natural waters only and not applicable for water extracted to fill swimming pools.

6.0 Results

6.1 Soil Conditions

The bore logs for the six new soil bores (GS_BH01 to GS_BH06) and three shallow soil bores (GS_SS1 to GS_SS3) drilled in August 2019 are shown in **Appendix E**. Soil bores GS_BH01 to GS_BH06 were drilled to between 7.0 and 7.4 mbgl before conversion to groundwater monitoring wells. GS_SS2 and GS_SS3 were hand augured to 0.5 mbgl. GS_SS1 was hand augured to 0.15 mbgl before refusal. GS_SS4 was a surface soil collected by hand from an area adjacent to the truck washdown area.

Soil conditions consisted of fill material as clay and sand primary constituents with silty and gravel inclusions to 0.5 mbgl underlain by gravel fill comprising a volcaniclastic sedimentary rock conglomerate to 1.8 mbgl. This was underlain by a disturbed natural silty or sandy clay except for BH01 where the gravel fill was underlain by a gravelly clay. Natural soil was generally identified as a silty or sandy clay except for BH01 which has secondary gravel inclusions to depth.

The natural soil profile is considered to be a weathered section of the Carboniferous Wandilla Formation. The geology of the bedrock encountered below the clay at approximately 7.4 mbgl is not known. Based on the presence of quartz arenite gravel within the clay, the bedrock possibly consists of arenite (sandstone).

There was no visual or olfactory indication of contamination in the soil samples during the drilling.

6.2 Hydrogeology

6.2.1 Observations during Drilling

Groundwater was encountered within the natural silty / sandy clay horizon in soil bores GS_BH02 to GS_BH06 at approximately 4.5 mbgl. Groundwater was encountered within gravelly clay in GS_BH01 at approximately 4.8 mbgl.

The depths of the groundwater strikes are shown on the bore logs in **Appendix E** and in **Table T1**, **Appendix B**.

6.2.2 Groundwater Elevations and Groundwater Flow Direction

The six groundwater monitoring wells sampled during this investigation were gauged before groundwater samples were collected. The standing water levels (SWLs in metres below top of casing [mbtoc]) were between 1.466 and 2.383 mbtoc. The corrected groundwater elevations were between 8.545 and 8.957 mAHD. The SWLs and corrected groundwater elevations are presented in **Table T2**, **Appendix B**.

The inferred groundwater contours and local groundwater flow direction at the fire station are shown on **Figure 3**, **Appendix A**. Based on the available data, groundwater is inferred to locally flow toward the northwest. It is noted however that the lateral groundwater (i.e. east – west) dataset is limited. In the northern portion of the former foam training area, there is the potential for a component of flow to be towards the northeast.

6.2.3 Water Quality Parameters

Physicochemical parameters (pH, electrical conductivity, dissolved oxygen and redox potential) were planned to be collected from groundwater samples collected from each monitoring well, however, due to the malfunction of the water quality meter, none of the parameters could be collected. Laboratory testing for parameters was considered, however was not conducted as the maximum hold times would be exceeded (due to the long transit time to the laboratory) and therefore the data could not be relied on. The non-collection of these data impacts interpretation by limiting understanding of the potability of the groundwater and pH, which can affect the transport of PFAS contaminants in groundwater.

6.2.4 Groundwater Field Observations

Field observations are identified in **Table T3**, **Appendix B** and are recorded on the field sheets presented in **Appendix F.** Other than a sulphurous odour in two monitoring wells (GS_MW02 and GS_MW06), there was no visual or olfactory indication of contamination in the monitoring wells during the groundwater sampling, including no identification of non-aqueous phase liquids, foaming or other odours. The sulphurous odour is potentially indicative of contamination and/or associated with decaying vegetation.

6.3 Analytical Results

6.3.1 Soil

The soil analytical results are presented in **Table T4**, **Appendix B** and on **Figure 4**, **Appendix A**. The laboratory analytical reports are presented in **Appendix I**. PFAS was detected in 22 of the 23 soil samples analysed. The only sample where PFAS was not detected was GS_BH06 at 7.0 mbgl, in the northeastern corner of the site hydraulically cross gradient of the potential source areas including the old foam storage shed and former foam training area.

There were no exceedances of the human health guideline values for commercial land use in the soil samples analysed. A summary of the results in comparison against the adopted human health guideline values is presented in **Table 15.**

Table 15 Summary of PFAS Soil Analytical Results and Assessment with Human Health Guideline Values

Com-pound	No. of samples analysed	No. of samples >LOR	Maximum concentration (mg/kg)	Human health commercial guideline value (mg/kg)	No. of samples exceeding human health commercial guideline value
∑PFHxS+ PFOS	23	22	4.08[9]	20	0
PFOS	23	22	3.91	No guideline value	
PFOA	23	22	0.123	50	0
Sum of PFAS	23	22	4.93	No guideline value	

A summary of the results in comparison against the adopted ecological guideline values is presented in **Table 16.** There were six exceedances of the ecological guideline value for PFOS (indirect exposure) for a commercial / industrial land use (not including duplicate / triplicate samples). The six exceedances were all reported within samples collected from soil bores from within the former foam training area (GS_BH01, GS_BH02, GS_SS1, GS_SS2 and GS_SS3).

An assessment of soil PFAS concentrations with the residential land use ecological guidelines for indirect exposure was also performed, as the landscaped areas are open ground/grassed areas where secondary consumers such as insectivorous birds and mammals may forage. This is a conservative approach, as it is considered that the wildlife would be transient in nature due to the urbanised setting of the site. There were fourteen exceedances of the ecological guideline value for PFOS for indirect exposure for residential land-use (not including duplicate and triplicate results). A summary of the results in comparison against the ecological criteria is presented in **Table 16**.

[9] Quality assurance samples were analysed for soil sample GS_BH02 0.5 m with ∑PFHxS+PFOS in the primary sample reporting 4.1 mg/kg, the intra-laboratory (duplicate) sample reporting 5.2 mg/kg and the inter-laboratory (triplicate) sample reporting 5.3 mg/kg. The results indicate variability in the samples, possible due to heterogeneity. Primary sample results are shown.

Table 16 Summary of PFAS Soil Analytical Results and Assessment with Ecological Guideline Values

Com-pound	No. of samples analysed	No. of samples >LOR	Max. concen-tration (mg/kg)	Ecological guideline commercial / residential (mg/kg)	No. of samples exceeding of commercial guideline value	No. of samples exceeding of residential guideline value
∑PFHxS +PFOS	23	22	4.08	No guideline value	No guideline value	No guideline value
PFOS	23	22	3.91	0.14 / 0.01	6	14
PFOA	23	22	0.123	No guideline value	No guideline value	No guideline value
Sum of PFAS	23	22	4.93	No guideline value	No guideline value	No guideline value

6.3.2 Groundwater

The groundwater analytical results for samples collected from the six on-site monitoring wells are presented on **Figure 5**, **Appendix A** and in **Table T5**, **Appendix B.** The laboratory analytical reports are presented in **Appendix I**. A summary of the assessment of the results with human health guideline values is presented in **Table 17** below.

Table 17 Assessment of Groundwater Results with Human Health Guideline Values

Compound	No. of samples analysed	No. of samples >LOR	Maximum concen-tration (µg/L)	Human health drinking water / recreational water guideline values	No. of samples exceeding drinking water guideline value	No. of samples exceeding recreational water guideline value
∑(PFHxS+ PFOS)	6	6	267	0.07 / 2.0	6	3
PFOA	6	6	8.02	0.56 / 10.0	2	0
Sum of PFAS	6	6	494	No guideline		

The groundwater analytical results for ∑(PFHxS+PFOS) and PFOA concentrations are presented on **Figure 5**, **Appendix A**. Groundwater samples from all six monitoring wells exceeded the NEMP (HEPA, 2018) human health guideline values for drinking water for ∑PFHxS+PFOS. Two of the samples from GS_MW01 and GS_MW02 had higher concentrations (105 and 267 ug/L, respectively) compared to the other four samples (0.11 to 2.47 µg/L). GS_MW01 and GS_MW02 are located within and hydraulically down-gradient of the former foam training area in the northwestern portion of the site. The concentrations of PFOA in the samples from GS_MW01 and GS_MW02 also exceeded the human health guideline value for drinking water.

Three of the groundwater samples (GS_MW01, GS_MW02 and GS_MW03) also exceeded the recreational water guideline value for ∑PFHxS+PFOS. None of the groundwater samples exceeded the recreational water guideline for PFOA.

The concentration of PFOS in all six groundwater samples exceeded the NEMP (HEPA, 2018) ecological guideline values for 99% species protection for fresh water. Four of the samples (GS_MW01 to GS_MW04) also exceeded the adopted ecological investigation level for 99% freshwater species protection value identified in Batley et. al (2018). There were no exceedances of the adopted ecological guideline values for PFOA.

6.3.3 TOPA

TOPA is used to detect certain harder to analyse PFAS precursor compounds that may be present. One soil sample and one groundwater sample were analysed for TOPA with the results summarised in **Table 18**.

Table 18 Summary of TOPA Analysis (Soil and Groundwater)

Sample	Units	Sum of 28 PFAS (standard analysis)	Sum of 28 PFAS (TOPA)	Sum of TOP C4-C14 Carboxylates and C4-C8 Sulfonates	% of Sum of 28 TOPA to 28 PFAS standard analysis
GS_BH02_0.5_190801	mg/kg	4.93	2.49	2.49	-50%
GS_MW02_190813	µg/L	494	494	493	0%

Review of the analytical results for TOPA indicates the soil sample has fully oxidised, however, full oxidation of the groundwater sample did not occur as indicated by the detection of 1.0 µg/L 6:2 FTS.

Comparison of the results for the soil sample indicates the sum of 28 PFAS by TOPA was 50% lower than the sum of 28 PFAS by standard analysis. This indicates depletion of oxidant by compounds other than PFAS compounds during the TOPA reaction. Alternatively, the difference could reflect heterogeneity of the subsamples taken within the fill material. The results indicate full oxidation of 6:2 FTS and 8:2 FTS have occurred with slight increases in the concentration of four shorter chain PFAS (PFBA, PFPeA, PFHxA and PFHpS).

Comparison of the results for the groundwater sample indicated the sum of 28 PFAS by TOPA was equal to the sum of 28 PFAS by standard analysis, suggesting no depletion of oxidants by compounds other PFAS during the TOPA reaction. The result suggests a degraded PFAS product that is unlikely to significantly increase through biotransformation or oxidation processes. However, it is noted that full oxidation of the sample did not occur (as indicated by the detection of 6:2 FTS in the sample analysed by TOPA), so the possibility that other fluorinated organic compounds may be present cannot be discounted. The TOPA results indicates the reduction of the majority of the fluorotelomers and corresponding increase in shorter chain compounds with the concentration of some compounds increasing significantly including PFBA (630%), PFPeA (213%), PFHxA (104%) and PFBS (42%).

6.3.4 Surface Water

The surface water analytical result for one sample collected from the drainage pit located on the western side of the workshop is presented on **Figure 6, Appendix A** and in **Table T6, Appendix B.** It was noted during field works that the drain in this area collects surface water runoff from the concrete slab in the centre of the site where trucks discharge water and conduct cleaning.

The laboratory analytical reports are presented in **Appendix I**. A summary of the assessment of the results with human health and ecological guideline values is presented in **Table 19** below.

Table 19 Assessment of Surface Water Results with Human Health and Ecological Guideline Values

Com-pound	No. of samples analysed	No. of samples >LOR	Maximum concen-tration (µg/L)	Human health recreational guideline value	Ecological guideline value HEPA 2018 / Batley 2018	No. of samples exceeding recreational water guideline value	No. of samples exceeding ecological value HEPA, 2018 / Batley et al 2018
∑(PFHxS + PFOS)	1	1	0.0499	2.0	No guideline	0	No guideline
PFOS	1	1	0.0434	No guideline	0.00023 / 0.051	No guideline	1 / 0
PFOA	1	1	0.0017	10	19 / None	0	0
Sum of PFAS	1	1	0.092	No guideline			

The surface water concentrations did not exceed the NEMP (HEPA, 2018) recreational guidelines for ∑(PFHxS+PFOS) or PFOA.

The surface water sample exceeded the NEMP (HEPA, 2018) ecological guidelines for 99% freshwater species protection for PFOS, however, it did not exceed the proposed updated guideline value presented in Batley et. al (2018).

6.3.5 Sediment

The sediment analytical results for the one sample collected from an on-site drain (GS_SED01) are presented in **Figure F6, Appendix B** and on **Table 7, Appendix A**. The laboratory analytical reports are presented in **Appendix I**. The concentration of sum of PFAS in the primary sample[10] was 0.26 mg/kg with the main compounds detected comprising long chain perfluorinated carbons including PFUnDA (0.14 mg/kg) and PFTrDA (0.09 mg/kg). ∑(PFHxS+PFOS) concentration was 0.0048 mg/kg.

No suitable criteria are available for assessing human and ecological risk from sediment. It is noted that the sediment PFHxS, PFOS and PFOA concentrations do not exceed either human health or ecological soil guidelines values for commercial landuse. The moisture content of SED01 was reported as 17.1%.

[10] Quality assurance samples indicate variability in PFAS concentrations in the sediment. The highest concentrations were detected in a triplicate sample (QC208) which had 0.42 mg/kg sum of PFAS, which mainly consisted of PFUnDA (0.23 mg/kg) and PFTrDA (0.15 mg/kg). The results are considered to reflect heterogeneity in the sediment.

7.0 Discussion

7.1 Geological and Hydrogeological Conditions

7.1.1 Soil Conditions

Based on the soil conditions recorded in the bore logs, the subsurface lithology beneath the site consists of clay, sand and gravel fill to 0.5 mbgl underlain by gravelly fill between approximately 0.5 and 1.8 mbgl. A disturbed or natural silty or sandy clay was present up to approximately 3.8 mbgl underlain by a natural silty or sandy clay with quartz arenite gravel to the maximum depth of the investigation (7.4 mbgl) overlying bedrock. The natural material is interpreted to be a weathered zone of the Wandilla Formation which consists of mudstones and sandstones. The geology of the bedrock is unknown.

The presence of fill materials and disturbed ground across the site suggests the near surface ground has undergone historical development. Due to the presence of the fill, building foundations are likely to extend beneath this layer to the clay or bedrock. Backfill around building foundations is likely to consist of coarse material which would have the potential to create preferential vertical pathways.

7.1.2 Hydrogeology

Groundwater strikes during drilling were at approximately 4.5 mbgl. As measured groundwater elevations were between 1.47 and 2.38 mbgl, this indicates the presence of a semi-confined aquifer, within the clay layer that overlies the bedrock between about 1.5 and 7.4 mbgl. Based on the geology of the area, it is considered possible that the groundwater table is present within the underlying rock formation (mudstone or sandstone) with the potential for groundwater flow to occur by fracture flow.

Based on the groundwater elevation data, the inferred hydraulic contours indicate local groundwater flow is to the northwest. This is consistent with the expected regional groundwater flow direction, which is considered to be towards the Auckland Inlet, located approximately 950 m to the northwest.

The former foam training area is located in an unsealed area of grass cover / bare earth which is now partly occupied by the new fire engine shed. It is likely that the majority of training exercises completed using AFFF would have resulted in the application of foam directly to the soil surface with subsequent direct infiltration to the subsurface. PFAS infiltration may have occurred vertically through the unconsolidated surface fill, rock fill layer and underlying disturbed or natural clay. Although the silty/sandy clay layer has the potential to limit (retard) vertical and lateral migration of PFAS through the unsaturated zone, the relatively high PFAS concentrations (several orders of magnitude higher than the LOR) detected in groundwater indicates the horizon is likely to be heterogeneous and there are vertical pathways for contaminant migration from the unsaturated zone.

The construction of the new fire engine shed at the location of the foam training area may have involved excavation (for construction of foundations) and stockpiling of waste soils. There is the potential for preferential pathways (i.e. flow through open excavations) to have occurred during the construction works or through backfill materials resulting in the migration of PFAS contaminants from impacted soils to the groundwater table.

With the exception of a shallow electrical line (<0.2 mbgl), services have not been identified within the footprint of the former foam training area (noting that services may be present but unidentified). An UST is present in the central portion of the site. Underground services are present to the east of the former fire training area including the sewer line running south-north to the east of the area of the decommissioned Case 4 Pit. Sewer and stormwater lines are noted to exist on the grassed area in the north of the site and underneath Breslin Street, inferred as hydraulically downgradient of the site. These services, including the decommissioned Case 4 Pit and the UST, may create preferential pathways via coarse backfill materials for contaminant migration through areas of clay fill.

7.2 Soil Analytical Results

The investigation results indicate PFAS concentrations are highest in samples collected from the northern portion of the area identified as the former fire training area in the PSI (AECOM, 2019). PFOS was reported in GS_BH02 at 0.5 mbgl (5.1 mg/kg) and in GS_SS3 at 0.1 mbgl (2.5 mg/kg) and these results are one order of magnitude higher compared to the next highest concentration detected in soil at the site. This indicates impacted near surface soil in this area is a secondary source area with potential for leaching of PFAS to groundwater or surface water.

Soil samples from nearby shallow soil bores, GS_SS1 and GS_SS2 (advanced to 0.5 mbgl), located in the southern portion of the former foam training area, reported ∑(PFHxS+PFOS) concentrations up to 0.22 mg/kg indicating detectable impacts are present in the 0.1 to 0.5 mbgl depth interval across the foam training area. PFAS impacts in near surface soil were also detected in GS_BH04, located to the east of the foam training area, across the access driveway from Breslin Street. The concentration of PFOS detected at GS_BH04 at 0.1 mbgl (0.13 mg/kg) was noted to be similar to the concentrations detected within the foam training area (e.g. GS_SS1 or GS_SS2). PFOS concentrations at GS_BH06, located in the northeastern corner of the site were relatively lower compared the foam training area, with the reported PFOS concentration close to the LOR (up to 0.0054 mg/kg).

PFAS concentrations in soil may be unevenly distributed in the foam training area with areas with relatively higher concentrations likely to be associated with areas where foam training was conducted more frequently. The lateral extent of PFAS impacts is uncertain and the presence of other areas of soil with elevated PFAS concentrations within, or outside, the foam training area cannot be discounted.

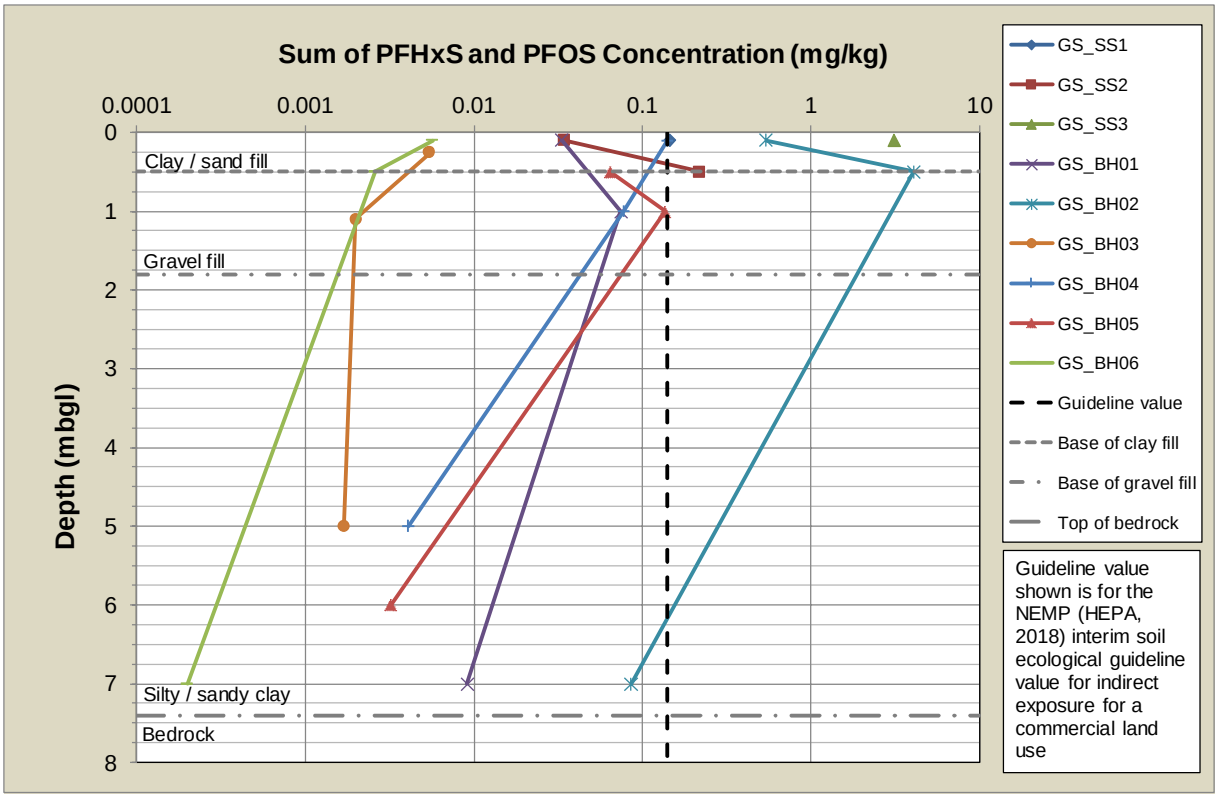
Chart 1 presents the ∑(PFHxS+PFOS) concentrations with depth for soil bores. Concentrations in samples from the saturated zone (5.0 – 7.0 mbgl) in natural clay at deeper soil bores, particularly within the foam training area (GS_BH01 and GS_BH02), were at least two orders of magnitude lower than within sandy and gravelly fill from the 0 to 1.8 mbgl depth interval indicating attenuation with depth through the unsaturated soil profile. This may be due to sorption within the clay matrix in silty / sandy clay type soils. The higher PFAS concentrations in the 0 to 1.8 mbgl depth interval is consistent with surface-based sources, such as direct application of foam to unsealed ground or spills.

The highest ∑(PFHxS+PFOS) concentration reported in soil samples is approximately 25% of the NEMP (HEPA, 2018) guideline value for human health for a commercial land use. Except for two soil samples from within the former foam training area, all other samples were at least two orders of magnitude below this guideline value.

All six exceedances of the NEMP (HEPA, 2018) guideline value for PFOS for ecological indirect exposure for a commercial land use, were reported in shallow soils (<0.5 mbgl) within the former foam training area, indicating a potential risk to terrestrial ecological receptors. However, this is likely to be mitigated by the lack of open space, the extensive paving which will prevent access to the subsurface soils and the minimal vegetation to be ingested and consumed by higher order predators.

The soil results indicate the presence of longer chain (e.g. greater than eight perfluorinated carbons) in the shallower samples from 0.1 and 0.5 mbgl, with PFUnDA (up to 1.14 mg/kg) and PFTrDA (up to 0.224 mg/kg) frequently present. Longer chain compounds were generally not detected in any of the soil samples from 5.0 to 7.0 mbgl (except for BH05 at 6.0 mbgl where PFUnDA and PFTrDA were detected at concentrations close to the LOR) indicating the low mobility of these longer chain compounds.

Chart 1 Concentration of ∑(PFHxS+PFOS) with depth in soil bores excluding GS_BH02 at Gladstone Fire Station



7.3 Groundwater Analytical Results

The highest ∑(PFHxS+PFOS) concentrations were detected in samples from the two monitoring wells (GS_MW01 at 267 µg/L and GS_MW02 at 105 µg/L), which are located within the former foam training area in the western portion of the site. Much lower concentrations were detected in the other four monitoring wells located in the central and eastern portions (∑(PFHxS+PFOS) were between 0.1 and 2.5 µg/L in GS_MW03 to GS_MW06). Although the former foam training area is hydraulically down-gradient of other features at the site (groundwater flow direction is to the northwest), the results are considered to indicate elevated groundwater impacts (at GS_MW01 and GS_MW02) are associated with former training activities in the former foam training area due to the elevated soil PFAS impacts detected in this area.

As the monitoring wells with the highest PFAS concentrations are located adjacent to the hydraulically down-gradient site boundaries, it is considered likely that PFAS impacts in groundwater (in particular, PFHxS, PFOS and PFOA) extend off-site to the northwest of the site at concentrations that exceed the NEMP (HEPA, 2018) human health drinking water and recreational guidelines and also the ecological guidelines for 99% freshwater species protection. The lateral extent of PFAS at concentrations exceeding the guideline values has not been established in any direction.

Monitoring well GS_MW03 is located adjacent to, and directly hydraulically down-gradient of the former foam store. PFAS was detected in a sample from this monitoring well (∑(PFHxS+PFOS) was 2.5 µg/L), which could indicate that historical spills or leaks from the former foam source may have locally impacted groundwater. A lower concentration of PFHxS and PFOS (1.6 µg/L) was detected in GS_MW04, located approximately 30 m hydraulically down-gradient of GS_MW03, potentially indicating attenuation of PFAS. Similar PFAS compounds were detected in monitoring wells GS_MW01 to GS_MW05. Fluorotelomers (mainly 6:2 FTS) were detected in the four groundwater samples (GS_MW01 to GS_MW04) with the highest sum of PFAS concentrations. These four monitoring wells are considered to be positioned close to potential on-site source areas. The groundwater sample from GS_MW06 had a slightly different signature with relatively higher concentrations of PFUnDA compared to the other groundwater samples. However, as this compound

was also detected in on-site sediment and soil samples, this may indicate the potential for a preferential pathway near the location of GS_MW06 for PFAS to migrate to groundwater.

The monitoring well slotted screens were all installed in the silty clay (possibly weathered) deposits overlying bedrock. As these deposits mainly consist of silty clay, PFAS is considered more likely to sorb to clay particles relative to coarser-grained material. As no monitoring wells are screened within the deeper part of the aquifer, the vertical extent of PFAS deeper in the aquifer is not known. The geology of the bedrock is not known and may be sandstone based on the present of quartz arenite gravel. The main flow through this formation could be fracture flow, with the potential for PFAS to be transported through permeable fractures (if present). Hydraulic conductivities and groundwater velocities in the aquifer underlying the site are uncertain. It is also uncertain when foams containing PFAS first started to be used at Gladstone Fire Station. As the potential for foam use containing PFAS could have occurred for 10 years or more, the potential for PFAS to have migrated at distance beyond the site boundary cannot be discounted.

No registered groundwater bores have been identified hydraulically down-gradient of the site. Due to the shallow depth to groundwater, there is the potential for unregistered bores to be present[11]. As the depth to groundwater is shallow (<5 mbgl) and the local groundwater flow direction is to the northwest, groundwater has the potential to discharge into the Auckland Inlet, which is the main hydrological feature located approximately 950 m to the northwest.

7.4 Comparison of PFAS composition in soil and groundwater samples

Table 20 shows that the PFAS present in soil samples ranged from short (four perfluorinated carbons) to long chain (fourteen perfluorinated carbons).

Comparison of the compounds detected in soil at different depths, and average compositions indicates a larger range of compounds were detected in the shallower depth interval (0.1 to 0.5 mbgl) compared to the deeper intervals (1.0 and 7.0 mbgl). It is noted that a greater volume of longer chain compounds was detected in the shallow depth interval (<0.5 mbgl) with 4% of the mass less than six perfluorinated carbons, 59% of the mass with compounds between six and eight perfluorinated carbons and about 37% of the mass comprised compounds greater than eight perfluorinated compounds). At 1.0 mbgl, 93% of the mass comprised compounds with between six and eight perfluorinated carbons. This may be due to the longer chain PFAS having a greater potential to sorb to soil particles compared to shorter chain PFAS, or due to longer chain PFAS having lower solubilities than shorter chain compounds. Soil samples in the saturated zone (6.0-7.0 mbgl) had 83% of the mass comprising compounds with between six and eight perfluorinated carbons with 12% of the mass comprising of compounds with less than six perfluorinated carbons.

The groundwater samples had a smaller range of chain lengths compared to soil samples, between four and eleven perfluorinated carbons. The main compounds present were those with between six and eight perfluorinated carbons (80% of mass) with 15% of mass having less than six perfluorinated carbons. GS_MW06 located hydraulically cross gradient of onsite source zones is noted to have a slightly different composition with PFUnDA (eleven perfluorinated carbons, 28%) and PFNA (eight perfluorinated carbons, 27%) the main compounds present.

[11] Note that bores in Queensland do not need to be registered if less than 6 m deep.

Table 20 PFAS Composition in Soil and Groundwater Samples

Compound	Carbon Chain Length	Average soil ratio at different sample depths			Average groundwater ratio (n = 6)
		0.1-0.5 mbgl (n = 12)	1.0 mbgl (n = 3)	6.0 – 7.0 mbgl (n = 3)	
PFBA	4	0.6%	0.1%	0%	0.6%
PFBS	4	0.3%	1.2%	3.8%	6.3%
PFPeA	5	2.3%	1.5%	1.7%	2.6%
PFPeS	5	0.2%	1.3%	5.6%	6.5%
PFHxA	6	1.3%	3.5%	7.8%	7.8%
PFHxS	6	2.2%	5.4%	34.0%	30.0%
6:2 FTS	6	1.4%	3.4%	2.4%	2.3%
PFHpA	7	0.6%	0.7%	1.3%	3.8%
PFHpS	7	0.3%	0.5%	0.6%	1.5%
PFOA	8	0.7%	0.9%	2.3%	4.0%
PFOS	8	37.4%	35.7%	12.7%	15.6%
PFNA	8	15.4%	44.3%	23.3%	13.8%
FOSA	8	0.1%	0%	0%	0%
8:2 FTS	8	0.6%	0%	0%	0%
PFDcA	10	2.3%	0.2%	0%	0.1%
PFDS	10	0.1%	0%	0%	0%
10:2 FTS	10	1.0%	0%	0%	0%
PFUnDA	11	26.5%	1.3%	3.2%	5.0%
PFDoDA	12	0.6%	0%	0%	0%
PFTrDA	12	6.0%	0%	1.3%	0.1%
PFTeDA	14	0.1%	0%	0%	0%

Note:

Averages for soil have been calculated for samples where PFAS was detected at concentrations greater than 0.01 mg/kg for sum of PFAS.

7.5 Surface Water and Sediment Analytical Results

The surface water sample (GS_SW03) was collected from the concrete lined drainage pit located on the external western wall of the workshop, which was an area noted to collect runoff from the concrete slab in the centre of the site where trucks discharge water and conduct cleaning. The sample reported a PFOS concentration of 0.0434 µg/L which exceeded the adopted ecological guidelines (0.00023 µg/L (NEMP HEPA, 2018)), however, is approaching but did not exceed the proposed updated 99% freshwater species protection guideline value (0.051 µg/L (Batley et al., 2018)). It is noted that this surface water drain discharges towards the north of the site.

∑(PFHxS+PFOS) concentration in the sediment sample from the drain located in the grassed area in the north of the site (GS_SED01) was reported as 0.262 mg/kg. This concentration is similar to concentrations reported for surface (<0.5 mbgl) soils outside of the former foam training area and indicates that sediment has the potential to migrate offsite via surface drainage.

The average composition of PFAS in surface water and sediment is summarised in **Table 21**. The composition of PFAS in the sediment sample collected is dominated PFUnDA (53%) and PFTrDA (34%), which are longer chained perfluorinated carbons (11 and 12 perfluorinated carbons, respectively). Approximately 91% of the mass was due to compounds with greater than eight perfluorinated carbons. Due to the low mobility of the longer chain compounds (PFUnDA and PFTrDA) detected in the sediment sample, this may indicate that the sampling location was close to a source area.

The main compound in the surface water sample was PFOS (47%) with the other main compounds present including 8:2 FTS (9%), 10:2 FTS (8%), PFUnDA (9%) and PFHxS (7%). Approximately 77% of the mass comprised compounds with between six and eight perfluorinated carbons.

Table 21 PFAS Composition in Surface Water and Sediment Samples

Compound	Carbon Chain Length	Surface water (n = 1)	Sediment (n = 1)
PFBA	4	0%	0.4%
PFBS	4	0%	0%
PFPeA	5	2.0%	0.5%
PFPeS	5	0%	0%
PFHxA	6	2.0%	0.2%
PFHxS	6	7.1%	0.1%
6:2 FTS	6	4.3%	0%
PFHpA	7	0%	0.1%
PFHpS	7	0%	0%
PFOA	8	1.8%	0.1%
PFOS	8	47.2%	1.8%
PFNA	8	5.2%	4.7%
8:2 FTS	8	8.7%	0%
FOSA	8	0.5%	0%
PFDcA	10	1.4%	1.0%
10:2 FTS	10	7.6%	0.2%
PFUnDA	11	8.9%	53.4%
PFDoDA	12	1.1%	3.2%
PFTrDA	12	2.2%	33.5%
PFTeDA	14	0%	0.8%

8.0 Conceptual Site Model - PFAS

8.1 Introduction

8.1.1 Purpose

The purpose of the CSM is to provide an understanding of the nature and extent of contamination impacts and the migration mechanisms, and the exposure pathways by which identified receptors may be exposed to contamination from the Investigation areas. The CSM also serves as a framework to assess risks to human health and ecological receptors and assists in identifying uncertainties and data gaps. A preliminary CSM was developed as part of the PSI (AECOM, 2019). The CSM has been updated based on the findings of this PFAS DSI.

8.1.2 Definition of source-pathway-receptor linkages

In accordance with national guidance on assessment of contamination (NEPM, 2013), potential risks to receptors are evaluated based on three components:

- **Source**: A potentially hazardous substance that has been released into the environment
- **Receptors**: A person, ecosystem or ecological member potentially at risk of experiencing an adverse response following exposure to the source or derivatives of the source
- **Pathway**: A mechanism by which receptors can become exposed to the source or derivatives of the source.

If all three components are present at an exposure scenario, the source-pathway-receptor linkage is considered complete and a receptor is exposed to risk. However, if one of these three is missing there is no direct risk to receptors.

8.1.3 Definition of exposure pathways

In order for a human receptor to be exposed to a chemical contaminant derived from the site, a complete exposure pathway must exist. An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual and generally includes the following elements (USEPA, 1989):

- A source and mechanism of chemical release
- A retention or transport medium (or media where chemicals are transferred between media)
- A point of potential human contact with the contaminated media
- An exposure route (e.g. ingestion, inhalation) at the point of exposure.

8.2 Contaminants of Potential Concern

The main contaminants of concern are those with guideline values in the NEMP (HEPA, 2018), PFHxS, PFOS and PFOA.

8.3 Sources

The main source areas of PFAS contamination at the site are summarised below.

8.3.1 Primary Sources

The following activities on the site are considered to have resulted in PFAS impacts to soil, and groundwater:

- Former firefighting training activities using AFFF containing PFAS at the former foam training area (see **Figure 2**)
- Leaks and spills of AFFF containing PFAS from storage areas, during product transfer and vehicle maintenance.

8.3.2 Secondary Sources

The following secondary sources were identified could potentially lead to PFAS impacts:

- Surface soil where AFFF containing PFAS was historically discharged to surface
- Unsaturated zone soil beneath potential source zones
- Concrete infrastructure that has been in contact with AFFF
- Sediment within concrete drainage lines.

8.3.3 Off-Site

The following off-site land uses have the potential to affect groundwater quality beneath the site:

- Glen Creek Park (former landfill), located approximately 280 m west of the site
- Industrial area beyond the Auckland Inlet, approximately 2 km west of the site, which includes a fuel depot, mechanical repairs depot and a waste management
- Rails yards are present 2.1 km to the southwest of the site
- The Port of Gladstone is located 2.5 km southeast of the site
- Gladstone Airport is located 2.8 km southwest of the site
- Gladstone Power Station is located approximately 3 km to the west
- Queensland Alumina (QAL) plant 4 km to the east

There is also a shale oil plant located 7 km south of the site.

The lot to the west (Lot 4 on RP606760, 7 Breslin Street) was potentially formerly part of the fire station and there is the potential for foam training activities to have occurred on this lot.

8.4 Migration Mechanisms

The mechanisms which may have contributed to the migration of PFAS across and from the site include:

- Historical discharge of AFFF containing PFAS to ground surface or leakage from storage infrastructure
- Spilling of AFFF containing PFAS to ground surface during filling and decanting operations
- Sorption of PFAS to soil in areas where AFFF was historically used, particularly in unsealed areas such as the grassed former foam training area
- Localised dispersion of firefighting foams with wind during historical application
- Surface water run-off containing PFAS flowing into surface water and off-site migration within the drainage system
- Leaching of PFAS from soil and infiltration to groundwater in areas where AFFF was historically used
- Leaching of PFAS from concrete pavements and infiltration to surface water or groundwater
- Lateral and vertical migration of PFAS in groundwater under the influence of groundwater flow and PFAS dispersion
- Migration within backfill to underground services and building foundations which may act as preferential pathways for PFAS in the unsaturated zone including UST bedding sands
- Use of groundwater off-site for industrial activities, recreational activities, irrigation for parks and gardens and domestic activities

- Sorption of PFAS to soil below the groundwater table during migration with groundwater. Sorption to soil slows down the migration of PFAS, but sorbed PFAS may continue to diffuse back into groundwater and act as a secondary source, if conditions are suitable
- Excavation of soil containing PFAS and relocation to other areas on site
- Transport of sediment along stormwater drains.

8.5 Receptors and Exposure Pathways

The following potential human and ecological receptors have been identified:

- Personnel who work at the fire station (current and future QFES employees). This includes intrusive (i.e. involved in soil excavation) maintenance workers who may conduct infrequent maintenance activities at the site and come into contact with impacted soil and/or stormwater and/or groundwater
- Visitors to the site who stay for a short period and are not frequently present at the site who may come into contact with impacted soil and/or stormwater
- Persons exposed to groundwater extracted from off-site bores for industrial activities, recreational activities, irrigation for parks and gardens and domestic activities
- Recreational users of nearby surface water bodies (including Auckland Inlet and Port Curtis)
- The terrestrial ecosystem (flora and fauna) both on and off site
- The aquatic ecosystems of nearby waterways (Auckland Inlet and Port Curtis).

The following potential exposure pathways have been identified for human receptors:

- Dermal contact and/or incidental ingestion of PFAS impacted soil, including dust inhalation
- Persons drinking PFAS impacted groundwater
- Dermal contact and/or incidental ingestion of PFAS impacted groundwater, surface water and sediment (in drains).

The following potential exposure pathways have been identified for ecological receptors:

- Ecological receptors in direct contact with PFAS impacted soil, sediment and surface water.

8.6 Assessment of Exposure Pathways

An assessment of the exposure pathways for the site is presented in **Table 22**. A figure showing the key features of the CSM is presented as **Figure 7**, **Appendix A**.

Table 22 Gladstone Fire Station CSM – PFAS

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
On-Site areas where firefighting foams have been discharged or spilt to the environment. Off-Site areas where firefighting foams have been discharged or spilt to the environment	PFAS in soil	Excavation of soil during construction / maintenance activities	Human health: incidental ingestion of soil, direct contact with soil (dermal contact and dust inhalation)	Intrusive maintenance / landscaping workers	Unlikely	Considered unlikely due to use of occupational health and safety controls and non-exceedance of health guideline values for PFAS in soil for a commercial land use. No anticipated change to future land use.
			Ecological: ingestion of plants and terrestrial biota by higher order ecological receptors	Terrestrial ecosystem	Possible	Considered possible due to exceedances of the indirect ecological guideline value for commercial/industrial land use and residential land use criteria. Near surface soils are considered accessible to ecological receptors. However, this is likely to be mitigated by the lack of open space, the extensive paving which will prevent access to the subsurface soils and the minimal vegetation to be ingested and consumed by higher order predators.
		General QFES activities	Human health: incidental ingestion of soil, direct contact with soil (dermal contact and dust inhalation)	Site workers and visitors	Unlikely	Considered unlikely due to non-exceedance of health guideline values for PFAS in soil for commercial land use. No anticipated change to future land use.
	PFAS in concrete lined pits and drains	Leaching of PFAS within concrete structures to	Human health - Incidental ingestion or contact with soil, groundwater or surface water.	Surface soil, groundwater, and surface	Possible	Considered possible as PFAS concentrations in soil and groundwater may be partly sourced from concrete impregnated with PFAS (i.e. including the

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
		soil, groundwater and surface water.	Ecological – uptake and bioaccumulation.	water		concrete slab in the centre of the site) and building foundations and slabs.
	PFAS in groundwater	Groundwater transport in aquifer followed by extraction and use for domestic, recreational, industrial uses and irrigation (parks)	Human health: direct ingestion or incidental ingestion or direct contact with groundwater (off-site)	Off-Site groundwater users	Possible	Considered possible. The monitoring wells installed on site for the project were screened from approximately 4.0 – 7.0 mbgl. The potential therefore exists for unregistered bores to be present, hydraulically down or cross gradient of the site (noting that bores less than 6 m deep do not need to be registered in Queensland). However, this is mitigated by the lack of registered bores within 1 km of the site. Only two bores have been identified which are both hydraulically upgradient of the site. As the groundwater is borderline potable (as indicated by the nearby registered bore logs), this indicates the potential for unregistered abstraction bores to be present. However, this is considered unlikely.
			Uptake and bioaccumulation in terrestrial biota	Flora and fauna	Possible	
		Groundwater transport in aquifer followed by extraction for stock watering	Livestock: direct ingestion or incidental ingestion or direct contact with groundwater (off-site)	Livestock	Unlikely	Considered unlikely as the fire station is located in an urban area and groundwater in the vicinity of the sites is unlikely to be used for stock watering purposes
	PFAS in surface water	Surface water transport via overland flow	Human health: direct or incidental ingestion or direct contact with off-site	Recreational users	Unlikely	Considered unlikely as recreational users are unlikely to incidentally ingest or have direct contact with surface water

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
		into on- and off-site drains that discharge into channels and potentially the Auckland Inlet	surface water (i.e. surface water, drainage overland flow water).			discharging into the drainage channel. The potential for an exposure pathway to recreational users of the Auckland Inlet is considered low due to the large distance to the Auckland Inlet (950 m distant). It is further noted that the Auckland Inlet would be a potential receptor for off-site source areas. For example, a former landfill is located at Glen Creek Park approximately 300 m to the west and down-gradient of the site.
			Ecological: direct exposure as well as ingestion of biota by higher order ecological receptors	Aquatic ecosystem	Possible	Considered possible as PFAS in shallow soil / concrete at the site has the potential to leach into runoff which may enter stormwater channels that likely discharge into the channel 50 m north of the site which subsequently discharges into Auckland Inlet 950 m northwest of the site. PFAS concentrations in one stormwater drain sample on-site did not exceed the human health (recreational water) guideline value but did exceed the adopted ecological guidelines.
	Accumulation of PFAS in creek sediment	Dispersion via surface water	Human health: incidental ingestion or direct contact with sediment (off-site). Direct ingestion of aquatic biota	Recreational users	Unlikely	Considered unlikely as recreational users are unlikely to incidentally ingest or have direct contact with sediment in the drainage channel. The potential for an exposure pathway to recreational users of the Auckland Inlet is considered low due to the large distance to the Auckland Inlet (950 m distant).

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
						It is further noted that the Auckland Inlet would be a potential receptor for off-site source areas. For example, a former landfill is located at Glen Creek Park approximately 300 m to the west and down-gradient of the site.
			Ecological: direct exposure, as well as ingestion of biota by higher order ecological receptors	Aquatic ecosystem	Possible	Considered possible as runoff from the site will enter surrounding stormwater channels and likely discharge into the channel to the north of the site, which subsequently discharges into Auckland Inlet 950 m northwest of the site.

9.0 Conclusions

The key findings of the PFAS DSI are presented below.

- All six soil bores were drilled to bedrock, which was encountered between 7.0 and 7.4 mbgl. Fill, consisting of silty and sandy clay and gravel was present up to approximately 1.8 mbgl, which is underlain by silty, sandy and gravelly clay which overlies the bedrock. The geology of the bedrock is not known but is likely to be mudstone or sandstone.
- During drilling, groundwater was encountered at approximately 4.5 mbgl with stabilised depth to groundwater reported between 1.47 and 2.38 m below top of casing. This indicates the presence of a semi-confined aquifer, which is confined by the clay layer that overlies the bedrock. Groundwater was inferred to locally flow from southeast towards the northwest. This flow direction is consistent with the expected regional groundwater flow direction, which is inferred to be to the northwest towards the Auckland Inlet, approximately 950 m away.
- Elevated PFAS concentrations were detected in soil samples with the highest concentrations detected in near-surface fill materials (0 to 0.5 m depth interval) in and near the former foam training area in the western portion of the site. The main PFAS compound detected in the near surface soil was PFOS. The highest sum of PFHxS and PFOS (4.1 mg/kg[12] in GS_BH02 at 0.5 mbgl) was detected in a sample from a bore located adjacent to the northern site boundary. PFHxS and PFOS concentrations decreased with increased depth, which may reflect sorption of PFAS onto clay. The presence of near-surface impacts is consistent with surface-based sources, such as direct application of foam to unsealed ground or spills.
- None of the ∑(PFHxS+PFOS), PFOA concentrations in the 23 soil samples collected and analysed from the soil bores exceeded the NEMP (HEPA, 2018) health guideline values for a commercial land use. Six exceedances of the NEMP (HEPA, 2018) PFOS interim soil ecological guideline value for indirect exposure for a commercial land use, were reported in shallow soils (<0.5 mbgl) within the foam training area, indicating a potential risk to terrestrial ecological receptors. However, this is likely to be mitigated by the lack of open space, the extensive paving which will prevent access to the subsurface soils and the minimal vegetation to be ingested and consumed by higher order predators.
- The primary PFAS compounds detected in the groundwater samples analysed were PFHxS and PFOS. The groundwater samples with the highest concentrations (267 µg/L and 105 µg/L ∑(PFHxS+PFOS)) were located within the foam training area (GS_MW02 and GS_MW01, respectively). The next highest concentration (2.5 µg/L ∑(PFHxS+PFOS)) was reported in GS_MW03 located hydraulically down-gradient of the former foam store. This suggests the two main sources of PFAS in groundwater on site are the foam training area and the former foam store.
- ∑(PFHxS+PFOS) concentrations exceeding the NEMP (HEPA, 2018) drinking water guideline value were reported in groundwater samples from all six monitoring wells (GS_MW01 to GS_MW06). The drinking water guideline value for PFOA was also exceeded in two of the groundwater samples (from GS_MW01 and GS_MW02). Groundwater samples from three monitoring wells (GS_MW01, GS_MW02 and GS_MW03) also reported ∑(PFHxS+PFOS) concentrations exceeding the NHMRC (2019) human health recreational water guideline value. The concentration of PFOS in all six groundwater samples exceeded the NEMP (HEPA, 2018) ecological guideline values for 99% species protection for fresh water. Four of the samples (GS_MW01 to GS_MW04) also exceeded the adopted ecological investigation level for 99% freshwater species protection value identified in Batley et. al (2018). There were no exceedances of the adopted ecological guideline values for PFOA.
- As the monitoring wells with the highest PFAS concentrations in groundwater are located adjacent to the hydraulically down-gradient site boundary, it is considered likely that PFAS impacts in

[12] Quality assurance samples were analysed for soil sample GS_BH02 0.5 m with ∑PFHxS+PFOS in the primary sample reporting 4.1 mg/kg, the intra-laboratory (duplicate) sample reporting 5.2 mg/kg and the inter-laboratory (triplicate) sample reporting 5.3 mg/kg. The results indicate variability in the samples, possible due to heterogeneity.

groundwater (in particular, PFHxS, PFOS and PFOA) extend off-site at concentrations that exceed the human health and ecological guidelines (HEPA, 2018 and NHMRC, 2019). As groundwater samples from all on-site monitoring wells exceeded human health and ecological guideline values, the lateral extent of PFAS in groundwater has not been characterised in any direction.

- The monitoring well screens were all installed in the clay deposits overlying bedrock. As no monitoring wells are screened below 7.4 mbgl, the vertical extent of PFAS deeper in the aquifer is not known. If a fractured rock is present (such as mudstone or sandstone), there is the potential for PFAS to be transported through permeable fractures. It is uncertain when foams containing PFAS first started to be used at Gladstone Fire Station. As the potential for foam use containing PFAS could have occurred for 10 years or more, the potential for PFAS to have migrated at distance beyond the site boundary cannot be discounted. The local groundwater flows towards the Auckland Inlet, which is the main hydrological feature located approximately 950 m to the northwest. No registered bores for water supply have been identified hydraulically down-gradient of the site.
- The laboratory analytical technique for TOPA is used to detect certain harder to analyse PFAS precursor compounds that may be present. The results of TOPA analysis on one soil and one groundwater sample did not indicate the presence of PFAS precursors. The results indicated a degraded PFAS product that is unlikely to significantly increase or alter through bio-transformation or oxidation processes.
- A surface water sample (GS_SW03) was collected from the concrete lined drainage pit located on the external western wall of the workshop, which was an area noted to collect runoff from the concrete slab in the centre of the site. The sample reported a PFOS concentration of 0.043 µg/L which exceeded the NEMP HEPA, 2018 ecological guidelines for 99% freshwater species protection. It is noted that this surface water drain discharges towards the north of the site.
- Sum of 28 PFAS concentration in the sediment sample from the drain located in the grassed area in the north of the site (GS_SED01) was reported as 0.42 mg/kg. This concentration is similar to concentrations reported for surface (<0.5 mbgl) soils in the foam training area and indicates that sediment has the potential to migrate offsite via surface drainage. The main compounds present were long chain PFAS (PFUnDA and PFTrDA). Due to the presence of shallow soil and sediment impacts at the site, there is the potential for leaching of PFAS to surface water, which may enter the stormwater drainage system in the northern portion of the site, and drain into the stormwater channel to the north of Breslin Street.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered likely to be related to the historical firefighting training practices at the fire station, and spills from storage containers, product transfer and other maintenance activities.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possibly complete exposure pathways for PFAS sourced from the fire station to impact off-site human and ecological receptors have been identified. The significance of these potentially complete source-pathway-receptor linkages is uncertain and further investigation is required to understand the potential risks to off-site receptors.

10.0 References

AECOM, 2019. *Preliminary Site Investigation and Sampling, Analysis and Quality Plan*, QFES, April 2019.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018 at https://www.waterquality.gov.au/anz-guidelines/guideline-values/default

Australian Government, National Water Commission, 2012. *Minimum Construction Requirements for Water Bores in Australia*, Edition 3, February 2012.

Batley et al., 2018. *Application of revised methodologies for default guideline value derivations: PFOS in freshwater*, presented at the Society of Environmental Toxicology and Chemistry (SETAC) scientific conference in November 2018.

CRC CARE, 2018. *Practitioner guide to risk-based assessment, remediation and management of PFAS site contamination*, Technical Report No. 43, *CRC Care 2018.*

Department of Agriculture and Fisheries, 2019. *Fisheries Act 1994.*

Department of Environment, 1998. *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*.

Department of Environment and Science, 2018. *Queensland Auditor Handbook for Contaminated Land, Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports*, ESR/2018/4224v2.01, 2018.

Department of Environment and Science, 2019. *Environmental Protection Act 1994.*

Department of Mines, 1988. 1:100,000 series Gladstone geological map Sheet 9150.

Government of Western Australia Department of Environmental Regulation, 2017. *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances*, Version 2.1 (20 January 2017).

Heads of Environmental Protection Agencies Australian and New Zealand, 2018. *PFAS National Environmental Plan (NEMP)*, January 2018.

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

National Health and Medical Research Council, 2019. *Guidance on Per and Polyfluoroalkyl substances in Recreational Water.*

QFES, 2016. *In-ground Tank Water Contamination by PFAS v1.3,* 2016.

Standards Australia, 1998. *Water quality – Sampling. Part 11: Guidance on sampling of groundwaters. Australian Standards*, AS5667.11, 5 April 1998.

Standards Australia, AS 4482.2-1999. *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile Substances*.

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

US EPA, 2002. *Guidance on Environmental Data Verification and Data Validation*, November 2002.

US EPA (2006) *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4 (EPA 240/B-06/001).

Web References in Report

https://www.solbergfoam.com/Foam-Concentrates/RE-HEALING-Foam.aspx Accessed on 14 October 2019.

http://technotes.alconox.com/industry/laboratory/manual-lab-cleaning/pfoa-pfos-pfas-alconox-cleaners/ Accessed on 16 October 2019.

http://www.bom.gov.au/climate/averages/tables/cw_039123.shtml Accessed on 18 November 2019.

http://www.bom.gov.au/water/groundwater/gde/map.shtml Accessed on 18 November 2019.

https://environment.des.qld.gov.au/licences-permits/maps_of_environmentally_sensitive_areas.php Accessed on 18 November 2019.

11.0 Limitations

AECOM Australia Pty Ltd has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Queensland Fire and Emergency Services and only those third parties who have been authorised in writing by AECOM to rely on the report.

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 report.

The report is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 23 May 2019.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

The methodology adopted and sources of information used by AECOM are outlined in the report.

Where this report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information unless required as part of the agreed scope of work. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This report was prepared between 19 August 2019 and 6 December 2019. The information in this report is considered to be accurate at the date of issue and is in accordance with conditions at the Site and surrounding areas at the dates sampled. Opinions and recommendations presented herein apply to the Site and surrounding areas existing at the time of our investigation and cannot necessarily apply to changes to Site and surrounding areas of which AECOM is not aware and has not had the opportunity to evaluate. This document and the information contained herein should only be regarded as validly representing the Site and surrounding area conditions at the time of the investigation unless otherwise explicitly stated in a preceding section of this report. AECOM disclaims responsibility for any changes that may have occurred after this time.

Except as required by law, no third party may use or rely on this report, unless otherwise agreed by AECOM in writing. Where such agreement is provided, AECOM will provide a letter of reliance to the agreed third party in the form required by AECOM.

To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this report. AECOM does not admit that any action, liability or claim may exist or be available to any third party.

AECOM does not represent that this report is suitable for use by any third party.

Except as specifically stated in this section, AECOM does not authorise the use of this report by any third party.

It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the relevant property.

List of Appendices

Appendix A

Figures

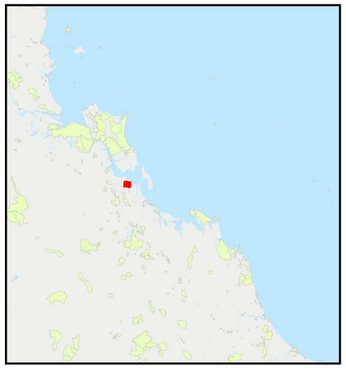
Appendix A Figures

AECOM

0 200 400
Meters

Legend

- Registered Groundwater Bores
- Streams
- Lakes
- 1kmSiteRadius
- Site Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 1
Site Location

PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019.
World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: BowenL2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 28/11/2019 MAP TITLE: : F1_A3_Landscape_RHS V1

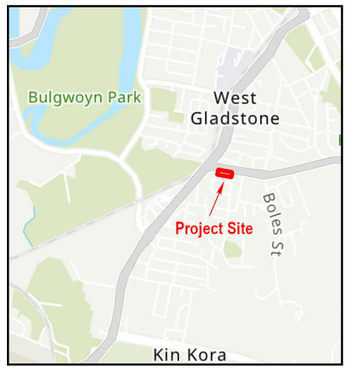
AECOM

N

0 5 10 15
Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Surface Water Sample Location
- Storm Water Pits
- Electrical Line
- Comms Line
- Sewer
- Storm Water Pipes
- 10 mAHD topographic contour
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 2
Site Layout and Sampling Locations

PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019. AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE : : F2_A3_Landscape_RHS V2

AECOM

N

0 5 10 15

Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Surface Water Sample Location
- Storm Water Pits
- Inferred groundwater contours (mAHD)*
- Electrical Line
- Comms Line
- Sewer
- Storm Water Pipes
- 10 mAHD topographic contour
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre
- Inferred Groundwater flow direction

* Groundwater elevations shown on map are in mAHD

Queensland Fire and Emergency Services (QFES)

FIGURE 3
Inferred Groundwater Contours: 6 August 2019

PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019. AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE : : F3_A3_Landscape_RHS V2

Analyte	Unit	GS_BH02_190801		
		0.1 m	0.5 m	7.0 m
PFOS	mg/kg	0.519	3.91	0.0394
PFHxS	mg/kg	0.0247	0.171	0.0468
PFOA	mg/kg	0.0113	0.0472	0.0029
PFHxA	mg/kg	0.0247	0.058	0.0067

Analyte	Unit	GS_BH04_190801		
		0.1 m	1.0 m	5.0 m
PFOS	mg/kg	0.131	0.0736	0.0027
PFHxS	mg/kg	0.0094	0.004	0.0014
PFOA	mg/kg	0.0019	0.0007	<0.0002
PFHxA	mg/kg	0.0081	0.0016	0.0003

Analyte	Unit	GS_SS2_190801	
		0.1 m	0.5 m
PFOS	mg/kg	0.0316	0.217
PFHxS	mg/kg	0.003	0.0021
PFOA	mg/kg	0.0046	0.0026
PFHxA	mg/kg	0.0059	0.006

Analyte	Unit	GS_BH05_190802		
		0.5 m	1.0 m	6.0 m
PFOS	mg/kg	0.0616	0.0688	0.0014
PFHxS	mg/kg	0.0029	0.0685	0.0018
PFOA	mg/kg	0.0007	0.0074	0.0003
PFHxA	mg/kg	0.0061	0.0555	0.0005

Analyte	Unit	GS_BH06_190802		
		0.1 m	0.5 m	7.0 m
PFOS	mg/kg	0.0054	0.0023	<0.0002
PFHxS	mg/kg	0.0003	0.0003	<0.0002
PFOA	mg/kg	0.0005	0.0009	<0.0002
PFHxA	mg/kg	0.0011	0.0014	<0.0002

Analyte	Unit	GS_BH01_190801		
		0.1 m	1.0 m	7.0 m
PFOS	mg/kg	0.0294	0.0626	<0.0002
PFHxS	mg/kg	0.004	0.012	0.0091
PFOA	mg/kg	0.0023	0.0031	0.0004
PFHxA	mg/kg	0.0199	0.0068	0.0024

Analyte	Unit	GS_SS1_190801
		0.1 m
PFOS	mg/kg	0.144
PFHxS	mg/kg	0.0014
PFOA	mg/kg	0.0006
PFHxA	mg/kg	0.001

Analyte	Unit	GS_SS3_190801
		0.1 m
PFOS	mg/kg	2.45
PFHxS	mg/kg	0.676
PFOA	mg/kg	0.123
PFHxA	mg/kg	0.0942

Analyte	Unit	GS_SS4_190813
		0.1 m
PFOS	mg/kg	0.452
PFHxS	mg/kg	0.0074
PFOA	mg/kg	0.001
PFHxA	mg/kg	0.0015

Analyte	Unit	GS_BH03_190801		
		0.25 m	1.1 m	5.0 m
PFOS	mg/kg	0.005	0.0013	0.0013
PFHxS	mg/kg	0.0005	0.0007	0.0004
PFOA	mg/kg	<0.0002	<0.0002	<0.0002
PFHxA	mg/kg	<0.0002	<0.0002	<0.0002

BRESLIN STREET
CHARLES STREET
WALTERS AVENUE
Service Pit
Workshop
Account Offices
New Fire Engine Shed
Waste & Oil Laydown Area
UST
Case 4 Pit
Training/ Foam Store
Training Tower
Car parking
Former Foam Store
Admin Building
GS_BH01/ MW01
GS_BH02/ MW02
GS_BH03/ MW03
GS_BH04/ MW04
GS_BH05/ MW05
GS_BH06/ MW06
GS_SS1
GS_SS2
GS_SS3
GS_SS4
GS_SW03
GS_SED01
Lot 4/RP606760 may have been part of the fire station prior to historical subdivision
3RP606760
4RP606760
5RP606760
6RP606760
7RP606760
8RP606760
9RP606760
10RP606760
11RP606760
12RP608797
13RP608797
14RP608797
15RP606760
17RP606760
58RP608665
57RP608665
56RP608665
55RP608665
ASP263701

Exceedance of NEMP (HEPA, 2018) guidance value for human health for commercial / industrial landuse.
Exceedance of NEMP (HEPA, 2018) guideline value for ecological indirect exposure for residential landuse.

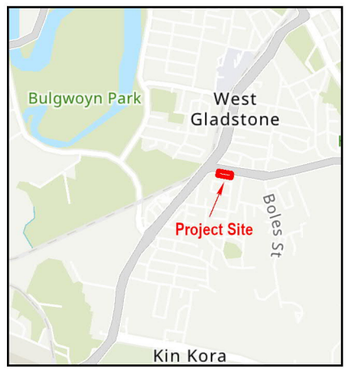
AECOM

N

0 5 10 15
Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Surface Water Sample Location
- Storm Water Pits
- Electrical Line
- Comms Line
- Sewer
- Storm Water Pipes
- 10 mAHD topographic contour
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre



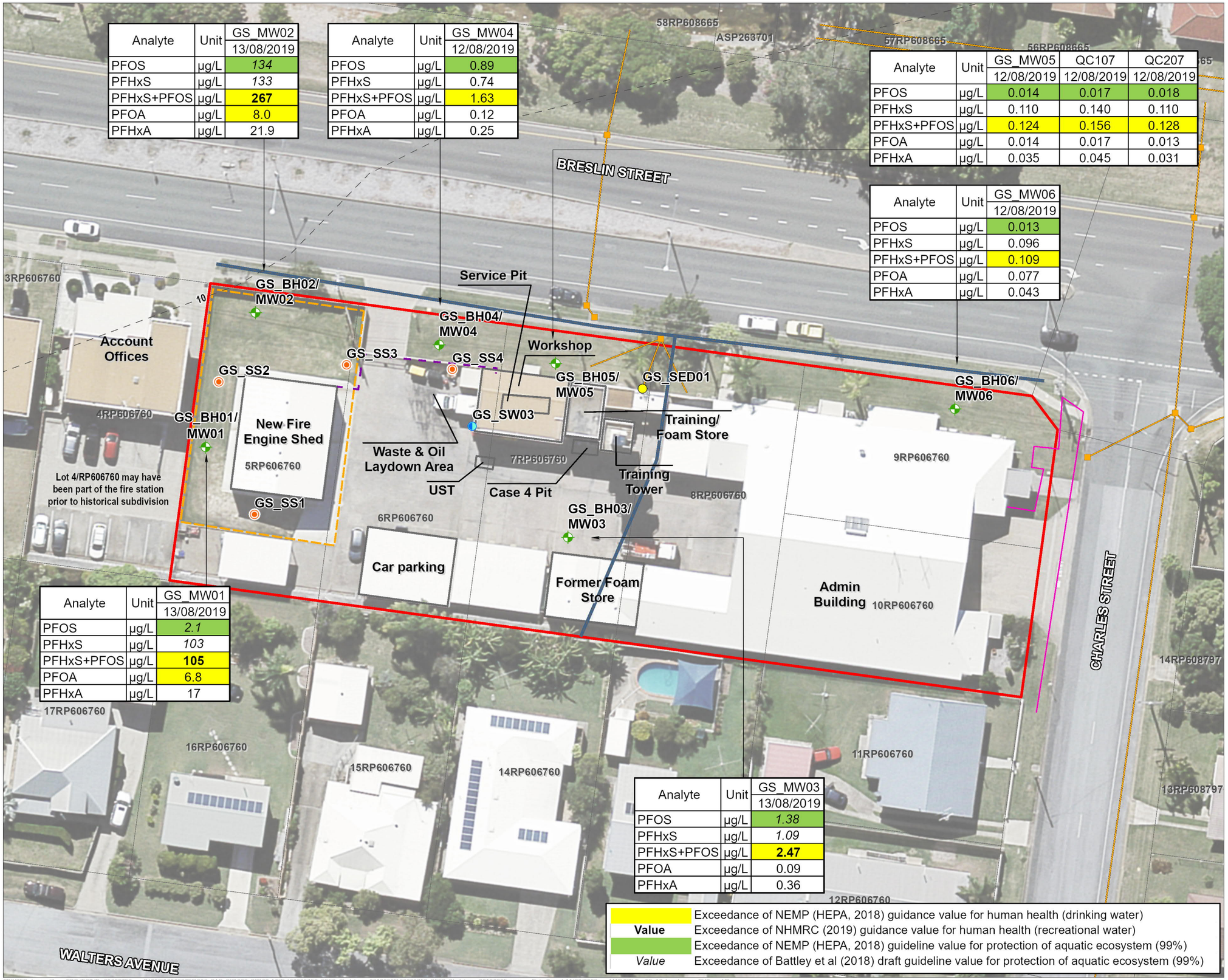
Queensland Fire and Emergency Services (QFES)

FIGURE 4
Soil PFAS Analytical Results

PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019. AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE: : F4_A3_Landscape_RHS V2



Analyte	Unit	GS_MW02 13/08/2019
PFOS	µg/L	*134*
PFHxS	µg/L	*133*
PFHxS+PFOS	µg/L	**267**
PFOA	µg/L	8.0
PFHxA	µg/L	21.9

Analyte	Unit	GS_MW04 12/08/2019
PFOS	µg/L	0.89
PFHxS	µg/L	0.74
PFHxS+PFOS	µg/L	1.63
PFOA	µg/L	0.12
PFHxA	µg/L	0.25

Analyte	Unit	GS_MW05 12/08/2019	QC107 12/08/2019	QC207 12/08/2019
PFOS	µg/L	0.014	0.017	0.018
PFHxS	µg/L	0.110	0.140	0.110
PFHxS+PFOS	µg/L	0.124	0.156	0.128
PFOA	µg/L	0.014	0.017	0.013
PFHxA	µg/L	0.035	0.045	0.031

Analyte	Unit	GS_MW06 12/08/2019
PFOS	µg/L	0.013
PFHxS	µg/L	0.096
PFHxS+PFOS	µg/L	0.109
PFOA	µg/L	0.077
PFHxA	µg/L	0.043

Analyte	Unit	GS_MW01 13/08/2019
PFOS	µg/L	*2.1*
PFHxS	µg/L	*103*
PFHxS+PFOS	µg/L	**105**
PFOA	µg/L	6.8
PFHxA	µg/L	17

Analyte	Unit	GS_MW03 13/08/2019
PFOS	µg/L	*1.38*
PFHxS	µg/L	*1.09*
PFHxS+PFOS	µg/L	**2.47**
PFOA	µg/L	0.09
PFHxA	µg/L	0.36

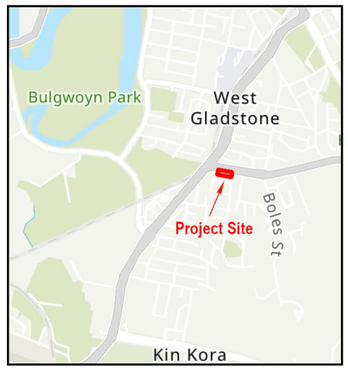
	Exceedance of NEMP (HEPA, 2018) guidance value for human health (drinking water)
Value	Exceedance of NHMRC (2019) guidance value for human health (recreational water)
	Exceedance of NEMP (HEPA, 2018) guideline value for protection of aquatic ecosystem (99%)
Value	Exceedance of Battley et al (2018) draft guideline value for protection of aquatic ecosystem (99%)

AECOM

0 5 10 15
Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Surface Water Sample Location
- Storm Water Pits
- Electrical Line
- Comms Line
- Sewer
- Storm Water Pipes
- 10 mAHD topographic contour
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre

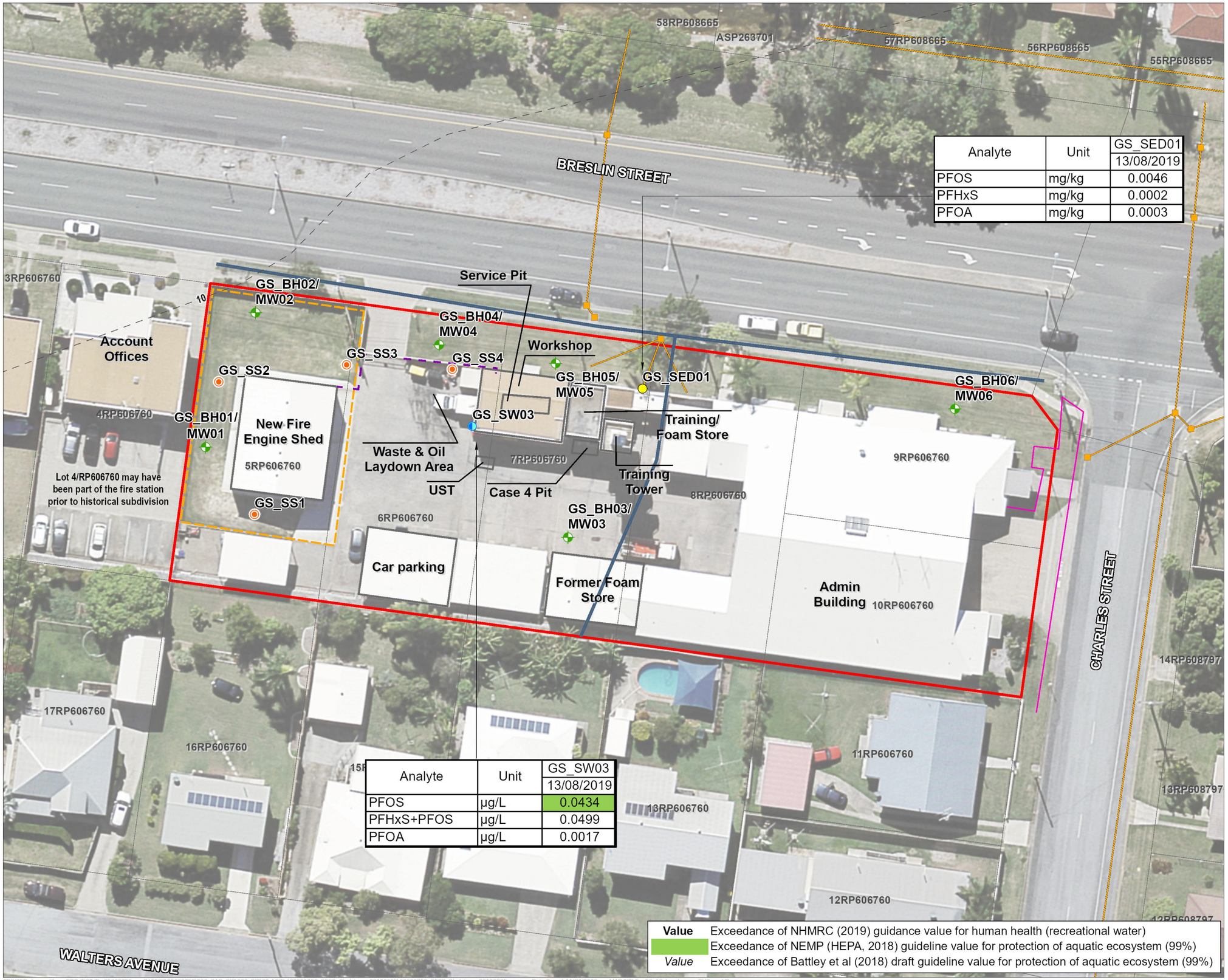


Queensland Fire and Emergency Services (QFES)

FIGURE 5
Groundwater PFAS Analytical Results
PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019, AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE: : F5_A3_Landscape_RHS V2



Analyte	Unit	GS_SED01
		13/08/2019
PFOS	mg/kg	0.0046
PFHxS	mg/kg	0.0002
PFOA	mg/kg	0.0003

Analyte	Unit	GS_SW03
		13/08/2019
PFOS	µg/L	0.0434
PFHxS+PFOS	µg/L	0.0499
PFOA	µg/L	0.0017

Value	Exceedance of NHMRC (2019) guidance value for human health (recreational water)
	Exceedance of NEMP (HEPA, 2018) guideline value for protection of aquatic ecosystem (99%)
Value	Exceedance of Battley et al (2018) draft guideline value for protection of aquatic ecosystem (99%)

AECOM

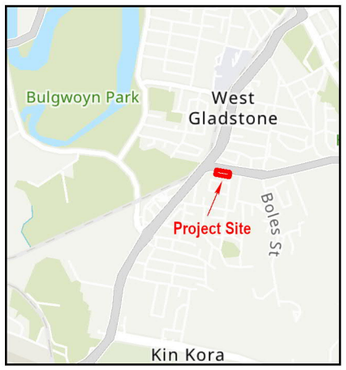
N

0 5 10 15

Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Surface Water Sample Location
- Storm Water Pits
- Electrical Line
- Comms Line
- Sewer
- Storm Water Pipes
- 10 mAHD topographic contour
- Approximate area used for foam training exercises
- Site Boundary
- Cadastre

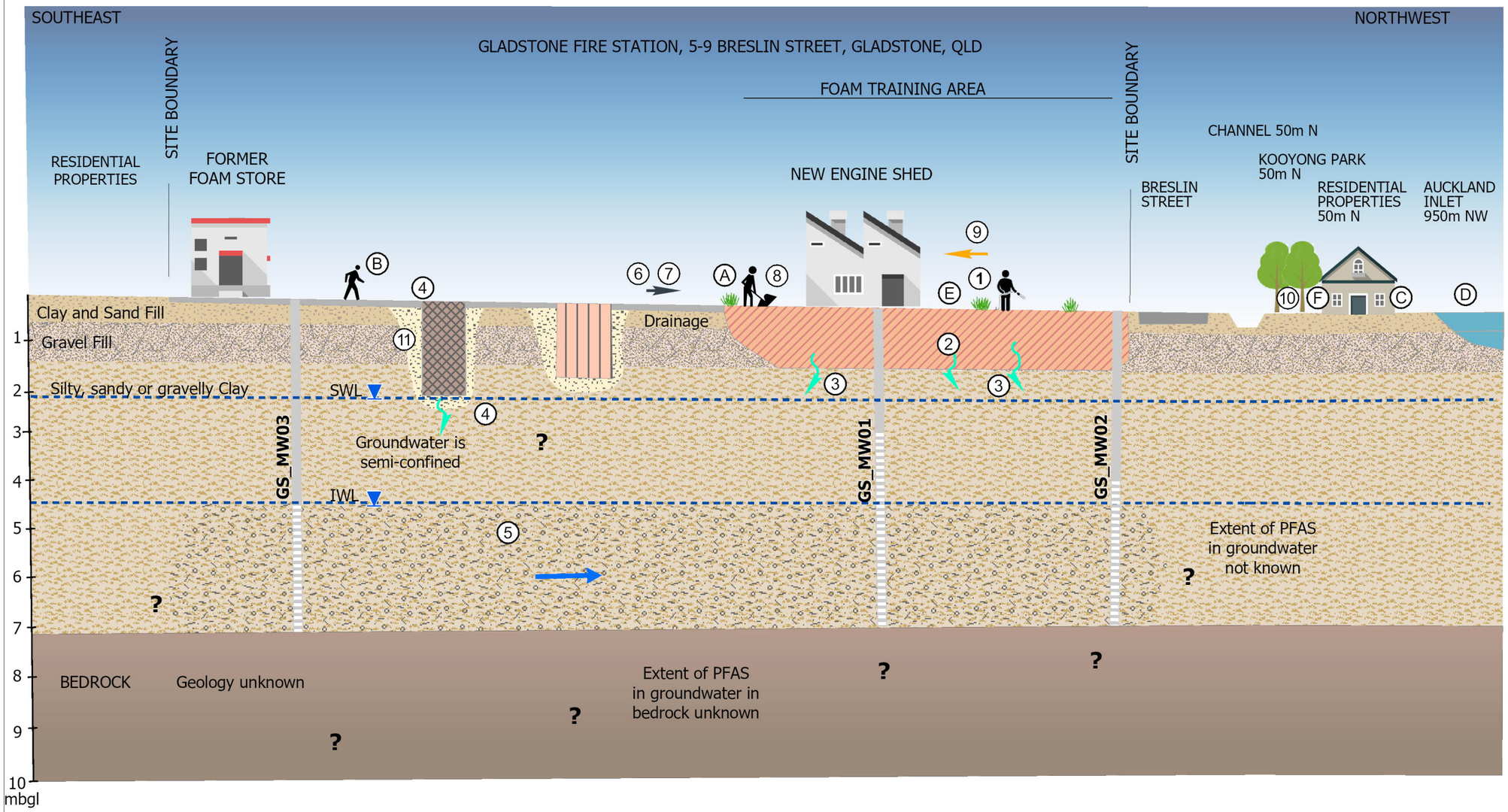


Queensland Fire and Emergency Services (QFES)

FIGURE 6
Surface Water & Sediment PFAS Analytical Results
PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019, AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE: : F6_A3_Landscape_RHS V2



TRANSPORT PATHWAYS

1. Historical discharge of AFFF to ground / leaks or spills of AFFF
2. Sorption of PFAS to soil
3. Infiltrating water leaching PFAS from soil to groundwater
4. Leaching of PFAS from concrete to groundwater or surface water
5. Groundwater transport followed by abstraction / discharge
6. Surface water runoff to surface water and off-site migration in the drainage system
7. Sediment transport along stormwater drains
8. Excavation of soil and relocation on site
9. Localised dispersion of foam with wind during historical application
10. Use of groundwater off-site for irrigation of parks and gardens
11. Migration in backfill around underground services and structures

RECEPTORS

- A. Intrusive construction workers
- B. QFES personnel
- C. Off-site groundwater users
- D. Off-site surface water recreational users
- E. Terrestrial ecosystems
- F. Aquatic ecosystems

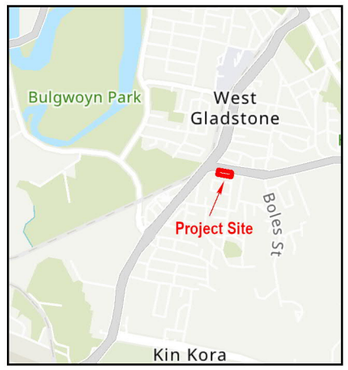
PRINTED: bowenl2 PROJECT ID: 60609758 P:\606X\60609758\900_CAD_GIS\920_GIS\02_MXDs\60609758_QFES_Gladstone_20190905\60609758_QFES_Gladstone_20190905.aprx Date Saved: 11/02/2020 MAP TITLE: : F7_A3_Landscape_RHS V2

AECOM

NOT TO SCALE

Legend

- PFAS in groundwater
- PFAS in soil
- Concrete
- Case 4 Pit
- Backfill
- UST
- Inferred groundwater flow direction
- Infiltration / Leaching
- Migration in stormwater drains
- Wind dispersion of foam
- Inferred groundwater depth
- Groundwater table



Queensland Fire and Emergency Services (QFES)

FIGURE 7
PFAS Conceptual Site Model

PFAS Detailed Site Investigation at Gladstone Fire Station

Source: State of Queensland, 2019. World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix B

Tables

Appendix B Tables

Location ID	Date of Installation	Easting	Northing	Top of Casing Elevation (mAHD)	Cover	Drilled Depth (m)	Top of screen (mbgl)	Water Strike (mbgl)	Lithology of screened section
GS_BH01/MW01	1/08/2019	321653.7	7360368.1	10.927	Gatic	7.0	4.0	4.8	Gravelly CLAY
GS_BH02/MW02	1/08/2019	321660.4	7360386.1	10.133	Gatic	7.4	4.4	4.5	Silty CLAY
GS_BH03/MW03	1/08/2019	321702.3	7360356.0	11.046	Gatic	7.3	3.8	4.5	Sandy CLAY
GS_BH04/MW04	1/08/2019	321685.0	7360381.8	10.677	Gatic	7.4	3.9	4.5	Silty CLAY
GS_BH05/MW05	2/08/2019	321700.6	7360379.3	10.816	Gatic	7.4	4.4	4.5	Silty CLAY to CLAY
GS_BH06/MW06	2/08/2019	321754.2	7360373.2	11.340	Gatic	7.4	3.9	4.5	Silty CLAY

Notes
'm' is metres
'mAHD' is metres above Australian height datum
'mbgl' is metres below ground level
NA Not Available

Well ID	Easting	Northing	Top of Casing Elevation (mAHD)	Gauging Date	Depth to Water (mbtoc)	Corrected Groundwater Elevation (mAHD)
GS_MW01	321653.7	7360368.1	10.927	12/08/2019	2.207	8.720
GS_MW02	321660.4	7360386.1	10.133	12/08/2019	1.466	8.667
GS_MW03	321702.3	7360356.0	11.046	12/08/2019	2.238	8.808
GS_MW04	321685.0	7360381.8	10.677	12/08/2019	2.132	8.545
GS_MW05	321700.6	7360379.3	10.816	12/08/2019	2.067	8.749
GS_MW06	321754.2	7360373.2	11.340	12/08/2019	2.383	8.957

Notes
'm' is metres
'mAHD' is metres above Australian height datum
'mbgl' is metres below ground level

Well ID	Date	pH	Temperature (°C)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Observations
GS_MW01	13/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						No odour, clear.
GS_MW02	13/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						No odour, clear.
GS_MW03	13/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						Sulphurous odour, clear.
GS_MW04	12/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						No odour, slightly cloudy.
GS_MW05	12/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						No odour, slightly cloudy.
GS_MW06	12/08/2019	Quality parameters not collected as the water quality meter (YSI) was not operational						Sulphurous odour, turbid, light brown colour.

Notes
'°C' is degrees Celsius
'µS/cm' is microsiemens per centimetre
'mg/L' is milligrams per litre
'mV' is millivolt

		Perfluoroalkyl Sulfonic Acids							Perfluoroalkyl Carbonic Acids											Perfluoroalkyl Sulfonamides							Fluorotelomer Sulfonic Acids					
	Sum (PFHxS + PFOS)	PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFDS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDcA	PFUnDA	PFDoA	PFTrDA	PFTeDA	FOSA	MeFOSA	EtFOSA	MeFOSE	Et-FOSE	MeFOSAA	EtFOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	Sum of PFAS	Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002
PFAS NEMP Human Health Industrial/Commercial	20											50																			
NEMP (HEPA, 2018) Interim Soil Ecological Residential						0.01																									
NEMP (HEPA, 2018) Interim Soil Ecological Commercial						**0.14**																									
Sample ID	**Date**	**Lab Report**	**Type**																													
PFAS by Standard Analysis																																
GS_SS1_0.1_190801	1/08/2019	EB1920146	Normal	0.145	<0.0002	0.0002	0.0014	0.0002	**0.144**	<0.0002	<0.001	0.0012	0.001	<0.0002	0.0006	0.0068	0.0063	0.0075	<0.0002	0.0017	<0.0005	0.0003	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0054	0.0019	0.0011	0.18	-
GS_SS2_0.1_190801	1/08/2019	EB1920146	Normal	0.0346	0.0002	0.0004	0.003	<0.0002	0.0316	<0.0005	0.005	0.017	0.0059	0.0069	0.0046	0.0057	0.0106	0.254	0.008	0.0719	0.001	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0018	0.0077	0.0088	0.444	-
GS_SS2_0.5_190801	1/08/2019	EB1920146	Normal	0.219	<0.0002	<0.0002	0.0021	<0.0002	**0.217**	<0.0002	0.002	0.0108	0.006	0.0031	0.0026	0.0125	0.0363	0.0798	0.0006	0.0069	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0091	0.0009	<0.0005	0.39	-
GS_SS3_0.1_190801	1/08/2019	EB1920146	Normal	3.13	0.0155	0.0384	0.676	0.0708	**2.45**	<0.001	0.004	0.0469	0.0942	0.0481	0.123	1.19	0.0193	0.042	<0.001	0.011	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.001	0.058	<0.001	<0.001	4.89	-
GS_SS4_190813	13/08/2019	ES1925572	Normal	0.459	0.0005	0.0006	0.0074	0.0031	**0.452**	0.0049	<0.001	0.0006	0.0015	0.0004	0.001	0.0059	0.0008	0.0071	0.001	0.0081	0.0005	0.0029	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0014	0.0041	0.029	0.533	-
GS_BH01_0.1_190801	1/08/2019	EB1920146	Normal	0.0334	0.0007	0.0005	0.004	<0.0002	0.0294	<0.0002	0.015	0.0716	0.0199	0.0048	0.0023	0.0115	0.0088	0.584	0.0173	0.224	0.0038	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	0.0006	<0.0005	0.0436	0.0146	0.0161	1.07	-
GS_BH01_1.0_190801	1/08/2019	EB1920146	Normal	0.0746	0.0006	0.001	0.012	0.001	0.0626	<0.0002	<0.001	0.0047	0.0068	0.0018	0.0031	0.179	0.0003	0.0004	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0254	<0.0005	<0.0005	0.299	-
GS_BH01_7.0_190801	1/08/2019	EB1920146	Normal	0.0091	0.0012	0.0016	0.0091	<0.0002	<0.0002	<0.0002	<0.001	0.0006	0.0024	0.0005	0.0004	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0163	-
GS_BH02_0.1_190801	1/08/2019	EB1920146	Normal	0.544	0.0062	0.0028	0.0247	<0.001	**0.519**	0.0093	0.013	0.0726	0.0247	0.0118	0.0113	0.0223	0.0409	1.14	0.0292	0.192	<0.0025	0.0075	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.001	0.0335	0.0518	0.0614	2.27	-
GS_BH02_0.5_190801	1/08/2019	EB1920146	Normal	4.08	0.0144	0.0134	0.171	0.0187	**3.91**	<0.001	0.003	0.0443	0.058	0.0199	0.0472	0.328	0.0578	0.0293	<0.001	0.0013	<0.0025	<0.001	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.001	0.195	0.0199	<0.001	4.93	-
GS_QC100_190801	1/08/2019	EB1920146	Duplicate	5.15	0.0163	0.0204	0.222	0.026	**4.93**	<0.0002	0.004	0.0504	0.0765	0.0237	0.0541	0.368	0.0714	0.0282	<0.0002	0.002	<0.0005	0.0014	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.183	0.0204	<0.0005	6.1	-
GS_QC200_190801	1/08/2019	RN1243119	Triplicate	5.29	0.013	0.012	0.19	0.023	**5.1**	<0.001	-	0.045	0.053	0.018	0.044	0.35	0.071	0.043	<0.002	0.0042	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.001	0.17	0.028	<0.002	6.164	-
GS_BH02_7.0_190801	1/08/2019	EB1920146	Normal	0.0862	0.0036	0.0044	0.0468	0.0028	0.0394	<0.0002	<0.001	0.0019	0.0067	0.0014	0.0029	0.0273	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0106	<0.0005	<0.0005	0.148	-
GS_BH03_0.25_190801	1/08/2019	EB1920146	Normal	0.0055	<0.0002	<0.0002	0.0005	<0.0002	0.005	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0019	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0074	-
GS_BH03_1.1_190801	1/08/2019	EB1920146	Normal	0.002	<0.0002	<0.0002	0.0007	<0.0002	0.0013	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0023	-
GS_BH03_5.0_19801	1/08/2019	EB1920146	Normal	0.0017	<0.0002	<0.0002	0.0004	<0.0002	0.0013	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0017	-
GS_BH04_0.1_190801	1/08/2019	EB1920146	Normal	0.14	0.002	0.0012	0.0094	0.0009	0.131	<0.0012	0.005	0.0129	0.0081	0.0031	0.0019	0.0109	0.0032	0.0697	0.0018	0.0185	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0005	<0.0005	<0.0005	0.28	-
GS_BH04_1.0_190801	1/08/2019	EB1920146	Normal	0.0776	0.0003	0.0007	0.004	0.0007	0.0736	<0.0002	<0.001	0.0014	0.0016	0.0004	0.0007	0.0058	0.0003	0.0031	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0016	<0.0005	<0.0005	0.0942	-
GS_QC104_190801	1/08/2019	EB1920146	Duplicate	0.108	0.0002	0.0009	0.0048	0.001	0.103	<0.0002	<0.001	0.0006	0.0015	0.0004	0.001	0.0083	0.0004	0.0043	<0.0002	0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	0.0018	<0.0005	<0.0005	0.128	-
GS_QC204_190801	1/08/2019	RN1243119	Triplicate	0.1256	<0.001	<0.001	0.0056	<0.001	0.12	<0.001	-	<0.002	0.0014	<0.001	0.001	0.012	<0.001	0.0077	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.001	0.002	<0.001	<0.002	0.150	-
GS_BH04_5.0_190801	1/08/2019	EB1920146	Normal	0.0041	<0.0002	0.0004	0.0014	<0.0002	0.0027	<0.0002	<0.001	<0.0002	0.0003	<0.0002	<0.0002	0.0021	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0069	-
GS_BH05_0.5_190802	2/08/2019	EB1920146	Normal	0.0645	0.0061	0.0016	0.0029	0.0003	0.0616	<0.0002	0.004	0.0093	0.0061	0.0009	0.0007	0.211	0.0121	0.044	0.0003	0.0061	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.367	-
GS_QC105_190802	2/08/2019	EB1920146	Duplicate	0.0713	0.0053	0.0015	0.0034	0.0003	0.0679	<0.0002	0.004	0.0083	0.0057	0.001	0.0007	0.183	0.0109	0.0477	0.0003	0.0057	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.346	-
GS_QC205_190802	2/08/2019	RN1243119	Triplicate	0.0771	0.0077	0.0012	0.0041	<0.001	0.073	<0.001	-	0.011	0.0069	0.0015	<0.001	0.19	0.019	0.14	<0.002	0.016	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	0.470	-
GS_BH05_1.0_190802	2/08/2019	EB1920146	Normal	0.137	0.0261	0.0249	0.0685	0.0032	0.0688	<0.0002	0.002	0.0122	0.0555	0.0096	0.0074	0.571	0.001	0.0045	<0.0002	0.0007	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.855	-
GS_BH05_6.0_190802	2/08/2019	EB1920146	Normal	0.0032	0.0002	0.0005	0.0018	<0.0002	0.0014	<0.0002	<0.001	<0.0002	0.0005	<0.0002	0.0003	0.006	<0.0002	0.0012	<0.0002	0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0124	-
GS_BH06_0.1_190802	2/08/2019	EB1920146	Normal	0.0057	<0.0002	<0.0002	0.0003	<0.0002	0.0054	<0.0002	<0.001	0.002	0.0011	0.0004	0.0005	0.0052	0.006	0.341	0.0038	0.0486	0.001	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.415	-
GS_BH06_0.5_190802	2/08/2019	EB1920146	Normal	0.0026	<0.0002	<0.0002	0.0003	<0.0002	0.0023	<0.0002	<0.001	0.0013	0.0014	0.0007	0.0009	0.0937	0.0029	0.0113	<0.0002	0.0019	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.117	-
GS_BH06_7.0_190802	2/08/2019	EB1920146	Normal	<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	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	-
PFAS by TOPA* Analysis																																
GS_BH02_0.5_190801	1/08/2019	EB1921187-AA	Normal	1.93	0.0093	0.0064	0.101	0.0162	**1.83**	<0.0002	0.028	0.0883	0.109	0.0241	0.0357	0.183	0.0344	0.0246	0.0002	0.0012	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	2.49	2.49

Notes
* Total Oxidisable Precursor Assay (TOPA)
'mg/kg' is milligrams per kilogram
'<' is less than limit of reporting
'-' not analysed

			Perfluoroalkyl Sulfonic Acids						Perfluoroalkyl Carbonic Acids											Perfluoroalkyl Sulfonamides							Fluorotelomer Sulfonic Acids					
		Sum (PFHxS + PFOS)	PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFDS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFDcA	PFNA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	FOSA	MeFOSA	EtFOSA	MeFOSE	EtFOSE	MeFOSAA	EtFOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	Sum of PFAS	Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates
	Units	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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
	LOR	0.0003	0.0005	0.0005	0.0005	0.0005	0.0003	0.0005	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.001	0.0005	0.0005	0.001	0.001	0.001	0.001	0.01	0.01
PFAS NEMP Human Health Drinking Water		0.07											0.56																			
NHMRC Human Health Recreational Water		**2.0**											**10**																			
PFAS NEMP Ecological Freshwater 99% Species Protection							0.00023						19																			
Battley et al (2018) 99% Species Protection							*0.051*																									
Sample ID	**Date**	**Lab Report**	**Type**																													
PFAS by Standard Analysis																																
GS_MW01_190813	13/08/2019	ES1925572	Normal	**105**	10.9	16.6	103	1.98	*2.09*	<0.01	0.36	3.72	17	6.51	6.81	<0.01	5.16	0.012	<0.01	<0.01	<0.025	<0.01	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01	0.031	2.29	<0.01	<0.01	176	-
GS_MW02_190813	13/08/2019	ES1925572	Normal	**267**	12.2	16.3	133	10.7	*134*	<0.01	1.34	5.88	21.9	4.81	8.02	0.182	97.2	0.024	<0.01	<0.01	<0.025	<0.01	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01	0.386	47.6	0.105	<0.01	494	-
GS_MW03_190813	13/08/2019	ES1925572	Normal	**2.47**	0.481	0.453	1.09	0.102	*1.38*	<0.002	0.06	0.091	0.361	0.057	0.091	<0.002	0.059	0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.005	0.015	<0.005	<0.005	4.24	-
GS_MW04_190812	12/08/2019	ES1925572	Normal	1.63	0.183	0.183	0.739	0.096	*0.893*	<0.002	0.02	0.089	0.254	0.077	0.124	<0.002	0.648	0.006	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.005	0.079	<0.005	<0.005	3.39	-
GS_MW05_190812	12/08/2019	ES1925572	Normal	0.124	0.03	0.025	0.11	0.002	0.014	<0.002	<0.01	0.01	0.035	0.013	0.014	<0.002	0.038	0.004	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.295	-
GS_QC107_190812	12/08/2019	ES1925572	Duplicate	0.156	0.04	0.031	0.139	0.003	0.017	<0.002	<0.01	0.012	0.045	0.017	0.017	<0.002	0.046	0.004	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.371	-
GS_QC207_190812	12/08/2019	RN1244345	Triplicate	0.128	0.026	0.023	0.11	0.0014	0.018	<0.001	0.0054	0.0088	0.031	0.011	0.013	<0.001	0.031	0.0019	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	0.281	-
GS_MW06_190812	12/08/2019	ES1925572	Normal	0.109	0.022	0.014	0.096	<0.002	0.013	<0.002	0.01	0.04	0.043	0.099	0.077	0.007	0.258	0.273	0.002	0.006	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.96	-
PFAS by TOPA* Analysis																																
GS_MW02_190813	13/08/2019	ES1926853	Normal	**268**	17.3	17	149	9.51	*119*	<0.1	9.8	18.4	44.6	6.09	**10.1**	0.15	91.9	<0.1	<0.1	<0.1	<0.25	<0.1	<0.25	<0.25	<0.25	<0.25	<0.1	<0.1	<0.1	1.04	<0.1	<0.1	494	493

Notes
* Total Oxidisable Precursor Assay (TOPA)
'µg/L' micrograms per litre
'<' less than the limit of reporting
'-' not analysed

		Sum (PFHxS + PFOS)	Perfluoroalkyl Sulfonic Acids						Perfluoroalkyl Carbonic Acids										Perfluoroalkyl Sulfonamides							Fluorotelomer Sulfonic Acids				Sum of PFAS
			PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFDS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFDcA	PFNA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	FOSA	MeFOSA	EtFOSA	MeFOSE	EtFOSE	MeFOSAA	EtFOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	
	Units	ug/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	ug/L	µg/L	µg/L	µg/L	ug/L	µg/L	µg/L	µg/L	µg/L
	LOR	0.0003	0.0005	0.0005	0.0005	0.0005	0.0003	0.0005	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.001	0.0005	0.001	0.001	0.001	0.001	0.0003
NHMRC Human Health Recreational Water		**2.0**											**10**																	
PFAS NEMP Ecological Freshwater 99% Species Protection							0.00023						19																	
Battley et al (2018) 99% Species Protection							*0.051*																							
Sample ID	**Date**	**Lab Report**	**Type**																											
GS_SW03_190812	13/08/2019	ES1925572	Normal	0.0499	<0.0005	<0.0005	0.0065	<0.0005	0.0434	<0.0005	<0.002	0.0018	0.0018	<0.0005	0.0017	0.0013	0.0048	0.0082	0.001	0.002	<0.0005	0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.001	0.004	0.008	0.007	0.092

Notes
'µg/L' micrograms per litre
'<' less than the limit of reporting

		Perfluoroalkyl Sulfonic Acids							Perfluoroalkyl Carbonic Acids											Perfluoroalkyl Sulfonamides							Fluorotelomer Sulfonic Acids				
	Sum (PFHxS + PFOS)	PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFDS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDcA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	FOSA	MeFOSE	EtFOSE	MeFOSA	EtFOSA	MeFOSAA	EtFOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	Sum of PFAS
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002
Sample ID	**Date**	**Lab Report**	**Type**																											
GS_SED01_190813	13/08/2019	ES1925572	Normal	0.0048	<0.0002	<0.0002	0.0002	<0.0002	0.0046	<0.0002	0.001	0.001	0.0004	0.0002	0.0003	0.0122	0.0027	0.14	0.0085	0.0879	0.002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	0.0006	0.262
GS_QC108_190813	13/08/2019	ES1925572	Duplicate	0.005	0.0002	<0.0002	0.0002	<0.0002	0.0048	<0.0002	0.001	0.0011	0.0005	0.0002	0.0002	0.0121	0.0028	0.159	0.0078	0.116	0.0015	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	0.0006	0.308
GS_QC208_190813	13/08/2019	RN1244345	Triplicate	0.0062	<0.001	<0.001	<0.001	<0.001	0.0062	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	0.015	0.0037	0.23	0.01	0.15	0.0029	<0.001	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	0.4178

Notes
'mg/kg' is milligrams per kilogram
'<' less than the limit of reporting
'-' not analysed

Appendix C

EMR / CLR Search Results

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude valley QLD 4006

Transaction ID: 50513658 EMR Site Id: 19 February 2019
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 5 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude Valley QLD 4006

Transaction ID: 50585156 EMR Site Id: 11 February 2020
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 6 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude Valley QLD 4006

Transaction ID: 50585155 EMR Site Id: 11 February 2020
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 7 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude Valley QLD 4006

Transaction ID: 50585154 EMR Site Id: 11 February 2020
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 8 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude Valley QLD 4006

Transaction ID: 50585153 EMR Site Id: 11 February 2020
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 9 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

AECOM
540 Wickham Street
Fortitude Valley QLD 4006

Transaction ID: 50585152 EMR Site Id: 11 February 2020
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 10 Plan: RP606760
3 CHARLES ST
WEST GLADSTONE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

Appendix D

Photographs

PHOTOGRAPHIC LOG

Site Name: Gladstone Fire Station	**Site Location:** 5-9 Breslin Street, Gladstone, Queensland	**Project No:** 60609758

Plate No.	**Date:**
1	29/01/2019

Direction Photo Taken: N/A

Description: Storage of Foam concentrate in storage shed.

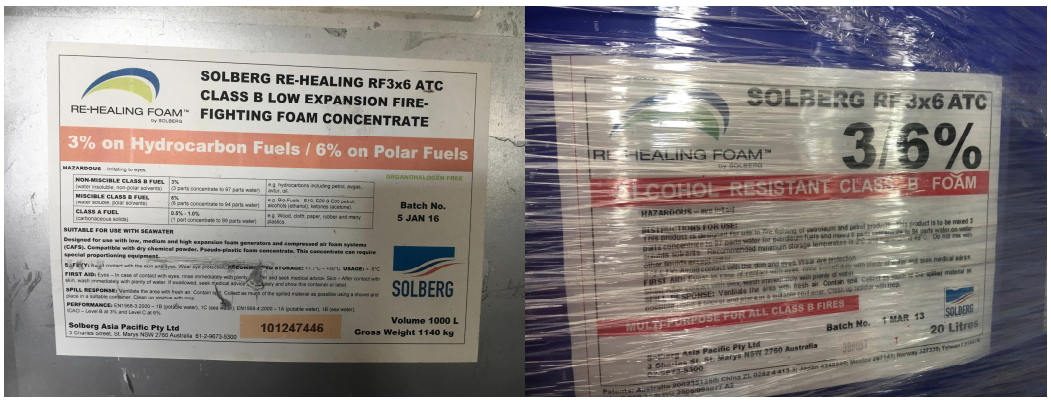
PHOTOGRAPHIC LOG

Site Name: Gladstone Fire Station	**Site Location:** 5-9 Breslin Street, Gladstone, Queensland	**Project No:** 60609758

Plate No.	**Date:**
2	29/01/2019

Direction Photo Taken: N/A

Description: Class B foam labels.



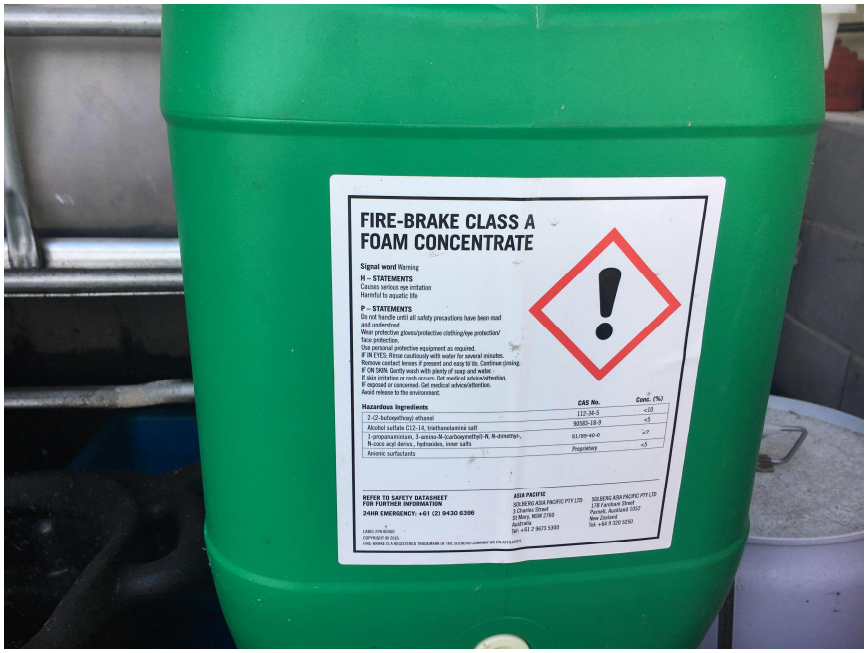
PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
3	29/01/2019

Direction Photo Taken:
N/A

Description:
Class A foam concentrate label.



PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
4	29/01/2019

Direction Photo Taken:
West

Description:
Shed constructed over grassed area historically used for training purposes and subject to foam usage.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
5	29/01/2019

Direction Photo Taken:
West

Description:
Grassed area historically used for training purposes and subject to foam use. Breslin Street beyond site fence on right side of photo.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
6	29/01/2019

Direction Photo Taken:
South

Description:
Grassed area historically used for training purposes and subject to foam use. Western neighboring property beyond site fence on right side of photo was anecdotally part of the foam training area before being sub-divided at an unknown date.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
7	29/01/2019

Direction Photo Taken:
West

Description:
Grassed area historically used for training purposes and subject to foam use.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Gladstone Fire Station	5-9 Breslin Street, Gladstone, Queensland	60609758

Plate No.	Date:
8	

Direction Photo Taken:
North

Description:
Waste laydown area. Used for containment and storage and waste materials.

PHOTOGRAPHIC LOG

Site Name: Gladstone Fire Station	**Site Location:** 5-9 Breslin Street, Gladstone, Queensland	**Project No:** 60609758

Plate No.	**Date:**
9	29/01/2019

Direction Photo Taken: South-west

Description: Inside site workshop. Pit used when working under vehicle visible.

PHOTOGRAPHIC LOG

Site Name: Gladstone Fire Station	**Site Location:** 5-9 Breslin Street, Gladstone, Queensland	**Project No:** 60609758

Plate No.	**Date:**
10	

Direction Photo Taken: East

Description: Stormwater drainage channel located across Breslin Street. Receives stormwater discharge from site.

Appendix E

Bore Logs

MONITORING WELL LOG GS_BH01/GS_MW01

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 10.927 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 1/8/2019
BLANK 0.0 - 4.0 m bgl
SCREEN 4.0 - 7.0 m bgl
GRAVEL PACK 3.5 - 7.0 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.5 m bgl
NORTHING 7360368.1
EASTING 321653.7

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			GS_BH01_0.1_190801				FILL: Silty CLAY loam, brown, dry, firm, no plasticity, with medium-coarse angular gravels, trace of angular cobbles.	0.25
0.0			GS_BH01_0.4_190801				FILL: Gravelly SAND, light brown, dry, medium dense, medium grained, fine-coarse gravels.	0.45
							FILL: Volcaniclastic sedimentary rock congolmerate.	0.80
0.0			GS_BH01_1.0_190801		1.0		FILL: Gravelly CLAY, orange, dry, stiff, low plasticity, fine-angular gravels.	
0.0			GS_BH01_1.5_190801					
								1.80
0.0			GS_BH01_2.0_190801		2.0		Gravelly CLAY, orange, hard, no plasticity, with quartz arenite returned as coarse angular gravels.	
0.0			GS_BH01_3.0_190801		3.0			
0.0			GS_BH01_4.0_190801		4.0			
								4.80
0.0			GS_BH01_5.0_190801		5.0		Banded orange clay with quartz arenite returned as coarse angular gravels.	
0.0			GS_BH01_6.0_190801		6.0		Quartz arenite returned as fine-medium angular gravels.	
0.0			GS_BH01_7.0_190801		7.0		Saturated at 7.00m bgs.	7.00
							End of hole at target depth. Total Depth: 7.00 m	

WELL DIAGRAM: Grout; Bentonite; Casing; Filter Sands; Screen

GS_BORELOGS.GPJ 16/12/19

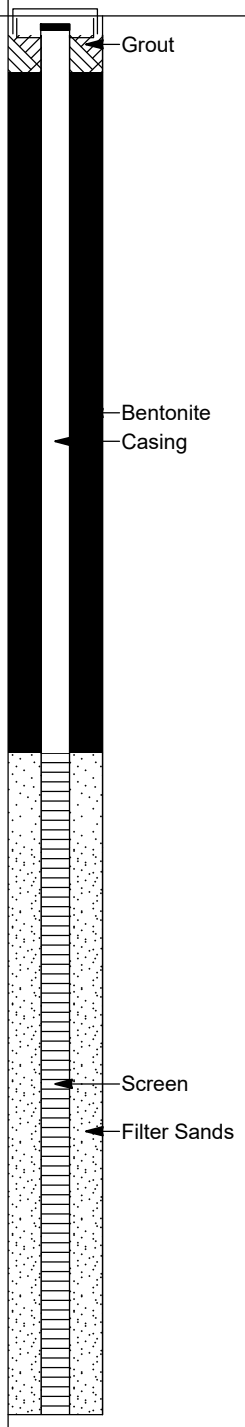
MONITORING WELL LOG GS_BH02/GS_MW02

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 10.133 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 1/8/2019
BLANK 0.0 - 4.4 m bgl
SCREEN 4.4 - 7.4 m bgl
GRAVEL PACK 3.9 - 7.4 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.9 m bgl
NORTHING 7360386.1
EASTING 321660.4

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			GS_BH02_0.1_190801				FILL: Silty CLAY loam, dark brown, dry, firm, no plasticity, with coarse angular gravels.	
								0.40
0.0			GS_BH02_0.5_190801				FILL: Sandy CLAY, grey, dry, stiff, low plasticity, with fine-medium sub-angular gravels.	0.60
							FILL: Volcaniclastic sedimentary rock congolmerate.	0.80
0.0			GS_BH02_1.0_190801		1.0		FILL: CLAY, brown, light brown mottle, dry, firm, medium plasticity, with fine-medium sub-angular gravels.	1.20
0.0			GS_BH02_1.5_190801				FILL: Gravelly CLAY, mottled brown/black/grey/white/orange, dry, firm, low plasticity, fine-coarse sub-angular gravels.	1.80
0.0			GS_BH02_2.0_190801		2.0		DISTURBED NATURAL: Silty CLAY, brown, slightly moist, stiff, low plasticity, with fine-medium sub-rounded gravels, trace of sub-angular cobbles.	
0.0			GS_BH02_3.0_190801		3.0			3.10
							Silty CLAY, brown, slightly moist, stiff, low plasticity, with quartz arenite returned as fine-medium sub-rounded gravels.	
0.0			GS_BH02_4.0_190801		4.0			
							Wet @ 4.50m bgs.	
0.0			GS_BH02_5.0_190801		5.0			
					6.0			
0.0			GS_BH02_7.0_190801		7.0			7.40
							End of hole at target depth. Total Depth: 7.40 m	



GS_BORELOGS.GPJ 16/12/19

MONITORING WELL LOG GS_BH03/GS_MW03

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 11.046 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 1/8/2019
BLANK 0.0 - 4.3 m bgl
SCREEN 4.3 - 7.3 m bgl
GRAVEL PACK 3.8 - 7.3 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.8 m bgl
NORTHING 7360356
EASTING 321702.3

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			GS_BH03_0.2_190801				FILL: CONCRETE	0.20
0.0			GS_BH03_0.5_190801				FILL: Gravelly CLAY, brown, mottled black/orange/grey, dry, firm, low plasticity, fine-coarse angular gravels.	0.45
							FILL: Volcaniclastic sedimentary rock congolmerate.	
0.0			GS_BH03_1.1_190801		1.0		FILL: Sandy CLAY, grey, dry, firm, medium plasticity, medium grained sand.	1.10 / 1.20
0.0			GS_BH03_1.5_190801				FILL: Weathered rock returned as fine-medium angular gravels, with medium grained sand.	1.80
0.0			GS_BH03_2.0_190801		2.0		DISTURBED NATURAL: Sandy CLAY, brown, pale grey mottle, dry, low plasticity, with fine-medium angular gravels.	
0.0			GS_BH03_3.0_190801		3.0		Sandy CLAY, brown, pale grey mottle, slightly moist, low plasticity.	3.00
0.0			GS_BH03_4.0_190801		4.0		Wet @ 4.50m bgs.	4.80
0.0			GS_BH03_5.0_190801		5.0		Banded clay as above with quartz arenite returned as coarse angular gravels.	
0.0			GS_BH03_6.0_190801		6.0			
					7.0		End of hole at target depth. Total Depth: 7.30 m	7.30

WELL DIAGRAM: Grout; Bentonite; Casing; Screen; Filter Sands

GS_BORELOGS.GPJ 16/12/19

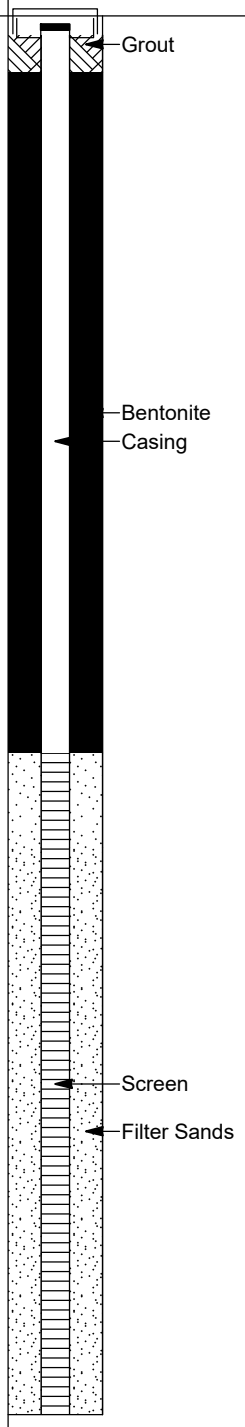
MONITORING WELL LOG GS_BH04/GS_MW04

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 10.677 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 1/8/2019
BLANK 0.0 - 4.4 m bgl
SCREEN 4.4 - 7.4 m bgl
GRAVEL PACK 3.9 - 7.4 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.9 m bgl
NORTHING 7360381.8
EASTING 321685

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			GS_BH04_0.1_190801				FILL: Silty CLAY loam, dark brown, dry, firm, no plasticity, with coarse angular gravels.	
								0.40
0.0			GS_BH04_0.5_190801				FILL: CLAY, grey, orange mottle, dry, firm, low plasticity, with fine-medium angular gravels indicative of highly weathered rock congolmerate as below.	
								0.80
0.0			GS_BH04_1.0_190801		1.0		FILL: Volcaniclastic sedimentary rock congolmerate.	1.10
0.0			GS_BH04_1.5_190801				DISTURBED NATURAL: Silty CLAY, brown, minor grey mottle, dry, stiff, low plasticity, with fine-medium angular/sub-angular gravels.	
0.0			GS_BH04_2.0_190801		2.0		Slightly moist @ 2.00m bgs.	
0.0			GS_BH04_3.0_190801		3.0			
								3.90
0.0			GS_BH04_4.0_190801		4.0		Silty CLAY, brown, minor grey mottle, moist, stiff, medium plasticity, with quartz aranite returned as fine-medium sub-angular gravels.	
								4.50
							Silty CLAY, light brown, wet, firm, medium-high plasticity, with quartz arenite returned as fine-medium sub-rounded gravels.	
0.0			GS_BH04_5.0_190801		5.0			
					6.0			
					7.0			
								7.40
							End of hole at target depth. Total Depth: 7.40 m	



GS_BORELOGS.GPJ 16/12/19

MONITORING WELL LOG GS_BH05/GS_MW05

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 10.816 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 2/8/2019
BLANK 0.0 - 4.4 m bgl
SCREEN 4.4 - 7.4 m bgl
GRAVEL PACK 3.9 - 7.4 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.9 m bgl
NORTHING 7360379.3
EASTING 321700.6

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			GS_BH05_0.1_190802				FILL: Silty SAND, brown, dry, fine grained, medium dense, with rootlets and weathered/crushed white rock indicative of phyllite.	0.30
0.0			GS_BH05_0.5_190802				Fill: CLAY, mottled brown/red/orange/white, dry, very stiff, no plasticity, trace of fine angular gravels and weathered/crushed white rock as above.	
0.0			GS_BH05_1.0_190802		1.0			
								1.40
0.0			GS_BH05_1.5_190802				Hard rock, limited return.	1.50
							DISTURBED NATURAL: Silty CLAY, brown, dry, firm, low plasticity, with medium-coarse sand.	
0.0			GS_BH05_2.0_190802		2.0		Slightly moist @ 2.0m bgs.	
								2.90
0.0			GS_BH05_3.0_190802		3.0		Silty CLAY, brown, firm, low plasticity, slightly moist, with white weathered rock returned as fine-medium angular gravels.	
0.0			GS_BH05_4.0_190802		4.0		Moist @ 4.00m bgs.	
							Wet @ 4.50m bgs.	
0.0			GS_BH05_5.0_190802		5.0		With quartz arenite returned as fine-medium sub-angular/sub-rounded gravels @ 5.00m bgs.	
0.0			GS_BH05_6.0_190802		6.0		With quartz arenite returned as medium-coarse sub-angular/sub-rounded gravels @ 6.00m bgs.	6.20
							Silty CLAY, grey, firm, low plasticity, wet, with quartz arenite returned as medium-coarse sub-angular/sub-rounded gravels.	
					7.0			
0.0			GS_BH05_7.4_190802				End of hole at target depth. Total Depth: 7.40 m	

WELL DIAGRAM: Grout; Bentonite; Casing; Screen; Filter Sands

GS_BORELOGS.GPJ 16/12/19

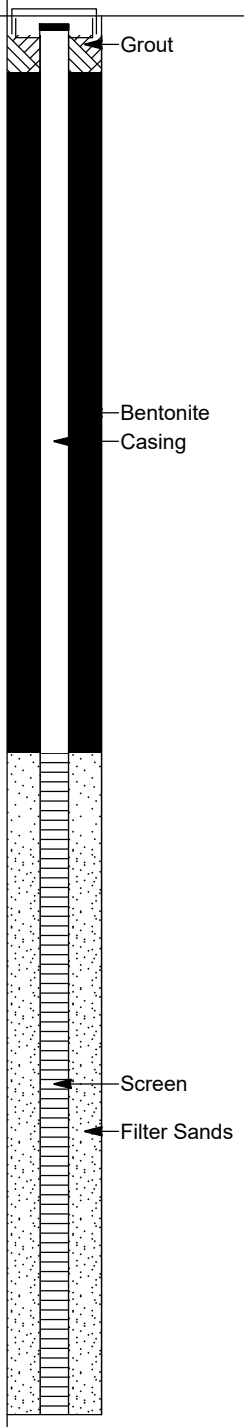
MONITORING WELL LOG GS_BH06/GS_MW06

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD NDD, Hand Auger & SSA
SAMPLING METHOD Grab
SURFACE ELEVATION 11.340 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 2/8/2019
BLANK 0.0 - 4.4 m bgl
SCREEN 4.4 - 7.4 m bgl
GRAVEL PACK 3.9 - 7.4 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.9 m bgl
NORTHING 7360373.2
EASTING 321754.2

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			GS_BH06_0.1_190802	✳			FILL: Silty SAND, brown, dry, fine grained, medium dense, with rootlets and weathered/crushed white rock indicative of phyllite.	0.30
			GS_BH04_0.5_190806	✳			FILL: Clayey GRAVEL, black, dry, fine, angular, grey/firm clay.	0.60
							FILL: Volcaniclastic sedimentary rock congolmerate.	0.90
			GS_BH06_1.0_190802		1.0		FILL: Silty CLAY, brown/orange, dry, firm, no plasticity, with fine angular gravels.	
			GS_BH06_1.5_190802				DISTURBED NATURAL: Silty CLAY, mottled brown/grey, dry, stiff, low plasticity, with quartz arenite returned as returned as fine-medium sub-angular gravels.	1.40
			GS_BH06_2.0_190802		2.0			
			GS_BH06_3.0_190802		3.0		Slightly moist @ 3.00m bgs.	
			GS_BH06_4.0_190802		4.0		Silty CLAY, brown, slightly moist, firm, medium plasticity, with quartz arenite returned as fine-medium sub-angular gravels.	3.80
			GS_BH06_5.0_190802		5.0			
			GS_BH06_6.0_190802		6.0			
			GS_BH06_7.0_190802	✳	7.0			
							Refusal at 7.40m bgs on rock. Target depth reached. Total Depth: 7.40 m	7.40



GS_BORELOGS.GPJ 16/12/19

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley, QLD 4006

BOREHOLE LOG GS_SS1

PROJECT NUMBER 60609758 **DATE** 01/08/2019
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD Hand Auger
SAMPLING METHOD Grab

LOGGED BY C. McCosker
COMMENTS

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0		GS_SS1_0.1_190801	✳			SPG	FILL: Gravelly SAND, brown, dry, dense, medium grain, coarse angular gravels, with angular cobbles and volcaniclastic sedimentary rock aggregate.	0.15
							Refusal @ 0.15m bgs on rock/gravel/cobbles. Total Depth: 0.15 m	

GS_BORELOGS.GPJ 16/12/19

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley, QLD 4006

BOREHOLE LOG GS_SS2

PROJECT NUMBER 60609758 **DATE** 01/08/2019
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD Hand Auger
SAMPLING METHOD Grab

LOGGED BY C. McCosker
COMMENTS

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0		GS_SS2_0.1_190801	✳			CL-ML	FILL: Silty CLAY loam, dark brown, dry, firm, no plasticity, with coarse angular gravels.	
						CLG	FILL: Gravelly CLAY, dark grey, dry, firm, no plasticity, fine-coarse angular gravels.	0.30
0.0		GS_SS2_0.5_190801	✳					0.60
							Refusal @ 0.60m bgs on volcaniclastic sedimentary rock aggregate. Total Depth: 0.60 m	

GS_BORELOGS.GPJ 16/12/19

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley, QLD 4006

BOREHOLE LOG GS_SS3

PROJECT NUMBER 60609758 **DATE** 01/08/2019
PROJECT NAME QFES PFAS DSIs - Gladstone
LOCATION 5-9 Breslin St, Gladstone, 4680
DRILLING METHOD Hand Auger
SAMPLING METHOD Grab

LOGGED BY C. McCosker
COMMENTS

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0		GS_SS3_0.1_190801	✳			CL-ML	FILL: Silty CLAY loam, dark brown, dry, firm, no plasticity, with coarse angular gravels.	
						CL-ML	FILL: Silty CLAY, grey, orange mottle, dry, firm, low plasticity, with coarse angular gravels.	0.30
0.0		GS_SS3_0.5_190801						0.60
							Refusal @ 0.60m bgs on volcaniclastic sedimentary rock aggregate. Total Depth: 0.60 m	

GS_BORELOGS.GPJ 16/12/19

Appendix F

Fieldsheets and Calibration Certificates

AECOM

ANZ

FQM - NAPL and Groundwater Level Gauging Record

Q4AN(EV)-414-FM1

Project Name:	QFES PFAS DSI	Project Location:	Gladstone	PM Name:	James Peachy
Project Number:	60609758_2.0	Client:	QFES	Fieldwork Staff Name:	Zoe Maskell

Confirm NAPL and groundwater levels by repeat measurements. All columns must be completed. If NAPL is not present in a well write 'ND' (Not Detected) in the relevant column.

Field Data

Well ID	Date (dd/mm/yy)	Time (24hr:mm)	PID Reading (ppm)	Depth to LNAPL (mBTOC)	Depth to Groundwater (mBTOC)	LNAPL Thickness (m)	Depth to DNAPL (mBTOC)	Total Well Depth (mBTOC)	DNAPL Thickness (m)	Comments (well condition, odour, NAPL colour and viscosity)
MW01	12/8/19	10:05	—	—	2.207	—	—	9.933		Muddy bottom.
MW02	12/8/19	10:00	—	—	1.466	—	—	10.000	—	earth outside casing loose. Muddy bottom.
MW03	12/8/19	10:11	—	—	2.238	—	—	6.900	—	Muddy bottom.
MW04	12/8/19	10:34	—	—	2.132	—	—	7.230	—	Clear bottom (hard)
MW05	12/8/19	10:46	—	—	2.067	—	—	7.331	—	Muddy bottom
MW06	12/18/19	1056	—	—	2.383	—	—	6.702	—	deep muddy bottom

No odour, clear. Mud creamy brown.

Measurement Equipment			
Make & Model:	Geotech Interface probe	Supplier:	AirMet
Serial No.:		Calibration Report Provided?	Yes

Notes/Comments

(PID) - photo ionisation detector; (ppm) - parts per million; (LNAPL) - light non-aqueous phase liquids; (DNAPL) - dense light non-aqueous phase liquid; (mBTOC) - metres below top of casing

Approval and Distribution

Fieldwork Staff Signature — Date: 12/08/19

Project Manager Signature — Date

Distribution: Project Central File

ANZ

FQM - Groundwater Sampling and Purging Record

						Bore ID:	MW01
Project Name:	QFES PFAS DSI	Project Number:	60609758_2.0	PM Name:	James Peachy	Sample Date:	13/08/19
Client:	QFES	Project Location:	Gladstone	Fieldwork Staff:	Zoe Maskell	Well Development or Well Sampling Event? (circle)	

General Bore Information			Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level:	12/08/19	Bore Radius (mm): 50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate: low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	2.207	Screen Interval (m): 4.0 - 7.0	Chem Kit Model:	☐ Dedicated	Intake depth: 6.0	Hydrasleeve Type:	
Bore Depth (m-pvc):	9.933	Casing Radius (mm): 150	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	—	Cover Type (gatic/stick up): G	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	—	Bore Locked (YES/NO): NO	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
		Key Type (if applicable): HEX8	☐ Retrieved				Parameters
Calculated bore volume (L):		Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L): 4.210		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
0950	0.1	2.35	low	No YSI					No odour, clear.
0955	0.4	2.40	low						"
1000	0.9	2.45	low						"
1005	1.3	2.44	low						"
1010	2.0	2.46	low						"
1015	2.5	2.48	low						"
1020	3.0	2.48	low						"
1025	3.7	2.48	low						"
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected					QA/QC Information	Field Commets
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	1	x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber	3	x 250 mL Plastic		Start WL: 2.24
						1	x 250 mL Plastic (PFAS)		Start time: 0945
									End WL: 2.48
									End time: 1030
									* No YSI - would not start

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
ZMaskell	13/08/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

AECOM

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW02
Project Name:	QFES PFAS DSI	Project Number:	60609758_2.0	PM Name:	James Peachy	Sample Date:	13/8/19
Client:	QFES	Project Location:	Gladstone	Fieldwork Staff:	Zoe Maskell	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12/8/19	Bore Radius (mm): 50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate: low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 1.466	Screen Interval (m): 4.4 - 7.4	Chem Kit Model:	☐ Dedicated	Intake depth: 6.4	Hydrasleeve Type:	
Bore Depth (m-pvc): 10.000	Casing Radius (mm): 150	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up): G	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO): NO	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): HEX	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L): 4.210		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
0700	0.1	1.61	low	No YSI →				→	Clear, no odour
0705	0.5	1.71	low						"
0710	1.1	1.71	low						"
0715	1.9	1.75	low						"
0720	2.2	1.76	low						"
0725	2.9	1.78	low						"
0730	3.5	1.80	low						" (very slightly cloudy)
0735	3.9	1.80	low						"
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected					QA/QC Information
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber	✓	x 250 mL Plastic
							x 250 mL Plastic (PFAS)

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

start depth: 1.53
start time: 0655
end depth: 1.79
end time: 0740

Took red ~~green~~ bottle here for feild parameters incase sample selected for TOPA.

* No ~~PF~~ YSI - won't turn on.

Approval and Distribution

ZMaskell — Fieldwork Staff Signature	13/8/19 — Date	Checker Name and Signature	Date
Project Manager Signature	Date	Distribution: Project Central File	

AECOM

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW03
Project Name:	QFES PFAS DSI	Project Number:	60609758_2.0	PM Name:	James Peachy	Sample Date:	13/8/19
Client:	QFES	Project Location:	Gladstone	Fieldwork Staff:	Zoe Maskell	Well Development or Well Sampling Event? (circle)	

General Bore Information				Parameter Info.	Decontamination	Sampling Method		Hydrasleeve info.	
Date of GW Level:	12/8/19	Bore Radius (mm):	50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate:	Low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	2.238	Screen Interval (m):	3.8-7.3	Chem Kit Model:	☐ Dedicated	Intake depth:	6.3	Hydrasleeve Type:	
Bore Depth (m-pvc):	6.900	Casing Radius (mm):	150	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve		Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	—	Cover Type (gatic/stick up):	G	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra		Hydrasleeve install time:	Hydrasleeve in
Product Thickness (m):	—	Bore Locked (YES/NO):	NO	Parameter method: ☐ Downhole		☐ Other (specify)		Sampling Start Time:	Hydrasleeve out
		Key Type (if applicable):	HEX8	☐ Retrieved					Parameters

Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:	Total purged volume (L): 4.810

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
0810	0.1	2.34	low	No YSI					no colour, sulphurous odour, clear
0815	1.0	2.44	low						"
0820	1.5	2.43	low						"
0825	2.0	2.45	low						"
0830	2.6	2.45	low						"
0835	3.2	2.46	low						"
0840	3.8	2.46	low						" (sample appears slightly cloudy with increased volume)
0845	4.5	2.46	low						
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected					QA/QC Information
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous	x 60 mL metals (HNO_3)	
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber	x 250 mL Plastic	
						x 250 mL Plastic (PFAS)	

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Z Maskell	13/8/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

Start depth: 2.29
Start time: 0810
End depth: 2.47
End time: 0850
* No YSI - wouldn't turn on

4.928 actual

ANZ

FQM - Groundwater Sampling and Purging Record

AECOM

Q4AN(EV)-405-FM1

						Bore ID:	MW04
Project Name:	QFES PFAS DSI	Project Number:	60609758_2.0	PM Name:	James Peachy	Sample Date:	12/08/2019
Client:	QFES	Project Location:	Gladstone	Fieldwork Staff:	Zoe Maskell	Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12/08/19	Bore Radius (mm): 50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate: low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 2.132	Screen Interval (m): 3.9→7.4	Chem Kit Model:	☐ Dedicated	Intake depth: 6.4	Hydrasleeve Type:	
Bore Depth (m-pvc): 7.230	Casing Radius (mm): 150	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up): G	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO): NO	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): HEX	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L): ~~4.5 5.5 6.5~~ 4.750		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1305	0.1	2.205	Mid	no YSI	→	→	→	→	Slightly cloudy, no odour
1310	0.6	2.401	Low	↓					"
1315	2.1	2.540	Low						"
1320	2.5	2.667	Low						"
1325	3.0	2.805	Low						" (Reduced speed further.)
1330	3.4	2.849	Low						" (appears milky, slightly opaque)
1335	4.1	2.882	Low						"
1340	4.5	2.887	Low						
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic	
						1	x 250 mL Plastic (PFAS)	

Field Commets

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

Start depth: 21.94
Start time: 1155
*NO YSI (would not turn on)

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Z Maskell	12/08/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

AECOM

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW05
Project Name:	QFES PFAS DSI	**Project Number:**	60609758_2.0	**PM Name:**	James Peachy	**Sample Date:**	12/08/2019
Client:	QFES	**Project Location:**	Gladstone	**Fieldwork Staff:**	Zoe Maskell	**Well Development or Well Sampling Event? (circle)**	

General Bore Information				Parameter Info.	Decontamination	Sampling Method		Hydrasleeve info.	
Date of GW Level:	12/08/2019	Bore Radius (mm):	50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate:	low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	2.067	Screen Interval (m):	4.4-7.4	Chem Kit Model:	☐ Dedicated	Intake depth:	6.4	Hydrasleeve Type:	
Bore Depth (m-pvc):	7.331	Casing Radius (mm):	150	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve		Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	—	Cover Type (gatic/stick up):	G	(The correction to apply is probe dependent)	☐ Other (specify)	☒ Peristaltic Pump ☐ Waterra		Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	—	Bore Locked (YES/NO):	NO	**Parameter method:** ☐ Downhole		☐ Other (specify)		Sampling Start Time:	Hydrasleeve out
		Key Type (if applicable):	HEX	☐ Retrieved					Parameters
Calculated bore volume (L):		Includes/ excludes bore annulus (circle)		# purge volumes removed:		Total purged volume (L):	4.850		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1425	0.1	2.08	low	No YSI					Slightly cloudy, no odour
1430	0.5	2.08	low						"
1435	1.5	2.08	low						"
1440	2.0	2.08	low						"
1445	2.2	2.082	low						"
1450	2.8	2.082	low						"
1455	3.5	2.082	low						"
1500	4.1	2.082	low						"
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	GS_QC107	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic	GS_QC207	Start : 2.055
						1	x 250 mL Plastic (PFAS)	taken here.	start time : 1420
									END : 2.082
									END TIME : 1310
									* Note: No YSI - would not turn on

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Project Manager Signature	Date	**Distribution:** Project Central File	

AECOM

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW06
Project Name:	QFES PFAS DSI	**Project Number:**	60609758_2.0	**PM Name:**	James Peachy	**Sample Date:**	12/08/2019
Client:	QFES	**Project Location:**	Gladstone	**Fieldwork Staff:**	Zoe Maskell	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 12/08/2019	Bore Radius (mm): 50	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate: low	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 2.383	Screen Interval (m): 3.9-7.4	Chem Kit Model:	☐ Dedicated	Intake depth: 6.4	Hydrasleeve Type:	
Bore Depth (m-pvc): 6.702	Casing Radius (mm): 150	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up): G	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO): NO	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): HEX	☐ Retrieved				Parameters

Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:	Total purged volume (L):

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1555	0.1	~~2.245~~	low	No YSI					Turbid light brown, sulphurous odour
1600	1.0	2.54	low						"
1605	1.5	2.56	low						"
1610	2.1	2.57	low						"
1615	2.5	2.60	low						"
1620	3.0	2.59	low						"
1625	3.5	2.59	low						"
1630	4.1	2.60	low						
SAMPLE									
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	Did rinsate QC305 after this site.	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic		Start WL: 2.365
						1	x 250 mL Plastic (PFAS)		Start time: 1550
									End WL: 2.60
									End time: 1635
									* No YSI: Would not turn on

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Z Maskell	12/08/19		
Project Manager Signature	**Date**	**Distribution:** Project Central File	

Coordinates : 23°51'30" S
151°14'58" E

AECOM

ANZ

FQM - Groundwater Sampling and Purging Record (SURFACE WATER SAMPLE)

Q4AN(EV)-405-FM1

						Bore ID:	SW03
Project Name:	QFES PFAS DSI	**Project Number:**	60609758_2.0	**PM Name:**	James Peachy	**Sample Date:**	12/08/2019
Client:	QFES	**Project Location:**	Gladstone	**Fieldwork Staff:**	Zoe Maskell	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level:	Bore Radius (mm):	Chem Kit Serial No.:	☐ Decontaminated	☐ **Low Flow** Pump rate:	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc):	Screen Interval (m):	Chem Kit Model:	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc):	Casing Radius (mm):	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):	☐ Retrieved				Parameters

Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:	Total purged volume (L):

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1125	0.25	—	—	—	—	—	—	—	Clear with organic matter [illegible] F
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)		Bore volume calculation, bore condition, fate of tubing, redox correction etc.
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic		Sample only accessable for short time - did not get to take probe sample. Will try again if possible + replace sample. Sampled from ground level inlet to down pipe drain (location shown on feild map)
							x 250 mL Plastic (PFAS)		

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Project Manager Signature	Date	**Distribution:** Project Central File	

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 224606

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15/07/2019

Next calibration due: 13/09/2019

Gas Detection Air Sampling & Monitoring Environmental & Water Quality Monitoring

airmet

Air-Met Scientific Pty Ltd

ABN 73 006 849 949

Ph 1300 137 067

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 11K100831

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
	Seal	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC/Temp.	✓	
	4. D.O	✓	
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00	NIST	320613	pH 7.00
2. pH 4.00		pH 4.00	NIST	320612	pH 4.00
3. mV		240mV	NIST	325420/325421	240mV
4. EC		2.76mS	NIST	304153	2.76mS
6. D.O		0 ppm	NIST	5928	0 ppm
7. Temp		22.6oC	NIST	MultiTherm 09000528	22.6oC

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15-Jul-19

Next calibration due: 11-Jan-20

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-114169

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Low	High	TWA	STEL
50ppm	100ppm		

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		93ppm Isobutylene	NIST	BR100		93.0ppm

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15/07/2019

Next calibration due: 14/08/2019

Gas Calibration Certificate

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument MX4
Serial No. 13054CJ-002
Sensors CO, H2S, O2, LEL

Item	Test	Pass	Comments			
Battery	Charge Condition	✓				
	Fuses	✓				
	Capacity	✓				
	Recharge OK?	✓				
Switch/keypad	Operation	✓				
Display	Intensity	✓				
	Operation (segments)	✓				
Grill Filter	Condition	✓				
	Seal	✓				
PCB	Condition	✓				
Connectors	Condition	✓				
			Low	**High**	**TWA**	**STEL**
Sensor	Oxygen	✓	19.50%	23.50%	N/A	N/A
	Pentane	✓	5% LEL	10% LEL	N/A	N/A
	CO	✓	30 ppm	60 ppm	30ppm	60ppm
	H2S	✓	10 ppm	15 ppm	10ppm	15ppm
Alarms	Beeper	✓				
	Settings	✓				
Software	Version					
Datalogger	Operation					
Download	Operation					
Other tests:						

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No	Instrument Reading
O2		Fresh Air		Fresh Air	20.90%
LEL		25% LEL Pentane	NIST	BR133	25% LEL Pentane
CO		100ppm	NIST	BR133	100ppm
H2S		25ppm	NIST	BR133	25ppm

Calibrated by: **Braeden Curtis**

Calibration date: **16/07/19**

Next calibration due: **15/01/2020 0:00**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (60m)
Serial No. 3956

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	9.0V
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Nikhil Mruthyunjayappa**

Calibration date: **07-Aug-19**

Next calibration due: **06-Oct-19**

Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **11K100830**

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00	**NIST**	320613	pH 7.00
2. pH 4.00		pH 4.00	**NIST**	307927	pH 4.00
3. mV		240mV	**NIST**	325420/325421	240mV
4. EC		2.76mS	**NIST**	304153	2.76mS
6. D.O		0 ppm	**NIST**	5928	0 ppm
7. Temp		24.oC	**NIST**	MultiTherm 09000528	24.oC

Calibrated by: **Nikhil Mruthyunjayappa**

Calibration date: **7/08/2019**

Next calibration due: **3/02/2020**

Appendix G

Surveying Report

Survey Control Mark Report

ADMINISTRATIVE

Mark Number	**120137**		
Alternate Names		Town	
		Local Authority	**GLADSTONE REGIONAL**
Locality Description	**BRESLIN & BOLES STS**		
Related Information	**mark is ramset nail**		

DETAILS

Mark Type	**R/INF**			
Installed By	**UNKNOWN**	Connections	**SP266695**	24-Nov-2016
Installed Date	**01-Jan-1992**		**SP266691**	18-Aug-2016
Mark Condition	**GOOD**		**SP266706**	18-Jul-2016
Last Visited	**24-Nov-2016**		**CP843206**	02-Jun-1992
Sketch Available	**Yes**			

GDA94 COORDINATES

Lineage	**Datum**		
Latitude	**23° 51' 29.58960" S**	Horizontal Uncertainty	**0.013m**
Longitude	**151° 15' 09.47531" E**		
Ellipsoidal Height	**64.429m**	Vertical Uncertainty	**0.030m**
MGA94 Easting	**322060.470m**	MGA94 Point Scale	**0.99999111**
MGA94 Northing	**7360372.702m**	MGA94 Grid Conv	**-0° 42' 25.03"**
MGA94 Zone	**56**		
Published	**09-Jul-2019**	Fixed By	**GPS**
Adjustment	**QLD ANJ 19.06**		

AHD HEIGHT

Lineage	**Derived**		
Height	**14.408m**	Vertical Uncertainty	**Class C / 3rd ORDER**
Published	**04-Dec-2006**	Fixed By	**SPIRIT LEVELLING**
Origin Mark	**70901**	NLN Section	
Source			

QUEENSLAND – DEPARTMENT OF NATURAL RESOURCES

PERMANENT MARK SKETCH PLAN

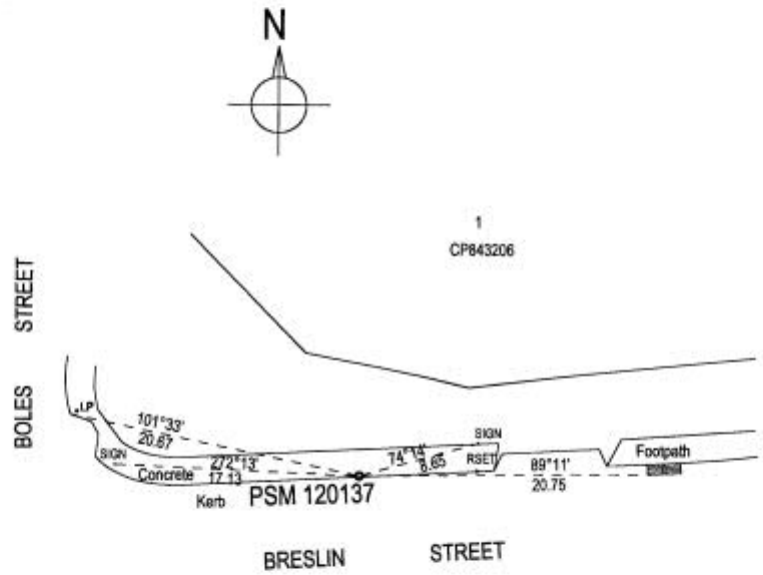
REGD NO. 120137

QUEENSLAND GOVERNMENT

NATURAL RESOURCES

Bearings are AMG (Magnetic, AMG) Distances are metres

Sketch plan to be completed in accordance with the Department's QA document, "Completion of Permanent Mark Sketch Plans"



Suited to GPS
Yes/No YES
Date 25.09.98

SCDB DETAILS ON REVERSE ARE TO BE COMPLETED

I certify that the permanent mark sketch has been prepared in accordance with the "The Survey Co-ordination Act of 1952-1989".

Date 3.4.98 Signature

15/04/96

Department of Natural Resources
Survey Control Database – Permanent Mark Data Sheet

Registered Number: 120137

Administrative Data

Alternative Name 1:	Dawson	Installed By:	CP843206 2/6/92
Alternative Name 2:		Date Installed:	1992
Alternative Name 3:		Date Last Visited:	Oct. 1998
Mark Type:	Ramset Nail	PSA:	
Mark Condition:	Good	Locality Description:	Breslin & Boles Sts.
Parish:	Gladstone	City or Town:	Gladstone
Local Authority:	Gladstone City Council	Map Reference:	9150-24334

Vertical Control Data

Height: 14.399 Datum: AHD D Vertical Accuracy - Order 4 Class C

Vertical Origin - Regd No: Height: Datum:

Geo-Sphd N: Datum: Model:
Fixed By: GPS Date: May 97

Horizontal Control Data

Latitude: S23°51'35.272646" Longitude: E151°15'05.634270" Datum: AGD84
Easting: 321 953.310 Northing: 7 360 187.408 Zone: 56
Horiz Origin: Lat: Long: Datum:

Horizontal Adjustment:
Horizontal Accuracy - Order 1 Class: A Fixed By: GPS

Cadastral Connection Data

Connected on Cadastral Plan No: **Connected on Cadastral Plan No. CP843206**

Comments Originally an Eccentric Station for PSM70897

ORIGINAL
SCDB
INIT

Details completed by: Gladstone City Council **Phone:** 07 49700746

Appendix H

Analytical Data Validation

Appendix H - Analytical Data Validation

H1.0 Introduction

The amended NEPM, Schedule B [2]) Guideline on Site Characterisation (2013) specifies that the nature and quality of the data produced in an investigation should be determined by the data quality objectives (DQOs). As referenced by the NEPM, 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 by the US EPA (2006) according to the following seven steps:

The seven steps in defining DQOs

Step	Data Quality Objective Step
1	***State the problem*** – Define the problem that necessitates the study; identify the planning team, examine budget, schedule.
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 & information needed to answer study questions.
4	***Define the boundaries of the study*** – Specify the target population & characteristics of interest, define spatial & 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 above is discussed below.

H1.1 Step 1 – State the Problem

A report prepared by QFES (QFES, 2016) indicated that PFAS was detected in water held within the Case 4 Pit at the fire station.

The findings of a review of the historical use of firefighting foams containing PFAS at the site have been documented in the PSI report (AECOM, 2019) and it was identified that there was the potential for PFAS to have been released to ground. The extent of the potential presence of PFAS in the different environmental media (soil, groundwater, surface water and sediment) was not known and characterisation of potential source areas, boundary locations and downstream (for surface water) and down-gradient (for groundwater) was required to inform the potential presence of complete source-pathway-receptor linkages at the site.

H1.2 Step 2 – Identify the Goal of the Study

The overarching purpose of the works is to characterise the potential for PFAS impacts, including concentration and distribution in environmental media (soil, groundwater, surface water and sediment), within and at the boundary of the site.

H1.3 Step 3 – Identify Information Inputs

To allow assessment of the data against the study goal listed in step 2 above, the following inputs have been considered:

- Anecdotal information on historical operations provided from interviews with personnel familiar with the fire stations
- Observations made during the site inspections completed in January 2019 and during the fieldwork in July and August 2019.
- The data review information (site and environmental setting) presented in the PSI report (AECOM, 2019) including:
    - Quantitative site characterisation data including visual observations, laboratory analytical data from field samples, samples of water from the Case 4 pit, comparison of analytical data with screening criteria appropriate for the land use
    - Hydrogeological and hydrological data including inferred groundwater and surface water flow direction
    - The potential for preferential pathways e.g. stormwater drains.
- Tier 1 health and ecological investigation and screening levels of each protected beneficial use applicable within the boundary of the study area
- Soil and groundwater analytical results collected between July and August 2019 as presented in this DSI report.

H1.4 Step 4 – Define the Boundaries of the Study

The lateral extent of the study area defined for decision making is the physical area of the fire station (Lot on Plan boundaries) is outlined in figures in **Appendix A**. The vertical extent of the investigation is the depth to the shallow aquifer system. This is considered to be less than 20m below ground level (mbgl).

The temporal boundary of the study is the current conditions at the time of the fieldwork in July – August 2019.

H1.5 Step 5 – Develop the Analytical Approach

The decision rules can be defined as:

- If the laboratory quality assurance/quality control data are within the acceptable ranges, the data should be considered suitable for use.
- If the PFAS concentrations are reported above the laboratory LOR or risk-based screening levels in one or more samples, then it should be considered whether further assessment is required.

The decision on the acceptance of the analytical data should 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 present at each fire station.
- **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.

H1.5.1 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 should be assessed as acceptable if less than or equal to 30% as per the NEPM Schedule B3. Where the results shows greater than 30% difference a review of the cause should be conducted (NEPC, 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.

H1.5.2 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 targeted in the primary samples
- Matrix spikes and surrogate recoveries
- Laboratory control samples.

H1.5.3 Representativeness

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

- Blank samples should be run in parallel with field samples to confirm there are no unacceptable instances of laboratory cross contamination.
- Review of RPD values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities.
- The appropriateness of collection methodologies, handling, storage and preservation techniques should be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation / transport methods).

H1.5.4 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.

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.

H1.5.5 Comparability

Given that assessment data can comprise several data sets from separate sampling episodes, 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.

In addition, the data should be collected by experienced field staff familiar with PFAS contamination investigations and National Association of Testing Authorities (NATA) accredited laboratories should be employed in all laboratory programs for soil, sediment and water analysis.

H1.5.6 Step 6 – Specify Performance or Acceptance Criteria

Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, 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 available new site data collected. 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 should 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.

Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site. To address this, the SAQP presented in the PSI (AECOM, 2019) outlined minimum numbers of samples proposed to be collected from each media.

- As such, there may be limitations in the data if aspects of the SAQP cannot be implemented. Some examples of this scenario include but are not limited to:
  - Proposed surface water sample locations may be dry at the time of sampling; and
  - Proposed samples are not collected due to access being restricted to a given location.
- Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. Some examples of this scenario include:
  - Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed:
    - Collection of sufficient sample mass to facilitate analysis reported to standard laboratory detections limits. Collection of insufficient sample mass may result in raised detection limits.
    - Field staff to follow a standard procedure when collecting samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, and use of appropriate sample containers and preservation methods.
    - Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis.
- Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project.

H1.5.7 Step 7 – Optimise the Design for Obtaining Data

The methodology is designed to meet the objectives described in **Section 1.3** of the main body of the report and to achieve the nominated DQOs. Optimisation of the data collection process should 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 fieldwork, to ensure that sample handling, and transport to and processing by the analytical laboratories is as smooth as possible; and
- Conducting sampling according to the environmental consultant's SOPs for the type of sampling being conducted.

The scope of works should be carried out to a level of accuracy and confidence presented in the NEPM (NEPC, 2013).

H2.0 Assessment of Data Quality

The quality of the data collected as part of the investigations was assessed on a range of factors including:

- Documentation and data completeness
- Data quality – comparability, representativeness, and precision and accuracy for sampling. Assessment criteria for data quality indicators for samples are listed below in the table below.

Acceptance criteria for data quality indicators in laboratory analysis

Data Quality Indicator	Acceptance Criteria
Rinsate Blanks	Less than the laboratory LOR
Intra laboratory field duplicates (1) (3)	RPD less than ± 30-50% (where results > 10 x LOR) (2)
Laboratory Duplicates (1) (2) (3)	RPDs in conformance with criteria in the laboratory QC report
Matrix Spikes (3) (4)	Recoveries between 70-130% of the theoretical recovery or as nominated in the laboratory's QC report
Method Blanks	Less than the laboratory LOR
Laboratory Control Samples (5)	Recoveries between laboratory specified range for each particular analyte / analytical suite.
Surrogate Spikes	Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for individual tests but are within the criteria described in USEPA Method SW846.

Notes:

1. Potential exceptions to this criterion may occur where sample variation or heterogeneity, rather than poor laboratory performance, is accountable for the poor reproducibility, or where the results are close to the LOR. This typical RPD range is obtained from AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil.
2. If the results are close to the LOR, then higher results will be accepted.
3. Criteria for sample duplicate and matrix spike results assume no sample heterogeneity. If samples are found to be heterogeneous with respect to a particular analyte the above criteria does not apply.
4. Assumes that samples are homogeneous and the background analyte level is less than 20% of the spike level (refer to USEPA Method 8000B). Note that there is no requirement for matrix spikes to pass as certain matrices may preclude recovery of spiked compounds. In this case, data will be accepted if LCS data meets the acceptance criteria.

   5.80% of the compounds tested must fall within the control limits. Control limits are dynamic and vary for individual tests as per USEPA Method 8000B.

5. Decision errors may include collecting samples that are not representative of the contamination status of the material and/or analytical errors.

H3.0 Field QA/QC Data Assessment

H3.1 General

All sampling work completed as part of the project was conducted in accordance with standard AECOM environmental sampling protocols. The essential elements of the QA/QC program are presented in the table below.

Essential elements of the field QA/QC program

Action	Description
Use of Experienced Personnel	Fieldwork was undertaken by trained AECOM engineers/scientists with previous experience in contaminated site assessment, field sampling techniques and health and safety issues.
Record Keeping	Full records of all field activities including sample collection and photo log are maintained on standard field activity sheets.
Sample Collection	New nitrile gloves were worn during soil, groundwater and sediment sampling, and were replaced between each sample collection.
Sample Labelling	A unique sample number was used for each sample to specify the sample origin (soil bore/monitoring well number and date), preservation standards and analytical requirements.
Chain of Custody	Chain of Custody procedures are required for all sample transfers. Custody sheets list sample numbers; date of collection and analyses required and are signed by each individual transferring and accepting custody.
Sample Storage	The collected samples were transferred to laboratory supplied sampling containers with appropriate preservation as required and then placed in cool storage prior to transfer to a NATA accredited laboratory (ALS and NMI).
Decontamination	All non-dedicated field equipment used in the sampling process was decontaminated using de-ionised water prior to mobilisation and between sampling locations to reduce the risks of cross contamination.

In addition to the primary samples, quality control field duplicate samples were collected to assess aspects of field protocols and laboratory performance and to classify the validity of the laboratory data. Field duplicates were collected in general accordance with AS 4482.1-2005 *Guide to the investigation and sampling of sites with potentially contaminated soil* (Standards Australia 2005).

Physicochemical parameters (pH, electrical conductivity, dissolved oxygen and redox potential) were planned to be collected from groundwater samples collected from each monitoring well, however, due to the malfunction of the water quality meter, none of the parameters could be collected. Laboratory testing for parameters was considered, however was not conducted as the maximum hold times would be exceeded (due to the long transit time to the laboratory) and therefore the data could not be relied on. The non-collection of these data impacts interpretation by limiting understanding of the potability of the groundwater and pH, which can affect the transport of PFAS contaminants in groundwater.

H3.2 Handling and Sample Preservation

The laboratories reported that all samples were received in appropriately pre-treated and preserved containers. Samples were received preserved and chilled at the laboratory. The sample temperature readings recorded on the Sample Receipt Notification (SRN) ranged from -0.7°C to 1.6°C with ice present.

H3.3 Frequency of Field Quality Control Samples

Field duplicate samples (intra-laboratory duplicates) and field triplicate samples (inter-laboratory duplicates) were collected and labelled so that they could not be linked to their respective primary samples.

Field duplicate and triplicate samples were collected as 1 duplicate and triplicate sample per 10 primary samples (10%) prepared in the field by equally splitting the primary field samples. A summary of the actual duplicate and triplicate analysis frequency undertaken during this investigation is presented in the table below. The table shows that the sufficient number of field QC samples were collected.

Summary of duplicate and triplicate samples

Media	No of Primary Samples	No of Duplicate Samples	% Duplicate Samples	No of Triplicate Samples	% Triplicate Samples
Soil samples	24	3	12.5	3	12.5
Water samples	6	1	16	1	16
Sediment samples	1	1	100	1	100

H3.4 Relative Percentage Difference (RPD) Calculations

A RPD analysis of primary and duplicate/triplicate samples is used to measure the representativeness and/or precision of duplicate samples. The RPD is calculated from the absolute difference between results of the duplicate pair divided by the mean value of the duplicate pair.

RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

Where: D1 = primary sample analysis, D2 = duplicate sample analysis

AS 4482.1-2005 states that the typical RPD which can be expected from acceptable field duplicates is < ± 30- 50% of the mean concentration of the analyte, where the results are greater than ten times the limit of reporting (LOR).

The acceptable ranges adopted are:

- 81% for laboratory duplicates between 0-10 x LOR.
- 50% for laboratory duplicates between 10-30 x LOR.
- 30% for laboratory duplicates greater than 30 x LOR.
- All other RPD calculations were either not calculable, due to the primary or duplicate sample reporting concentrations of COPC less than the LOR or within the expected range of 0- 30% for all other analytes reported.

Evaluation of the soil and sediment datasets are presented in **Table H1** and **Table H2** respectively. The RPD non-conformances for compounds are summarised in the table below.

Summary of PFAS RPD non- conformances in the soil and sediment dataset

Primary Sample ID	QC sample ID	Type	PFPeS (%)	PFHpS	PFOS (%)	PFNA (%)	PFDA (%)	8:2 FTS	PFUnDA	PFTrDA
GS_BH02_0.5_190801	GS_QC100_190729	Soil	41	33			-			
	GS_QC200_190729	Soil					-	34	38	105
GS_BH04_1.0_190801	GS_QC104_190801	Soil			33	35	-		32	
	GS_QC204_190801	Soil			48	70	-		85	
GS_BH05_0.5_190802	GS_QC205_190802	Soil					44		104	90
GS_SED01_190813	GSQC208_190813	Sed-iment							45	52

The RPD non-conformances for soil and sediment samples may be attributed to the sample heterogeneity within shallow fill type soils. Duplicate and triplicate samples were included within the analytical tables attached within **Appendix B** and conservatively, where significant differences between the primary and duplicate samples have been recorded, the highest concentration has been considered in the assessment of soil and groundwater contamination.

Evaluation of the groundwater dataset is presented in **Table H3**. It is noted that no RPD non-conformances were reported for groundwater samples.

The RPD results are not considered to impact on data interpretation for this investigation but do demonstrate that difference in soil heterogeneity, laboratory analysis and extraction methods in soil and sediment samples should be considered in assessing the contamination status of the site.

H3.5 Rinsate Blank Samples

To assess the effectiveness of sampling procedures, five rinsate blank samples were collected, on days when sampling equipment was used. Rinsate blanks were collected from sampling equipment which was decontaminated and re-used by passing laboratory supplied deionised water over the sampling equipment following decontamination procedures. The rinsate samples were analysed for PFAS.

The analytical results for PFAS compounds recorded for the rinsate blank samples are presented in **Table H4**. All results for the rinsate samples were below the LOR. The data are deemed acceptable for interpretative use and not considered to impact on data interpretation for this investigation.

H4.0 Laboratory QA/QC

The analytical data was received from the laboratories as the following laboratory batches:

ALS – EB1920146, ES1925572, EB1921187, ES1926853.

NMI – RN1244345, RN1243119, RN1244345.

H4.1 Extraction and Analysis Holding Time

All samples were received and analysed within the specified holding times with the exception of moisture content within BH02_0.5 (TOPA) however it is noted that moisture content was analysed within the holding time for the standard analysis and that this exceedance was due to the re-batching of this sample for TOPA analysis.

H4.2 Laboratory QA/QC

The laboratories used in the investigation (ALS for primary and duplicate samples and NMI for triplicate samples) are National Association of Testing Authorities (NATA) approved for the analyses required. Quality assurance procedures adopted by both primary and secondary analytical laboratories included analysis of blanks, duplicates, laboratory control samples, matrix spikes and surrogate spikes (for organics).

For this investigation, 41 primary and field quality control samples were analysed across seven laboratory batches. The additional two laboratory batches identified in **Section G4.0** (EB1921187 and ES1926853) were samples re-run for TOPA analysis.

H4.2.1 Laboratory/Method Blanks

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 type is to monitor potential laboratory contamination.

All the laboratory blanks were within the DQO limits for this investigation. Method blank concentrations were not detected above the LOR for all analytes.

H4.2.2 Laboratory Control Sample (LCS)

The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Accepted frequency of LCS samples is 1 in 20.

LCS recovery non-conformances were reported for one analyte in ES1925572. As advised by ALS a batch is accepted if at least 80% of the analytes return conforming LCS recoveries. As this criteria has been met for these two batches and as the analytes that reported non-conformances are not key analytes, these non-conformances are not considered to affect the data analysis and interpretation for this investigation.

H4.2.3 Laboratory Duplicates

The quality control term laboratory duplicate refers to an intra-laboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity. Relative percentage differences (RPDs) are used to assess precision. Frequency of laboratory duplicate samples 1 in 10.

The RPDs for laboratory duplicate samples were within the limits for all analytes for all batches except for:

- EB1921187 where the RPD for PFDA and PFUnDA exceeded the DQO limit for BH02_0.5, which is considered indicative of sample heterogeneity identified within the intra/inter laboratory QC samples or potentially due to differing laboratory methods.

H4.2.4 Matrix Spikes

The quality control term Matrix Spike (MS) refers to an intra-laboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. The samples undergo the same extraction and analysis procedures and the results are used to assess the method precision and bias. Spike recoveries are reported as a percent recovery. Frequency of MS samples is 1 in 20.

A summary of batches with MS recovery non-conformances for select analytes, are presented in the table below.

Summary of matrix spike recovery non-conformances

Analyte	Batches	Comments
PFNA, PFUnDA, PFDoDA, PFTrDA	ES1925572 (GS_QC108_190813)	Recovery was less than the lower data quality objective. Likely due to sample heterogeneity within shallow soils and sediment samples.
PFBS, PFPeS, PFHxS, PFHpS, PFOS, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFPeA, 4:2 FTS, 6:2 FTS	ES1925572 (GS_MW02_190813, Anonymous sample)	MSR was outside the DQO and/or MS were not determined due to the higher background level greater than or equal to 4x spike level. This is potentially due to the matrix of the particular sample rather than the spike recovery and as such does not affect the quality of the data for interpretative use.
PFDA, PFBA, 8:2 FTS	ES1925572 (GS_MW02_190813, Anonymous sample)	Recovery was less than the lower data quality objective.
PFOS, PFPeA, PFHpA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, 8:2 FTS, 10:2 FTS	EB1920146 (GS_SS2_0.1_190801, GS_BH04_1.0_190801)	MSR was outside the DQO and/or MS were not determined due to the higher background level greater than or equal to 4x spike level. This is potentially due to the matrix of the particular sample rather than the spike recovery and as such does not affect the quality of the data for interpretative use.

AS- Anonymous Sample

The recoveries of matrix spikes below the data quality objectives are considered to be due to heterogeneity of the samples. The non-determining of the MS recovery is potentially due to the matrix of the particular sample rather than the spike recovery. Overall the data are not considered to affect the quality of the data for interpretative use.

H4.2.5 Surrogate Spikes

The quality control term Surrogate Spike (SS) refers to a compound added to a sample aliquot in known amounts before extraction and analysis. The compound should be similar in composition and behaviour to the target analyte but not naturally occurring in the sample. A surrogate is used to monitor the method performance for analysis of organic compounds. Spike recoveries are reported as a percent recovery.

All the laboratory surrogate spikes were within the DQO limits for this investigation.

H4.2.6 Frequency of Laboratory QC samples

The laboratory reported a sufficient frequency of quality control samples to assess whether the results have been reported to an acceptable accuracy and precision for all the batches.

H5.0 Conclusions

While non-conformances with the laboratory QA/QC have been identified, these non-conformances are not considered to adversely impact the purpose of the investigation with respect to comparison against the adopted assessment criteria. It is concluded that, for the purposes of this investigation, the data are suitable for interpretation and acceptable for use in this assessment.

Table H1 Soil Duplicate and Triplicate Analytical Results
PFAS DSI
QFES - Gladstone Fire Station

AECOM Imagine it. Delivered.

Lab Report Number			EB1920146	EB1920146		EB1920146	RN1243119		EB1920146	EB1920146		EB1920146	RN1243119		EB1920146	EB1920146		EB1920146	RN1243119	
Field ID			GS_BH02_0.5_190801	GS_QC100_190801	**RPD**	GS_BH02_0.5_190801	GS_QC200_190801	**RPD**	GS_BH04_1.0_190801	GS_QC104_190801	**RPD**	GS_BH04_1.0_190801	GS_QC204_190801	**RPD**	GS_BH05_0.5_190802	GS_QC105_190802	**RPD**	GS_BH05_0.5_190802	GS_QC205_190802	**RPD**
Sampled Date			1/08/2019	1/08/2019		1/08/2019	1/08/2019		1/08/2019	1/08/2019		1/08/2019	1/08/2019		2/08/2019	2/08/2019		2/08/2019	2/08/2019	
	Units	**LOR**																	
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	0.0144	0.0163	12	0.0144	0.013	10	0.0003	0.0002	40	0.0003	<0.001	0	0.0061	0.0053	14	0.0061	0.0077	23
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	**0.0134**	**0.0204**	**41**	0.0134	0.012	11	0.0007	0.0009	25	0.0007	<0.001	0	0.0016	0.0015	6	0.0016	0.0012	29
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.171	0.222	26	0.171	0.19	11	0.004	0.0048	18	0.004	0.0056	33	0.0029	0.0034	16	0.0029	0.0041	34
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	**0.0187**	**0.026**	**33**	0.0187	0.023	21	0.0007	0.001	35	0.0007	<0.001	0	0.0003	0.0003	0	0.0003	<0.001	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	3.91	4.93	23	3.91	5.1	26	**0.0736**	**0.103**	**33**	**0.0736**	**0.12**	**48**	0.0616	0.0679	10	0.0616	0.073	17
PFDS	mg/kg	0.0002	<0.001	<0.0002	0	<0.001	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFBA	mg/kg	0.001	0.003	0.004	29	0.003	0.0049	48	<0.001	<0.001	0	<0.001	<0.002	0	0.004	0.004	0	0.004	0.0064	46
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	0.0443	0.0504	13	0.0443	0.045	2	0.0014	0.0006	80	0.0014	<0.002	0	0.0093	0.0083	11	0.0093	0.011	17
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	0.058	0.0765	28	0.058	0.053	9	0.0016	0.0015	6	0.0016	0.0014	13	0.0061	0.0057	7	0.0061	0.0069	12
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	0.0199	0.0237	17	0.0199	0.018	10	0.0004	0.0004	0	0.0004	<0.001	0	0.0009	0.001	11	0.0009	0.0015	50
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	0.0472	0.0541	14	0.0472	0.044	7	0.0007	0.001	35	0.0007	0.001	35	0.0007	0.0007	0	0.0007	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	0.328	0.368	11	0.328	0.35	6	**0.0058**	**0.0083**	**35**	**0.0058**	**0.012**	**70**	0.211	0.183	14	0.211	0.19	10
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	0.0578	0.0714	21	0.0578	0.071	20	0.0003	0.0004	29	0.0003	<0.001	0	0.0121	0.0109	10	**0.0121**	**0.019**	**44**
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0293	0.0282	4	**0.0293**	**0.043**	**38**	**0.0031**	**0.0043**	**32**	**0.0031**	**0.0077**	**85**	0.044	0.0477	8	**0.044**	**0.14**	**104**
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.001	<0.0002	0	<0.001	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0003	0.0003	0	0.0003	<0.002	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0013	0.002	42	**0.0013**	**0.0042**	**105**	<0.0002	0.0002	0	<0.0002	<0.002	0	0.0061	0.0057	7	**0.0061**	**0.016**	**90**
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0025	<0.0005	0	<0.0025	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.001	<0.0005	0	<0.001	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	0.195	0.183	6	0.195	0.17	14	0.0016	0.0018	12	0.0016	0.002	22	<0.0005	<0.0005	0	<0.0005	<0.001	0
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	0.0199	0.0204	2	**0.0199**	**0.028**	**34**	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	<0.001	<0.0005	0	<0.001	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.001	<0.0002	0	<0.001	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.001	<0.0002	0	<0.001	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.001	0.0014	33	<0.001	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0025	<0.0005	0	<0.0025	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0025	<0.0005	0	<0.0025	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0025	<0.0005	0	<0.0025	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0025	<0.0005	0	<0.0025	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	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: 81 (1-10 x LOR); 50 (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

Lab Report Number			ALSE-Sydney 13-Aug-19	ALSE-Sydney 13-Aug-19		ALSE-Sydney 13-Aug-19	RN1244345	
Field ID			GS_SE01_190813	GS_QC108_190813	**RPD**	GS_SE01_190813	GS_QC208_190813	**RPD**
Sampled Date			13/08/2019	13/08/2019		13/08/2019	13/08/2019	
	Units	**LOR**						
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	0.0002	0	<0.0002	<0.001	0
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.0002	0.0002	0	0.0002	<0.001	0
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	0.0046	0.0048	4	0.0046	0.0062	30
PFDS	mg/kg	0.0002	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFBA	mg/kg	0.001	0.001	0.001	0	0.001	<0.002	0
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	0.001	0.0011	10	0.001	<0.002	0
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	0.0004	0.0005	22	0.0004	<0.001	0
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	0.0002	0.0002	0	0.0002	<0.001	0
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	0.0002	40	0.0003	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	0.0122	0.0121	1	0.0122	0.015	21
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	0.0027	0.0028	4	0.0027	0.0037	31
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	0.14	0.159	13	0.14	0.23	**49**
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0085	0.0078	9	0.0085	0.01	16
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0879	0.116	28	0.0879	0.15	**52**
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	0.002	0.0015	29	0.002	0.0029	37
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	0.0006	0.0006	0	0.0006	<0.002	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	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: 81 (1-10 x LOR); 50 (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

AECOM Imagine it. Delivered.

Lab Report Number	ES1925572	ES1925572		ES1925572	RN1244345	
Field ID	GS_MW05_190812	GS_QC107__190812	**RPD**	GS_MW05_190812	GS_QC207__190812	**RPD**
Sampled Date	12/08/2019	12/08/2019		12/08/2019	12/08/2019	

	Units	**LOR**						
PFBS	µg/L	0.002	0.03	0.04	29	0.03	0.026	14
PFPeS	µg/L	0.002	0.025	0.031	21	0.025	0.023	8
PFHxS	µg/L	0.002	0.11	0.139	23	0.11	0.11	0
PFHpS	µg/L	0.002	0.002	0.003	40	0.002	0.0014	35
PFOS	µg/L	0.002	0.014	0.017	19	0.014	0.018	25
PFDS	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.001	0
PFBA	µg/L	0.01	<0.01	<0.01	0	<0.01	0.0054	0
PFPeA	µg/L	0.002	0.01	0.012	18	0.01	0.0088	13
PFHxA	µg/L	0.002	0.035	0.045	25	0.035	0.031	12
PFHpA	µg/L	0.002	0.013	0.017	27	0.013	0.011	17
PFOA	µg/L	0.002	0.014	0.017	19	0.014	0.013	7
PFNA	µg/L	0.002	0.038	0.046	19	0.038	0.031	20
PFDA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.001	0
PFUnDA	µg/L	0.002	0.004	0.004	0	0.004	0.0019	71
PFDoDA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.001	0
PFTrDA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
PFTeDA	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.002	0
4:2 FTS	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.001	0
6:2 FTS	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.001	0
8:2 FTS	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.001	0
10:2 FTS	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.001	0
MeFOSAA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
EtFOSAA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.002	0
FOSA	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.001	0
EtFOSA	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.002	0
MeFOSA	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.002	0
EtFOSE	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
MeFOSE	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	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 EQL multiplier range are: 81 (1-10 x LOR); 50 (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

Lab Report Number		EB1920146	EB1920146	EB1920146	ES1925572	ES1925572
Field ID		GS_QC300_190801	GS_QC301_190801	GS_QC302_190801	GS_QC305__190812	GS_QC306_190813
Sampled Date		1/08/2019	1/08/2019	1/08/2019	12/08/2019	13/08/2019
Chemical	**Units**	**LOR**				
PFBS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFPeS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHxS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHpS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFOS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDS	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFBA	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PFPeA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHxA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHpA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFOA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFNA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFUnDA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDoDA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFTrDA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFTeDA	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4:2 FTS	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
6:2 FTS	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8:2 FTS	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
10:2 FTS	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSAA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
EtFOSAA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
FOSA	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
EtFOSA	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSA	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
EtFOSE	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSE	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Appendix I

Analytical Laboratory Reports

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: 2-8-19	DATE TIME: 5-8-19 1500	DATE TIME: 6/8 9150

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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: ℃

Other comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	GS_SS1_0.1_190801		01/08/2019 08:46 AM	Soil	ALS: 1 Non ALS: 0	No		X			
002	GS_SS2_0.1_190801		01/08/2019 08:47 AM	Soil	ALS: 1 Non ALS: 0	No		X			
003	GS_SS2_0.5_190801		01/08/2019 08:48 AM	Water	ALS: 1 Non ALS: 0	No		X			
004	GS_SS3_0.1_190801		01/08/2019 08:49 AM	Soil	ALS: 1 Non ALS: 0	No		X			
005	GS_SS3_0.5_190801		01/08/2019 08:49 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
006	GS_BH02_0.1_190801		01/08/2019 09:46 AM	Water	ALS: 1 Non ALS: 0	No		X			
007	GS_BH02_0.5_190801		01/08/2019 09:47 AM	Water	ALS: 1 Non ALS: 0	No		X			
008	GS_BH02_1.0_190801		01/08/2019 09:47 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
009	GS_BH02_1.5_190801		01/08/2019 09:48 AM	Soil	ALS: 1 Non ALS: 0	Yes	-				

Environmental Division
Brisbane
Work Order Reference
EB1920146

Telephone : + 61-7-3243 7222

CHAIN OF CUSTODY

(ALS) COC#: 2658 *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2·8·19	KSchafer DATE TIME: 5·8·19 1500	JB DATE TIME: 6/8 9:30

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
010	GS_BH02_2.0_190801		01/08/2019 09:49 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
011	GS_BH02_3.0_190801		01/08/2019 09:49 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
012	GS_BH02_4.0_190801		01/08/2019 09:49 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
013	GS_BH02_5.0_190801		01/08/2019 09:50 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
014	GS_BH02_7.0_190801		01/08/2019 09:50 AM	Water	ALS: 1 Non ALS: 0	No		X			
015	GS_BH01_0.1_190801		01/08/2019 12:08 PM	Water	ALS: 1 Non ALS: 0	No		X			
016	GS_BH01_0.5_190801		01/08/2019 12:09 PM	Soil	ALS: 1 Non ALS: 0	Yes	-				
017	GS_BH01_1.0_190801		01/08/2019 12:09 PM	Water	ALS: 1 Non ALS: 0	No		X			
018	GS_BH01_1.5_190801		01/08/2019 12:15 PM	Water	ALS: 1 Non ALS: 0	Yes	-				

CHAIN OF CUSTODY

(ALS) COC#: 2658 *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2-8-19	KSchafer DATE TIME: 5-8-19 1500	JB DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:			

PROJECT MANAGER: Camden Mccosker CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
019	GS_BH01_2.0_190801		01/08/2019 12:15 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
020	GS_BH01_3.0_190801		01/08/2019 12:15 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
021	GS_BH01_4.0_190801		01/08/2019 12:16 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
022	GS_BH01_5.0_190801		01/08/2019 12:16 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
023	GS_BH01_6.0_190801		01/08/2019 12:17 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
024	GS_BH01_7.0_190801		01/08/2019 12:17 PM	Water	ALS: 1 Non ALS: 0	No		X			
025	GS_BH03_0.25_190801		01/08/2019 12:18 PM	Water	ALS: 1 Non ALS: 0	No		X			
026	GS_BH03_0.5_190801		01/08/2019 02:31 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
027	GS_BH03_1.1_190801		01/08/2019 02:32 PM	Water	ALS: 1 Non ALS: 0	No		X			

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2-8-19	KSchafer DATE TIME: 5-8-19 1500	JD DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker — CONTACT PH: 0499 990 214 — SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker — QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
028	GS_BH03_1.5_190801		01/08/2019 02:32 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
029	GS_BH03_2.0_190801		01/08/2019 02:33 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
030	GS_BH03_3.0_190801		01/08/2019 02:33 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
031	GS_BH03_4.0_190801		01/08/2019 02:33 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
032	GS_BH03_5.0_19801		01/08/2019 02:34 PM	Soil	ALS: 1 Non ALS: 0	No		X			
033	GS_BH03_6.0_190801		01/08/2019 02:34 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
034	GS_BH04_0.1_190801		01/08/2019 03:42 PM	Water	ALS: 1 Non ALS: 0	No		X			
035	GS_BH04_0.5_190801		01/08/2019 03:43 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
036	GS_BH04_1.0_190801		01/08/2019 03:43 PM	Water	ALS: 1 Non ALS: 0	No		X			

CHAIN OF CUSTODY

COC#: 2658 *ALS Laboratory:* EB Brisbane

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214

QUOTE NO: BN/112/19

SAMPLER MOBILE: 0499 990 214

/ EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2-8-19	KSchafer DATE TIME: 5-8-19 1500	SB DATE TIME: 6/8 9:50

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
037	GS_BH04_1.5_190801		01/08/2019 03:44 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
038	GS_BH04_2.0_190801		01/08/2019 03:44 PM	Soil	ALS: 1 Non ALS: 0	Yes	-				
039	GS_BH04_3.0_190801		01/08/2019 03:45 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
040	GS_BH04_4.0_190801		01/08/2019 03:45 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
041	GS_BH04_5.0_190801		01/08/2019 03:46 PM	Water	ALS: 1 Non ALS: 0	No		X			
042	GS_BH05_0.1_190802		02/08/2019 08:14 AM	Soil	ALS: 1 Non ALS: 0	Yes	-				
043	GS_BH05_0.5_190802		02/08/2019 08:15 AM	Water	ALS: 1 Non ALS: 0	No		X			
044	GS_BH05_1.0_190802		02/08/2019 08:15 AM	Water	ALS: 1 Non ALS: 0	No		X			
045	GS_BH05_1.5_190802		02/08/2019 08:16 AM	Water	ALS: 1 Non ALS: 0	Yes	-				

CHAIN OF CUSTODY

ALS COC#: 2658 ALS Laboratory: EB Brisbane

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214

QUOTE NO: BN/112/19

SAMPLER MOBILE: 0499 990 214

/ EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	DATE TIME: 2-8-19	DATE TIME: 5-8-19 1500	DATE TIME: 6/8 9:50

TURNAROUND REQUIREMENTS: 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
046	GS_BH05_2.0_190802		02/08/2019 08:16 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
047	GS_BH05_3.0_190802		02/08/2019 08:16 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
048	GS_BH05_4.0_190802		02/08/2019 08:17 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
049	GS_BH05_5.0_190802		02/08/2019 08:17 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
050	GS_BH05_6.0_190802		02/08/2019 08:18 AM	Water	ALS: 1 Non ALS: 0	No		X			
051	GS_QC300_190801		01/08/2019 08:45 AM	Water	ALS: 1 Non ALS: 0	No			Partial 1/2		
052	GS_QC100_190801		01/08/2019 08:46 AM	Water	ALS: 1 Non ALS: 0	No		X			
053	GS_QC101_190801		01/08/2019 09:43 AM	Soil	ALS: 1 Non ALS: 0	Yes	-				
054	GS_QC301_190801		01/08/2019 10:48 AM	Water	ALS: 1 Non ALS: 0	No			Partial 1/2		

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214

QUOTE NO: BN/112/19

SAMPLER MOBILE: 0499 990 214 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2-8-19	KSchafer DATE TIME: 5-8-19 1500	JB DATE TIME: 6/8 9:50

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
055	GS_QC302_190801		01/08/2019 10:49 AM	Water	ALS: 1 Non ALS: 0	No			Partial 1/2		
056	GS_QC102_190801		01/08/2019 12:08 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
057	GS_QC103_190801		01/08/2019 02:31 PM	Water	ALS: 1 Non ALS: 0	Yes	-				
058	GS_QC104_190801		01/08/2019 03:42 PM	Water	ALS: 1 Non ALS: 0	No		X			
059	GS_QC303_190802		02/08/2019 06:52 AM	Water	ALS: 1 Non ALS: 0	No	-				
060	GS_QC304_190802		02/08/2019 06:53 AM	Water	ALS: 1 Non ALS: 0	No	-				
061	GS_QC105_190802		02/08/2019 08:13 AM	Soil	ALS: 1 Non ALS: 0	No		X			
062	GS_QC106_190802		02/08/2019 10:10 AM	Soil	ALS: 1 Non ALS: 0	Yes	-				
063	GS_BH05_7.4_190802		02/08/2019 08:19 AM	Water	ALS: 1 Non ALS: 0	Yes	-				

CHAIN OF CUSTODY

(ALS) COC#: **2658** *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	K Schafer DATE TIME: 2-8-19	K Schafer DATE TIME: 5-8-19 1500	JB DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214

QUOTE NO: BN/112/19

SAMPLER MOBILE: 0499 990 214 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
064	GS_BH06_0.1_190802		02/08/2019 10:11 AM	Water	ALS: 1 Non ALS: 0	No		X			
065	GS_BH06_0.5_190802		02/08/2019 10:11 AM	Water	ALS: 1 Non ALS: 0	No		X			
066	GS_BH06_1.0_190802		02/08/2019 10:12 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
067	GS_BH06_1.5_190802		02/08/2019 10:13 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
068	GS_BH06_2.0_190802		02/08/2019 10:13 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
069	GS_BH06_3.0_190802		02/08/2019 10:14 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
070	GS_BH06_4.0_190802		02/08/2019 10:15 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
071	GS_BH06_5.0_190802		02/08/2019 10:15 AM	Water	ALS: 1 Non ALS: 0	Yes	-				
072	GS_BH06_6.0_190802		02/08/2019 10:16 AM	Water	ALS: 1 Non ALS: 0	Yes	-				

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE TIME:	KSchafer DATE TIME: 2-8-19	KSchafer DATE TIME: 5-8-19 1500	JB DATE TIME: 6/8 9:50

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE DETAILS							ANALYSIS REQUIRED				
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1 Soil Analysis SOIL	Table 2 Water WATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
073	GS_BH06_7.0_190802		02/08/2019 10:16 AM	Water	ALS: 1 Non ALS: 0	No		X			

CHAIN OF CUSTODY

COC#: **2658** *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY: JB
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214

QUOTE NO: BN/112/19

SAMPLER MOBILE: 0499 990 214

EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:			

SAMPLE	SAMPLE NAME	PARTIAL ANALYSIS GROUP NAME	MATRIX	SELECTED ANALYSIS NAME
051	GS_QC300_190801	Table 2 Water WATER	Water	- EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)
054	GS_QC301_190801	Table 2 Water WATER	Water	- EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)
055	GS_QC302_190801	Table 2 Water WATER	Water	- EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY: JB
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker

PRIMARY SAMPLER: Camden Mccosker

CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	GS_SS1_0.1_190801	HDPE Soil Jar	200 mL	00620219040716	Grey	No	
002	GS_SS2_0.1_190801	HDPE Soil Jar	200 mL	00620219040671	Grey	No	
003	GS_SS2_0.5_190801	HDPE Soil Jar	200 mL	00620219040663	Grey	No	
004	GS_SS3_0.1_190801	HDPE Soil Jar	200 mL	00620219040682	Grey	No	
005	GS_SS3_0.5_190801	HDPE Soil Jar	200 mL	00620219040668	Grey	No	
006	GS_BH02_0.1_190801	HDPE Soil Jar	200 mL	00620219040642	Grey	No	
007	GS_BH02_0.5_190801	HDPE Soil Jar	200 mL	00620219040587	Grey	No	
008	GS_BH02_1.0_190801	HDPE Soil Jar	200 mL	00620219040679	Grey	No	
009	GS_BH02_1.5_190801	HDPE Soil Jar	200 mL	00620219040669	Grey	No	
010	GS_BH02_2.0_190801	HDPE Soil Jar	200 mL	00620219040661	Grey	No	
011	GS_BH02_3.0_190801	HDPE Soil Jar	200 mL	00620219040603	Grey	No	
012	GS_BH02_4.0_190801	HDPE Soil Jar	200 mL	00620219040703	Grey	No	
013	GS_BH02_5.0_190801	HDPE Soil Jar	200 mL	00620219040623	Grey	No	
014	GS_BH02_7.0_190801	HDPE Soil Jar	200 mL	00620219040702	Grey	No	
015	GS_BH01_0.1_190801	HDPE Soil Jar	200 mL	00620219040649	Grey	No	
016	GS_BH01_0.5_190801	HDPE Soil Jar	200 mL	00620219040691	Grey	No	
017	GS_BH01_1.0_190801	HDPE Soil Jar	200 mL	00620219040614	Grey	No	
018	GS_BH01_1.5_190801	HDPE Soil Jar	200 mL	00620219040660	Grey	No	
019	GS_BH01_2.0_190801	HDPE Soil Jar	200 mL	00620219040584	Grey	No	
020	GS_BH01_3.0_190801	HDPE Soil Jar	200 mL	00620219040605	Grey	No	
021	GS_BH01_4.0_190801	HDPE Soil Jar	200 mL	00620219040592	Grey	No	
022	GS_BH01_5.0_190801	HDPE Soil Jar	200 mL	00620219040582	Grey	No	
023	GS_BH01_6.0_190801	HDPE Soil Jar	200 mL	00620219040576	Grey	No	
024	GS_BH01_7.0_190801	HDPE Soil Jar	200 mL	00620219040610	Grey	No	
025	GS_BH03_0.25_190801	HDPE Soil Jar	200 mL	00620219040687	Grey	No	
026	GS_BH03_0.5_190801	HDPE Soil Jar	200 mL	00620219040580	Grey	No	

CHAIN OF CUSTODY

ALS COC#: 2658 *ALS Laboratory:* EB Brisbane

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY: JB
DATE TIME:	DATE TIME:	DATE TIME:	DATE TIME: 6/8 9:50

CLIENT: AECOMAU - AECOM Australia Pty Ltd

PROJECT: 60609758

SITE: 60609758_GS

ORDER NO: 60609758 2.0

PROJECT MANAGER: Camden Mccosker CONTACT PH: 0499 990 214 SAMPLER MOBILE: 0499 990 214

PRIMARY SAMPLER: Camden Mccosker QUOTE NO: BN/112/19 / EB2019AECOMAU0002

EMAIL REPORTS TO: camden.mccosker@aecom.com, james.peachey@aecom.com

EMAIL INVOICES TO: james.peachey@aecom.com, camden.mccosker@aecom.com

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

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 comments:

027	GS_BH03_1.1_190801	HDPE Soil Jar	200 mL	00620219040578	Grey	No	
028	GS_BH03_1.5_190801	HDPE Soil Jar	200 mL	00620219040599	Grey	No	
029	GS_BH03_2.0_190801	HDPE Soil Jar	200 mL	00620219040620	Grey	No	
030	GS_BH03_3.0_190801	HDPE Soil Jar	200 mL	00620219040655	Grey	No	
031	GS_BH03_4.0_190801	HDPE Soil Jar	200 mL	00620219040672	Grey	No	
032	GS_BH03_5.0_19801	HDPE Soil Jar	200 mL	00620219040670	Grey	No	
033	GS_BH03_6.0_190801	HDPE Soil Jar	200 mL	00620219040624	Grey	No	
034	GS_BH04_0.1_190801	HDPE Soil Jar	200 mL	00620219040662	Grey	No	
035	GS_BH04_0.5_190801	HDPE Soil Jar	200 mL	00620219040713	Grey	No	
036	GS_BH04_1.0_190801	HDPE Soil Jar	200 mL	00620219040640	Grey	No	
037	GS_BH04_1.5_190801	HDPE Soil Jar	200 mL	00620219040604	Grey	No	
038	GS_BH04_2.0_190801	HDPE Soil Jar	200 mL	00620219040579	Grey	No	
039	GS_BH04_3.0_190801	HDPE Soil Jar	200 mL	00620219040653	Grey	No	
040	GS_BH04_4.0_190801	HDPE Soil Jar	200 mL	00620219040646	Grey	No	
041	GS_BH04_5.0_190801	HDPE Soil Jar	200 mL	00620219040665	Grey	No	
042	GS_BH05_0.1_190802	HDPE Soil Jar	200 mL	00620219040636	Grey	No	
043	GS_BH05_0.5_190802	HDPE Soil Jar	200 mL	00620219040594	Grey	No	
044	GS_BH05_1.0_190802	HDPE Soil Jar	200 mL	00620219040575	Grey	No	
045	GS_BH05_1.5_190802	HDPE Soil Jar	200 mL	00620219040684	Grey	No	
046	GS_BH05_2.0_190802	HDPE Soil Jar	200 mL	00620219040591	Grey	No	
047	GS_BH05_3.0_190802	HDPE Soil Jar	200 mL	00620219040635	Grey	No	
048	GS_BH05_4.0_190802	HDPE Soil Jar	200 mL	00620219040664	Grey	No	
049	GS_BH05_5.0_190802	HDPE Soil Jar	200 mL	00620219040615	Grey	No	
050	GS_BH05_6.0_190802	HDPE Soil Jar	200 mL	00620219040637	Grey	No	
051	GS_QC300_190801	HDPE (no PTFE)	250 mL	00350219027337	Grey	No	
052	GS_QC100_190801	HDPE Soil Jar	200 mL	00620219040639	Grey	No	
053	GS_QC101_190801	HDPE Soil Jar	200 mL	00620219040631	Grey	No	

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1920146**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: camden.mccosker@aecom.com	E-mail	: carsten.emrich@alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8616
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 60609758 2.0-GS	Page	: 1 of 4
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: 2658	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: 60609758_GS		
Sampler	: CAMDEN McCOSKER		

Dates

Date Samples Received	: 06-Aug-2019 09:50	Issue Date	: 06-Aug-2019
Client Requested Due Date	: 13-Aug-2019	Scheduled Reporting Date	: **13-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 4	Temperature	: 0.2°C / 0.5°C / 1.2°C / 1.6°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 73 / 28

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 be advised that the container provided for Sample (ALS ID: 20) 'GS_BH01_3.0_190801' was received with the Sample ID 'BH02_3.0' printed on the container. This sample will be reported as listed on COC and as entered into ALS Compass. If you wish to discuss this please contact client services ALSEnviro.Brisbane@alsglobal.com.**
- **Please be advised that the following samples were not assigned analysis in ALS Compass: (ALS ID: 3, 17, 24, 25, 34, 36, 50, 58, 64, 65 and 73) 'GS_SS2_0.5_190801', 'GS_BH01_1.0_190801', 'GS_BH01_7.0_190801','GS_BH02_0.5_190801', 'GS_BH03_0.25_190801', 'GS_BH04_0.1_190801', 'GS_BH04_1.0_190801', 'GS_BH05_6.0_190802', 'GS_QC104_190801', 'GS_BH06_0.1_190802', 'GS_BH06_0.5_190802', 'GS_BH06_7.0_190802'. As all of these samples requested 'Table 1 Soil Analysis SOIL', the analysis has been added. If you wish to discuss this please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- **Samples 'GS_QC200_190801' to 'GS_QC206_190801' has been forwarded to NMI, as requested. Please note that this will incur a freight forwarding fee.**
- 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	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1920146-001	01-Aug-2019 08:46	GS_SS1_0.1_190801		✓	✓
EB1920146-002	01-Aug-2019 08:47	GS_SS2_0.1_190801		✓	✓
EB1920146-003	01-Aug-2019 08:48	GS_SS2_0.5_190801		✓	✓
EB1920146-004	01-Aug-2019 08:49	GS_SS3_0.1_190801		✓	✓
EB1920146-005	01-Aug-2019 08:49	GS_SS3_0.5_190801	✓		
EB1920146-006	01-Aug-2019 09:46	GS_BH02_0.1_190801		✓	✓
EB1920146-007	01-Aug-2019 09:47	GS_BH02_0.5_190801		✓	✓
EB1920146-008	01-Aug-2019 09:47	GS_BH02_1.0_190801	✓		
EB1920146-009	01-Aug-2019 09:48	GS_BH02_1.5_190801	✓		
EB1920146-010	01-Aug-2019 09:49	GS_BH02_2.0_190801	✓		
EB1920146-011	01-Aug-2019 09:49	GS_BH02_3.0_190801	✓		
EB1920146-012	01-Aug-2019 09:49	GS_BH02_4.0_190801	✓		
EB1920146-013	01-Aug-2019 09:50	GS_BH02_5.0_190801	✓		
EB1920146-014	01-Aug-2019 09:50	GS_BH02_7.0_190801		✓	✓
EB1920146-015	01-Aug-2019 12:08	GS_BH01_0.1_190801		✓	✓
EB1920146-016	01-Aug-2019 12:09	GS_BH01_0.5_190801	✓		
EB1920146-017	01-Aug-2019 12:09	GS_BH01_1.0_190801		✓	✓
EB1920146-018	01-Aug-2019 12:15	GS_BH01_1.5_190801	✓		
EB1920146-019	01-Aug-2019 12:15	GS_BH01_2.0_190801	✓		
EB1920146-020	01-Aug-2019 12:15	GS_BH01_3.0_190801	✓		
EB1920146-021	01-Aug-2019 12:16	GS_BH01_4.0_190801	✓		
EB1920146-022	01-Aug-2019 12:16	GS_BH01_5.0_190801	✓		
EB1920146-023	01-Aug-2019 12:17	GS_BH01_6.0_190801	✓		
EB1920146-024	01-Aug-2019 12:17	GS_BH01_7.0_190801		✓	✓
EB1920146-025	01-Aug-2019 12:18	GS_BH03_0.25_190801		✓	✓
EB1920146-026	01-Aug-2019 14:31	GS_BH03_0.5_190801	✓		
EB1920146-027	01-Aug-2019 14:32	GS_BH03_1.1_190801		✓	✓
EB1920146-028	01-Aug-2019 14:32	GS_BH03_1.5_190801	✓		
EB1920146-029	01-Aug-2019 14:33	GS_BH03_2.0_190801	✓		
EB1920146-030	01-Aug-2019 14:33	GS_BH03_3.0_190801	✓		
EB1920146-031	01-Aug-2019 14:33	GS_BH03_4.0_190801	✓		
EB1920146-032	01-Aug-2019 14:34	GS_BH03_5.0_19801		✓	✓
EB1920146-033	01-Aug-2019 14:34	GS_BH03_6.0_190801	✓		
EB1920146-034	01-Aug-2019 15:42	GS_BH04_0.1_190801		✓	✓
EB1920146-035	01-Aug-2019 15:43	GS_BH04_0.5_190801	✓		

			(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1920146-036	01-Aug-2019 15:43	GS_BH04_1.0_190801		✓	✓
EB1920146-037	01-Aug-2019 15:44	GS_BH04_1.5_190801	✓		
EB1920146-038	01-Aug-2019 15:44	GS_BH04_2.0_190801	✓		
EB1920146-039	01-Aug-2019 15:45	GS_BH04_3.0_190801	✓		
EB1920146-040	01-Aug-2019 15:45	GS_BH04_4.0_190801	✓		
EB1920146-041	01-Aug-2019 15:46	GS_BH04_5.0_190801		✓	✓
EB1920146-042	02-Aug-2019 08:14	GS_BH05_0.1_190802	✓		
EB1920146-043	02-Aug-2019 08:15	GS_BH05_0.5_190802		✓	✓
EB1920146-044	02-Aug-2019 08:15	GS_BH05_1.0_190802		✓	✓
EB1920146-045	02-Aug-2019 08:16	GS_BH05_1.5_190802	✓		
EB1920146-046	02-Aug-2019 08:16	GS_BH05_2.0_190802	✓		
EB1920146-047	02-Aug-2019 08:16	GS_BH05_3.0_190802	✓		
EB1920146-048	02-Aug-2019 08:17	GS_BH05_4.0_190802	✓		
EB1920146-049	02-Aug-2019 08:17	GS_BH05_5.0_190802	✓		
EB1920146-050	02-Aug-2019 08:18	GS_BH05_6.0_190802		✓	✓
EB1920146-052	01-Aug-2019 08:46	GS_QC100_190801		✓	✓
EB1920146-053	01-Aug-2019 09:43	GS_QC101_190801	✓		
EB1920146-056	01-Aug-2019 12:08	GS_QC102_190801	✓		
EB1920146-057	01-Aug-2019 14:31	GS_QC103_190801	✓		
EB1920146-058	01-Aug-2019 15:42	GS_QC104_190801		✓	✓
EB1920146-061	02-Aug-2019 08:13	GS_QC105_190802		✓	✓
EB1920146-062	02-Aug-2019 10:10	GS_QC106_190802	✓		
EB1920146-063	02-Aug-2019 08:19	GS_BH05_7.4_190802	✓		
EB1920146-064	02-Aug-2019 10:11	GS_BH06_0.1_190802		✓	✓
EB1920146-065	02-Aug-2019 10:11	GS_BH06_0.5_190802		✓	✓
EB1920146-066	02-Aug-2019 10:12	GS_BH06_1.0_190802	✓		
EB1920146-067	02-Aug-2019 10:13	GS_BH06_1.5_190802	✓		
EB1920146-068	02-Aug-2019 10:13	GS_BH06_2.0_190802	✓		
EB1920146-069	02-Aug-2019 10:14	GS_BH06_3.0_190802	✓		
EB1920146-070	02-Aug-2019 10:15	GS_BH06_4.0_190802	✓		
EB1920146-071	02-Aug-2019 10:15	GS_BH06_5.0_190802	✓		
EB1920146-072	02-Aug-2019 10:16	GS_BH06_6.0_190802	✓		
EB1920146-073	02-Aug-2019 10:16	GS_BH06_7.0_190802		✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)
EB1920146-051	01-Aug-2019 08:45	GS_QC300_190801		✓
EB1920146-054	01-Aug-2019 10:48	GS_QC301_190801		✓
EB1920146-055	01-Aug-2019 10:49	GS_QC302_190801		✓
EB1920146-059	02-Aug-2019 06:52	GS_QC303_190802	✓	
EB1920146-060	02-Aug-2019 06:53	GS_QC304_190802	✓	

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

CAMDEN McCOSKER

- *AU Certificate of Analysis - NATA (COA)	Email	camden.mccosker@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	camden.mccosker@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	camden.mccosker@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	camden.mccosker@aecom.com
- A4 - AU Tax Invoice (INV)	Email	camden.mccosker@aecom.com
- Chain of Custody (CoC) (COC)	Email	camden.mccosker@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	camden.mccosker@aecom.com

JAMES PEACHEY

- *AU Certificate of Analysis - NATA (COA)	Email	james.peachey@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	james.peachey@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	james.peachey@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	james.peachey@aecom.com
- A4 - AU Tax Invoice (INV)	Email	james.peachey@aecom.com
- Chain of Custody (CoC) (COC)	Email	james.peachey@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	james.peachey@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1920146**	Page	: 1 of 15
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: 60609758 2.0-GS	Date Samples Received	: 06-Aug-2019 09:50
Order number	: 60609758 2.0	Date Analysis Commenced	: 06-Aug-2019
C-O-C number	: 2658	Issue Date	: 13-Aug-2019 14:28
Sampler	: CAMDEN McCOSKER		
Site	: 60609758_GS		
Quote number	: BN/112/19		
No. of samples received	: 73		
No. of samples analysed	: 28		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- EP231X: Sample 'V' shows high matrix spike recovery due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- EP231X: Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly and surrogates have not been determined.
- EP231X: Sample 'GS_BH04_0.1_190801' required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.
- EP231X: The LOR of PFDS for sample 'GS_SS2_0.1_190801' has been raised due to matrix interference.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_SS1_0.1_190801	GS_SS2_0.1_190801	GS_SS2_0.5_190801	GS_SS3_0.1_190801	GS_BH02_0.1_190801
				Client sampling date / time	01-Aug-2019 08:46	01-Aug-2019 08:47	01-Aug-2019 08:48	01-Aug-2019 08:49	01-Aug-2019 09:46
Compound	CAS Number	LOR	Unit		EB1920146-001	EB1920146-002	EB1920146-003	EB1920146-004	EB1920146-006
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**5.3**	**17.1**	**10.2**	**12.3**	**16.5**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	**0.0155**	**0.0062**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0002**	**0.0004**	<0.0002	**0.0384**	**0.0028**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0014**	**0.0030**	**0.0021**	**0.676**	**0.0247**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0002**	<0.0002	<0.0002	**0.0708**	<0.0010
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.144**	**0.0316**	**0.217**	**2.45**	**0.519**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0005	<0.0002	<0.0010	**0.0093**
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	**0.005**	**0.002**	**0.004**	**0.013**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0012**	**0.0170**	**0.0108**	**0.0469**	**0.0726**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0010**	**0.0059**	**0.0060**	**0.0942**	**0.0247**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	**0.0069**	**0.0031**	**0.0481**	**0.0118**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0006**	**0.0046**	**0.0026**	**0.123**	**0.0113**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0068**	**0.0057**	**0.0125**	**1.19**	**0.0223**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0063**	**0.0106**	**0.0363**	**0.0193**	**0.0409**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0075**	**0.254**	**0.0798**	**0.0420**	**1.14**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0080**	**0.0006**	<0.0010	**0.0292**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		**0.0017**	**0.0719**	**0.0069**	**0.0110**	**0.192**
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	**0.0010**	<0.0005	<0.0025	<0.0025
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	<0.0010	**0.0075**
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0025	<0.0025

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_SS1_0.1_190801	GS_SS2_0.1_190801	GS_SS2_0.5_190801	GS_SS3_0.1_190801	GS_BH02_0.1_190801
				Client sampling date / time	01-Aug-2019 08:46	01-Aug-2019 08:47	01-Aug-2019 08:48	01-Aug-2019 08:49	01-Aug-2019 09:46
Compound	CAS Number	LOR	Unit		EB1920146-001	EB1920146-002	EB1920146-003	EB1920146-004	EB1920146-006
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0025	<0.0025
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0025	<0.0025
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0025	<0.0025
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0010	<0.0010
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0010	<0.0010
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	<0.0010	<0.0010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0054**	**0.0018**	**0.0091**	**0.0580**	**0.0335**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0019**	**0.0077**	**0.0009**	<0.0010	**0.0518**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0011**	**0.0088**	<0.0005	<0.0010	**0.0614**
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.180**	**0.444**	**0.390**	**4.89**	**2.27**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.145**	**0.0346**	**0.219**	**3.13**	**0.544**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.156**	**0.0837**	**0.254**	**3.52**	**0.769**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**74.0**	**83.0**	**83.5**	**Not Determined**	**Not Determined**
13C8-PFOA	----	0.0002	%		**80.0**	**96.5**	**99.0**	**Not Determined**	**Not Determined**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH02_0.5_190801	GS_BH02_7.0_190801	GS_BH01_0.1_190801	GS_BH01_1.0_190801	GS_BH01_7.0_190801
				Client sampling date / time	01-Aug-2019 09:47	01-Aug-2019 09:50	01-Aug-2019 12:08	01-Aug-2019 12:09	01-Aug-2019 12:17
Compound	CAS Number	LOR	Unit		EB1920146-007	EB1920146-014	EB1920146-015	EB1920146-017	EB1920146-024
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		14.4	20.3	13.2	16.3	20.0
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		0.0144	0.0036	0.0007	0.0006	0.0012
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		0.0134	0.0044	0.0005	0.0010	0.0016
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		0.171	0.0468	0.0040	0.0120	0.0091
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		0.0187	0.0028	<0.0002	0.0010	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		3.91	0.0394	0.0294	0.0626	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0010	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		0.003	<0.001	0.015	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		0.0443	0.0019	0.0716	0.0047	0.0006
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		0.0580	0.0067	0.0199	0.0068	0.0024
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		0.0199	0.0014	0.0048	0.0018	0.0005
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		0.0472	0.0029	0.0023	0.0031	0.0004
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		0.328	0.0273	0.0115	0.179	0.0005
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		0.0578	<0.0002	0.0088	0.0003	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		0.0293	<0.0002	0.584	0.0004	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0010	<0.0002	0.0173	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		0.0013	<0.0002	0.224	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0025	<0.0005	0.0038	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0010	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0025	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH02_0.5_190801	GS_BH02_7.0_190801	GS_BH01_0.1_190801	GS_BH01_1.0_190801	GS_BH01_7.0_190801
				Client sampling date / time	01-Aug-2019 09:47	01-Aug-2019 09:50	01-Aug-2019 12:08	01-Aug-2019 12:09	01-Aug-2019 12:17
Compound	CAS Number	LOR	Unit		EB1920146-007	EB1920146-014	EB1920146-015	EB1920146-017	EB1920146-024
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0025	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0025	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0025	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0010	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0010	<0.0002	**0.0006**	<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		<0.0010	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.195**	**0.0106**	**0.0436**	**0.0254**	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0199**	<0.0005	**0.0146**	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0010	<0.0005	**0.0161**	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**4.93**	**0.148**	**1.07**	**0.299**	**0.0163**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**4.08**	**0.0862**	**0.0334**	**0.0746**	**0.0091**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**4.48**	**0.113**	**0.206**	**0.117**	**0.0142**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**Not Determined**	**104**	**91.5**	**91.5**	**106**
13C8-PFOA	----	0.0002	%		**Not Determined**	**102**	**105**	**98.5**	**106**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH03_0.25_190801	GS_BH03_1.1_190801	GS_BH03_5.0_19801	GS_BH04_0.1_190801	GS_BH04_1.0_190801
				Client sampling date / time	01-Aug-2019 12:18	01-Aug-2019 14:32	01-Aug-2019 14:34	01-Aug-2019 15:42	01-Aug-2019 15:43
Compound	CAS Number	LOR	Unit		EB1920146-025	EB1920146-027	EB1920146-032	EB1920146-034	EB1920146-036
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**13.3**	**13.2**	**15.6**	**15.4**	**10.9**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0020**	**0.0003**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0012**	**0.0007**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0005**	**0.0007**	**0.0004**	**0.0094**	**0.0040**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0009**	**0.0007**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0050**	**0.0013**	**0.0013**	**0.131**	**0.0736**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0012	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	**0.005**	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0129**	**0.0014**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0081**	**0.0016**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0031**	**0.0004**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0019**	**0.0007**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	**0.0003**	<0.0002	**0.0109**	**0.0058**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0032**	**0.0003**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0019**	<0.0002	<0.0002	**0.0697**	**0.0031**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0018**	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0185**	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH03_0.25_190801	GS_BH03_1.1_190801	GS_BH03_5.0_19801	GS_BH04_0.1_190801	GS_BH04_1.0_190801
				Client sampling date / time	01-Aug-2019 12:18	01-Aug-2019 14:32	01-Aug-2019 14:34	01-Aug-2019 15:42	01-Aug-2019 15:43
Compound	CAS Number	LOR	Unit		EB1920146-025	EB1920146-027	EB1920146-032	EB1920146-034	EB1920146-036
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<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	<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	**0.0005**	**0.0016**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0074**	**0.0023**	**0.0017**	**0.280**	**0.0942**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0055**	**0.0020**	**0.0017**	**0.140**	**0.0776**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0055**	**0.0020**	**0.0017**	**0.174**	**0.0836**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**79.0**	**76.5**	**82.5**	**86.0**	**94.5**
13C8-PFOA	----	0.0002	%		**84.5**	**83.5**	**85.0**	**92.5**	**99.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH04_5.0_190801	GS_BH05_0.5_190802	GS_BH05_1.0_190802	GS_BH05_6.0_190802	GS_QC100_190801
				Client sampling date / time	01-Aug-2019 15:46	02-Aug-2019 08:15	02-Aug-2019 08:15	02-Aug-2019 08:18	01-Aug-2019 08:46
Compound	CAS Number	LOR	Unit		EB1920146-041	EB1920146-043	EB1920146-044	EB1920146-050	EB1920146-052
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**19.7**	**18.6**	**15.2**	**19.2**	**14.5**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	**0.0061**	**0.0261**	**0.0002**	**0.0163**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0004**	**0.0016**	**0.0249**	**0.0005**	**0.0204**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0014**	**0.0029**	**0.0685**	**0.0018**	**0.222**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	**0.0003**	**0.0032**	<0.0002	**0.0260**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0027**	**0.0616**	**0.0688**	**0.0014**	**4.93**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	**0.004**	**0.002**	<0.001	**0.004**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	**0.0093**	**0.0122**	<0.0002	**0.0504**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0003**	**0.0061**	**0.0555**	**0.0005**	**0.0765**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	**0.0009**	**0.0096**	<0.0002	**0.0237**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0007**	**0.0074**	**0.0003**	**0.0541**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0021**	**0.211**	**0.571**	**0.0060**	**0.368**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	**0.0121**	**0.0010**	<0.0002	**0.0714**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	**0.0440**	**0.0045**	**0.0012**	**0.0282**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0003**	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	**0.0061**	**0.0007**	**0.0005**	**0.0020**
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0002	**0.0014**
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH04_5.0_190801	GS_BH05_0.5_190802	GS_BH05_1.0_190802	GS_BH05_6.0_190802	GS_QC100_190801
				Client sampling date / time	01-Aug-2019 15:46	02-Aug-2019 08:15	02-Aug-2019 08:15	02-Aug-2019 08:18	01-Aug-2019 08:46
Compound	CAS Number	LOR	Unit		EB1920146-041	EB1920146-043	EB1920146-044	EB1920146-050	EB1920146-052
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<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	<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	<0.0005	**0.183**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	**0.0204**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0069**	**0.367**	**0.855**	**0.0124**	**6.10**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0041**	**0.0645**	**0.137**	**0.0032**	**5.15**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0044**	**0.0916**	**0.250**	**0.0042**	**5.58**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**96.0**	**88.0**	**93.0**	**100**	**80.0**
13C8-PFOA	----	0.0002	%		**100**	**100**	**102**	**99.0**	**102**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_QC104_190801	GS_QC105_190802	GS_BH06_0.1_190802	GS_BH06_0.5_190802	GS_BH06_7.0_190802
				Client sampling date / time	01-Aug-2019 15:42	02-Aug-2019 08:13	02-Aug-2019 10:11	02-Aug-2019 10:11	02-Aug-2019 10:16
Compound	CAS Number	LOR	Unit		EB1920146-058	EB1920146-061	EB1920146-064	EB1920146-065	EB1920146-073
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**12.2**	**18.4**	**17.0**	**14.6**	**10.7**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		**0.0002**	**0.0053**	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0009**	**0.0015**	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0048**	**0.0034**	**0.0003**	**0.0003**	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0010**	**0.0003**	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.103**	**0.0679**	**0.0054**	**0.0023**	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	**0.004**	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0006**	**0.0083**	**0.0020**	**0.0013**	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0015**	**0.0057**	**0.0011**	**0.0014**	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0004**	**0.0010**	**0.0004**	**0.0007**	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0010**	**0.0007**	**0.0005**	**0.0009**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0083**	**0.183**	**0.0052**	**0.0937**	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0004**	**0.0109**	**0.0060**	**0.0029**	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0043**	**0.0477**	**0.341**	**0.0113**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0003**	**0.0038**	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		**0.0002**	**0.0057**	**0.0486**	**0.0019**	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	**0.0010**	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_QC104_190801	GS_QC105_190802	GS_BH06_0.1_190802	GS_BH06_0.5_190802	GS_BH06_7.0_190802
				Client sampling date / time	01-Aug-2019 15:42	02-Aug-2019 08:13	02-Aug-2019 10:11	02-Aug-2019 10:11	02-Aug-2019 10:16
Compound	CAS Number	LOR	Unit		EB1920146-058	EB1920146-061	EB1920146-064	EB1920146-065	EB1920146-073
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<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	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0018**	<0.0005	<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	<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	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.128**	**0.346**	**0.415**	**0.117**	<0.0002
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.108**	**0.0713**	**0.0057**	**0.0026**	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.113**	**0.0963**	**0.0097**	**0.0069**	<0.0002
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**98.5**	**98.5**	**91.0**	**97.5**	**91.0**
13C8-PFOA	----	0.0002	%		**104**	**102**	**106**	**104**	**91.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_QC300_190801	GS_QC301_190801	GS_QC302_190801	----	----
				Client sampling date / time	01-Aug-2019 08:45	01-Aug-2019 10:48	01-Aug-2019 10:49	----	----
Compound	CAS Number	LOR	Unit		EB1920146-051	EB1920146-054	EB1920146-055	--------	--------
					Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.01	<0.01	<0.01	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	<0.005	<0.005	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	<0.002	<0.002	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_QC300_190801	GS_QC301_190801	GS_QC302_190801	----	----
				Client sampling date / time	01-Aug-2019 08:45	01-Aug-2019 10:48	01-Aug-2019 10:49	----	----
Compound	CAS Number	LOR	Unit		EB1920146-051	EB1920146-054	EB1920146-055	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	<0.002	<0.002	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.005	<0.005	<0.005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	<0.005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	<0.005	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**83.8**	**85.3**	**81.5**	----	----
13C8-PFOA	----	0.002	%		**92.9**	**92.9**	**90.8**	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1920146**	Page	: 1 of 14
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: 60609758 2.0-GS	Date Samples Received	: 06-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 06-Aug-2019
C-O-C number	: 2658	Issue Date	: 13-Aug-2019
Sampler	: CAMDEN McCOSKER		
Site	: 60609758_GS		
Quote number	: BN/112/19		
No. of samples received	: 73		
No. of samples analysed	: 28		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2509780)									
EB1920146-001	GS_SS1_0.1_190801	EA055: Moisture Content	----	0.1	%	5.3	5.3	0.00	0% - 20%
EB1920146-025	GS_BH03_0.25_190801	EA055: Moisture Content	----	0.1	%	13.3	13.5	1.19	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2509781)									
EB1920146-034	GS_BH04_0.1_190801	EA055: Moisture Content	----	0.1	%	15.4	15.2	1.65	0% - 20%
EB1920146-065	GS_BH06_0.5_190802	EA055: Moisture Content	----	0.1	%	14.6	14.9	2.13	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2509774)									
EB1920146-001	GS_SS1_0.1_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0002	0.0003	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0014	0.0018	20.1	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0002	0.0003	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.144	0.162	11.8	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1920146-025	GS_BH03_0.25_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0005	0.0004	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0050	0.0049	2.98	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2509775)									
EB1920146-034	GS_BH04_0.1_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0020	0.0014	30.1	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0012	0.0009	24.8	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0094	0.0079	17.4	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0009	0.0008	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.131	0.121	8.18	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2509775) - continued									
EB1920146-034	GS_BH04_0.1_190801	EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0012	<0.0008	40.0	No Limit
EB1920146-065	GS_BH06_0.5_190802	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0003	0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0023	0.0019	18.3	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2509774)									
EB1920146-001	GS_SS1_0.1_190801	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0012	0.0011	15.5	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0010	0.0009	11.1	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0006	0.0006	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0068	0.0075	10.5	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0063	0.0071	12.7	0% - 20%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0075	0.0084	10.3	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0017	0.0020	14.3	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EB1920146-025	GS_BH03_0.25_190801	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0019	0.0024	21.0	0% - 50%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2509775)									
EB1920146-034	GS_BH04_0.1_190801	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0129	0.0110	16.1	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0081	0.0068	17.1	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0031	0.0026	16.0	0% - 50%
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0019	0.0018	6.95	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0109	0.0113	3.65	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0032	0.0031	4.32	0% - 50%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0697	0.0615	12.5	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0018	0.0015	19.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0185	0.0158	16.1	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2509775) - continued									
EB1920146-034	GS_BH04_0.1_190801	EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	0.005	0.004	23.0	No Limit
EB1920146-065	GS_BH06_0.5_190802	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0013	0.0013	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0014	0.0014	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0007	0.0007	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0009	0.0010	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0937	0.0981	4.58	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0029	0.0026	10.2	0% - 50%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0113	0.0106	6.22	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0019	0.0019	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2509774)									
EB1920146-001	GS_SS1_0.1_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	0.0003	0.0004	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1920146-025	GS_BH03_0.25_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2509775)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2509775) - continued									
EB1920146-034	GS_BH04_0.1_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1920146-065	GS_BH06_0.5_190802	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2509774)									
EB1920146-001	GS_SS1_0.1_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0054	0.0058	8.04	0% - 50%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0019	0.0022	14.4	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0011	0.0015	29.5	No Limit
EB1920146-025	GS_BH03_0.25_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2509774) - continued									
EB1920146-025	GS_BH03_0.25_190801	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2509775)									
EB1920146-034	GS_BH04_0.1_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0005	0.0008	42.1	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1920146-065	GS_BH06_0.5_190802	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2514757)									
EB1920433-003	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2514757)									
EB1920433-003	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2514757) - continued									
EB1920433-003	Anonymous	EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2514757)									
EB1920433-003	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2514757)									
EB1920433-003	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2514757)									
EB1920433-003	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2509774)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	99.1	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	107	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	111	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	93.7	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	93.5	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	91.7	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2509775)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	94.1	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	105	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	101	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	101	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	94.8	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	100	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509774)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	86.6	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.2	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.6	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.8	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.6	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.6	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	86.2	59	129
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509775)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	83.2	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.8	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.2	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.2	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.8	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	90.4	62	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509775) - continued								
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	92.6	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2509774)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.4	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	89.1	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	89.3	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	72.6	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	84.4	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	101	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2509775)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	81.2	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	84.9	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	81.6	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	84.9	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	81.6	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.2	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.6	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2509774)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	98.3	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	100	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	90.8	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	81.7	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2509775)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	89.6	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	93.6	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	91.2	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	87.5	60	130

Sub-Matrix: **WATER**

	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
		Spike	Spike Recovery (%)	Recovery Limits (%)

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2514757)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	98.9	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	115	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	108	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	100	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	87.3	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	68.7	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2514757)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	89.7	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	96.6	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	96.6	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	106	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	99.0	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	97.0	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	92.8	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	53.4	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	71.6	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	98.4	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	90.9	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2514757)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	65.2	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	70.2	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	64.1	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	79.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	64.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	74.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	71.8	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2514757)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	97.4	50	130
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.0474 µg/L	99.6	50	130
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.0479 µg/L	78.1	50	130
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.0482 µg/L	76.6	50	130
EP231P: PFAS Sums (QCLot: 2514757)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231P: PFAS Sums (QCLot: 2514757) - continued								
EP231X-LL: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2509774)							
EB1920146-002	GS_SS2_0.1_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	88.8	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	106	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	98.9	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	97.2	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	119	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2509775)							
EB1920146-036	GS_BH04_1.0_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	76.8	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	112	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	78.1	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	102	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	97.6	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509774)							
EB1920146-002	GS_SS2_0.1_190801	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	82.2	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	# Not Determined	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	102	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	# Not Determined	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	104	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	# 144	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	# Not Determined	55	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509774) - continued							
EB1920146-002	GS_SS2_0.1_190801	EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	# Not Determined	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# Not Determined	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	# Not Determined	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	97.1	59	129
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2509775)							
EB1920146-036	GS_BH04_1.0_190801	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	69.2	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	57.6	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	92.0	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	95.6	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	100	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	108	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	89.2	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	89.7	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	92.4	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	77.6	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	95.8	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2509774)							
EB1920146-002	GS_SS2_0.1_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	88.8	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	85.2	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	67.5	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	80.0	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	75.6	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	110	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	85.6	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2509775)							
EB1920146-036	GS_BH04_1.0_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	83.6	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	122	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	71.3	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	70.8	63	124

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2509775) - continued							
EB1920146-036	GS_BH04_1.0_190801	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	81.4	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	90.4	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	97.6	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2509774)							
EB1920146-002	GS_SS2_0.1_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	90.8	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	127	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	# Not Determined	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	# Not Determined	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2509775)							
EB1920146-036	GS_BH04_1.0_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	83.2	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	95.6	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	82.8	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	122	60	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2514757)							
EB1920146-054	GS_QC301_190801	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	88.0	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	110	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	97.8	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	97.6	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	87.6	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	65.2	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2514757)							
EB1920146-054	GS_QC301_190801	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	87.3	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	95.8	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	94.6	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	102	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	97.0	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	92.2	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	88.8	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	56.0	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	68.2	40	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2514757) - continued							
EB1920146-054	GS_QC301_190801	EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	93.0	40	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	86.4	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2514757)							
EB1920146-054	GS_QC301_190801	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	66.4	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	71.9	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	66.6	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	77.1	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	66.0	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	79.0	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	62.4	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2514757)							
EB1920146-054	GS_QC301_190801	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	86.2	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	96.0	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	81.4	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	73.0	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1920146**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Telephone	: +61 7 3552 8616
Project	: 60609758 2.0-GS	Date Samples Received	: 06-Aug-2019
Site	: 60609758_GS	Issue Date	: 13-Aug-2019
Sampler	: CAMDEN McCOSKER	No. of samples received	: 73
Order number	: 60609758 2.0	No. of samples analysed	: 28

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

- **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
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1920146--002	GS_SS2_0.1_190801	**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	EB1920146--036	GS_BH04_1.0_190801	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluoropentanoic acid (PFPeA)**	2706-90-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluoroheptanoic acid (PFHpA)**	375-85-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluorononanoic acid (PFNA)**	375-95-1	144 %	63-130%	**Recovery greater than upper data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluorodecanoic acid (PFDA)**	335-76-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluorododecanoic acid (PFDoDA)**	307-55-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1920146--002	GS_SS2_0.1_190801	**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1920146--002	GS_SS2_0.1_190801	**8:2 Fluorotelomer sulfonic acid (8:2 FTS)**	39108-34-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1920146--002	GS_SS2_0.1_190801	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

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)							
HDPE Soil Jar (EA055) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801, GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**----**	----	----	**06-Aug-2019**	15-Aug-2019	✓
HDPE Soil Jar (EA055) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**----**	----	----	**06-Aug-2019**	16-Aug-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**07-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**07-Aug-2019**	29-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓

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
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**07-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**07-Aug-2019**	29-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**07-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**07-Aug-2019**	29-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓

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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**07-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**07-Aug-2019**	29-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) GS_SS1_0.1_190801, GS_SS2_0.1_190801, GS_SS2_0.5_190801, GS_SS3_0.1_190801, GS_BH02_0.1_190801, GS_BH02_0.5_190801, GS_BH02_7.0_190801, GS_BH01_0.1_190801, GS_BH01_1.0_190801, GS_BH01_7.0_190801, GS_BH03_0.25_190801, GS_BH03_1.1_190801, GS_BH03_5.0_19801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**07-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH04_0.1_190801, GS_BH04_1.0_190801, GS_BH04_5.0_190801, GS_QC100_190801, GS_QC104_190801	**01-Aug-2019**	**07-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓
HDPE Soil Jar (EP231X) GS_BH05_0.5_190802, GS_BH05_1.0_190802, GS_BH05_6.0_190802, GS_QC105_190802, GS_BH06_0.1_190802, GS_BH06_0.5_190802, GS_BH06_7.0_190802	**02-Aug-2019**	**07-Aug-2019**	29-Jan-2020	✓	**08-Aug-2019**	16-Sep-2019	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation

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-LL)								
GS_QC300_190801, GS_QC302_190801	GS_QC301_190801,	**01-Aug-2019**	**08-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	28-Jan-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-LL)								
GS_QC300_190801, GS_QC302_190801	GS_QC301_190801,	**01-Aug-2019**	**08-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	28-Jan-2020	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-LL)								
GS_QC300_190801, GS_QC302_190801	GS_QC301_190801,	**01-Aug-2019**	**08-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	28-Jan-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL)								
GS_QC300_190801, GS_QC302_190801	GS_QC301_190801,	**01-Aug-2019**	**08-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	28-Jan-2020	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-LL)								
GS_QC300_190801, GS_QC302_190801	GS_QC301_190801,	**01-Aug-2019**	**08-Aug-2019**	28-Jan-2020	✓	**08-Aug-2019**	28-Jan-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	25	**16.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	25	**16.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	**8.00**	**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-LL	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	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 (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. 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. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. 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. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

AECOM 190808 AM
DUE 16/08/19

CHAIN OF CUSTODY

ALS Environmental

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 Pty Ltd	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☑ Standard TAT (List due date): 5 Day	FOR LABORATORY USE ONLY (Circle)
OFFICE: Brisbane		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: 60609758 2.0	ALS QUOTE NO.: BN/112/19	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: James Peachey	CONTACT PH: 0426 206 362	OF: (1) 2 3 4 5 6 7	Other comment:
SAMPLER: Camden McCosker	SAMPLER MOBILE: 0499 990 214	RELINQUISHED BY: Camden JB	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY: J Butina	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME: 7/8	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please Forward to NMI with this COC

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	EP231X (PFAS 28)		EP231X-ST (PFAS 28 super trace)	EP231X-LL (low level)			HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	CJ-GC200-190801	1/8/19	S	P N19/019902	1								Forward to NMI
	CJ-GC201-190801	"	"	" N19/019903	1								"
	CJ-GC202-190801	"	"	" N19/019904	1								"
	CJ-GC203-190801	"	"	P N19/019905	1								"
	CJ-GC204-190801	"	"	" N19/019906	1							Am	"
	CJ-GC205-190802	2/8/19	"	" N19/019907	1				CLIENT CONFIRMED TO BE TESTED				"
	CJ-GC206-190802	"	"	" N19/019908	1								"
				TOTAL									

RECEIVED 08 AUG 2019 BY: Am 14:02

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.

LAB00087426

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

SAMPLE RECEIPT NOTIFICATION

CUSTOMER DETAILS

Attention: JAMES PEACHEY

Customer: AECOM AUSTRALIA PTY LTD

Address: LEVEL 8
FORTITUDE VALLEY QLD 4006

Email: james.peachey@aecom.com

Telephone:

Fax:

LABORATORY DETAILS

Lab: National Measurement Institute

Contact: Susanne Neuman

Address: 105 Delhi Road, North Ryde, NSW
NSW 2113

Email: Susanne.Neuman@measurement.gov.au

Telephone: 02 9449 0181

Fax:

SAMPLE DETAILS

NMI Job Name: **AECO06/190808**

Total No. of Samples: **7**

LRNs	Customer Sample ID	Lab Sample Description
N19/019902	GS_QC200_190801	SOIL 01/08/2019
N19/019903	GS_QC201_190801	SOIL 01/08/2019
N19/019904	GS_QC202_190801	SOIL 01/08/2019
N19/019905	GS_QC203_190801	SOIL 01/08/2019
N19/019906	GS_QC204_190801	SOIL 01/08/2019
N19/019907	GS_QC205_190802	SOIL 02/08/2019
N19/019908	GS_QC206_190802	SOIL 02/08/2019

SAMPLE RECEIVED CONDITION

Date samples received:	8-AUG-2019
Sample received in good order:	Yes
NMI Quotation no. provided:	
Client purchase order number:	60609758_2_0
Temperature of samples:	Chilled
Comments:	QC205 WAS RELEASHED FROM HOLD AS PER YOUR ADVISED.
Estimated report date:	16-AUG-2019
Mode of Delivery:	Courier

Additional Terms and Conditions

Incomplete / unclear information about samples or required testing will delay the start of the analysis work

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission and before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

The lodgement of an order or receipt of samples for NMI services referenced in this Sample Receipt Notification constitutes an acceptence of the current version of NMI Terms and Conditions or other applicable Terms referenced in the NMI Quotation. NMI Terms and Conditions are available on the web at http://www.measurement.gov.au/Services/EnvironmentalTesting/Pages/Terms-and-Conditions.aspx

REPORT OF ANALYSIS

Report No. RN1243119

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190808
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609758_2_0
		Date Received	: 08-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758_2_0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/019902	GS_QC200_190801	SOIL 01/08/2019
N19/019906	GS_QC204_190801	SOIL 01/08/2019
N19/019907	GS_QC205_190802	SOIL 02/08/2019

Lab Reg No.		N19/019902	N19/019906	N19/019907		
Date Sampled		01-AUG-2019	01-AUG-2019	02-AUG-2019		
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
PFBA (375-22-4)	mg/kg	0.0049	<0.002	0.0064		NR70
PFPeA (2706-90-3)	mg/kg	0.045	<0.002	0.011		NR70
PFHxA (307-24-4)	mg/kg	0.053	0.0014	0.0069		NR70
PFHpA (375-85-9)	mg/kg	0.018	<0.001	0.0015		NR70
PFOA (335-67-1)	mg/kg	0.044	0.0010	<0.001		NR70
PFNA (375-95-1)	mg/kg	0.35	0.012	0.19		NR70
PFDA (335-76-2)	mg/kg	0.071	<0.001	0.019		NR70
PFUdA (2058-94-8)	mg/kg	0.043	0.0077	0.14		NR70
PFDoA (307-55-1)	mg/kg	<0.002	<0.002	<0.002		NR70
PFTrDA (72629-94-8)	mg/kg	0.0042	<0.002	0.016		NR70
PFTeDA (376-06-7)	mg/kg	<0.002	<0.002	<0.002		NR70
PFHxDA (67905-19-5)	mg/kg	<0.002	<0.002	<0.002		NR70
PFODA (16517-11-6)	mg/kg	<0.005	<0.005	<0.005		NR70
FOUEA (70887-84-2)	mg/kg	<0.001	<0.001	<0.001		NR70
PFBS (375-73-5)	mg/kg	0.013	<0.001	0.0077		NR70
PFPeS (2706-91-4)	mg/kg	0.012	<0.001	0.0012		NR70
PFHxS (355-46-4)	mg/kg	0.19	0.0056	0.0041		NR70
PFHpS (375-92-8)	mg/kg	0.023	<0.001	<0.001		NR70
PFOS (1763-23-1)	mg/kg	5.1	0.12	0.073		NR70
PFNS (68259-12-1)	mg/kg	0.0018	<0.001	<0.001		NR70
PFDS (335-77-3)	mg/kg	<0.001	<0.001	<0.001		NR70
PFOSA (754-91-6)	mg/kg	<0.001	<0.001	<0.001		NR70
N-MeFOSA (31506-32-8)	mg/kg	<0.002	<0.002	<0.002		NR70
N-EtFOSA (4151-50-2)	mg/kg	<0.002	<0.002	<0.002		NR70
N-MeFOSAA (2355-31-9)	mg/kg	<0.002	<0.002	<0.002		NR70
N-EtFOSAA(2991-50-6)	mg/kg	<0.002	<0.002	<0.002		NR70
N-MeFOSE (24448-09-7)	mg/kg	<0.005	<0.005	<0.005		NR70

REPORT OF ANALYSIS

Lab Reg No.		N19/019902	N19/019906	N19/019907		
Date Sampled		01-AUG-2019	01-AUG-2019	02-AUG-2019		
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
N-EtFOSE (1691-99-2)	mg/kg	<0.005	<0.005	<0.005		NR70
4:2 FTS (757124-72-4)	mg/kg	<0.001	<0.001	<0.001		NR70
6:2 FTS (27619-97-2)	mg/kg	0.17	0.0020	<0.001		NR70
8:2 FTS (39108-34-4)	mg/kg	0.028	<0.001	<0.001		NR70
10:2 FTS (120226-60-0)	mg/kg	<0.002	<0.002	<0.002		NR70
8:2 diPAP (678-41-1)	mg/kg	<0.002	<0.002	<0.002		NR70
PFBA (Surrogate Recovery)	%	107	106	108		NR70
PFPeA (Surrogate Recovery)	%	105	106	115		NR70
PFHxA (Surrogate Recovery)	%	117	117	115		NR70
PFHpA (Surrogate Recovery)	%	116	106	110		NR70
PFOA (Surrogate Recovery)	%	117	107	109		NR70
PFNA (Surrogate Recovery)	%	70	114	82		NR70
PFDA (Surrogate Recovery)	%	116	125	98		NR70
PFUdA (Surrogate Recovery)	%	113	130	95		NR70
PFDoA (Surrogate Recovery)	%	125	131	102		NR70
PFTeDA (Surrogate Recovery)	%	119	133	94		NR70
PFHxDA (Surrogate Recovery)	%	137	112	120		NR70
FOUEA (Surrogate Recovery)	%	60	48	52		NR70
PFBS (Surrogate Recovery)	%	118	115	116		NR70
PFHxS (Surrogate Recovery)	%	117	107	112		NR70
PFOS (Surrogate Recovery)	%	96	98	121		NR70
PFOSA (Surrogate Recovery)	%	112	124	102		NR70
N-MeFOSA (Surrogate Recovery)	%	103	96	95		NR70
N-EtFOSA (Surrogate Recovery)	%	110	109	103		NR70
N-MeFOSAA (Surrogate Recovery)	%	103	116	77		NR70
N-EtFOSAA (Surrogate Recovery)	%	94	106	84		NR70
N-MeFOSE (Surrogate Recovery)	%	106	98	78		NR70
N-EtFOSE (Surrogate Recovery)	%	103	90	113		NR70
4:2 FTS (Surrogate Recovery)	%	82	76	91		NR70
6:2 FTS (Surrogate Recovery)	%	167	83	85		NR70
8:2 FTS (Surrogate Recovery)	%	91	102	69		NR70
8:2 diPAP (Surrogate Recovery)	%	63	42	58		NR70
Dates						
Date extracted		12-AUG-2019	12-AUG-2019	12-AUG-2019		
Date analysed		13-AUG-2019	13-AUG-2019	13-AUG-2019		

N19/019902
To

REPORT OF ANALYSIS

N19/019907

PFOS is quantified using a combined branched and linear standard,
linear and branched isomers are totalled for reporting.
All results corrected for labelled surrogate recoveries.

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

16-AUG-2019

Lab Reg No.		N19/019902	N19/019906	N19/019907		
Date Sampled		01-AUG-2019	01-AUG-2019	02-AUG-2019		
	Units					Method
Trace Elements						
Total Solids	%	85.7	87.5	81.7		NT2_49

Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

16-AUG-2019

All results are expressed on a dry weight basis.

REPORT OF ANALYSIS

This Report supersedes reports: *RN1242731* *RN1243106*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM AUSTRALIA PTY LTD

NMI QA Report No: AECO06/190808 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
PFBA (375-22-4)	NR70	0.002	<0.002	NA	NA	NA	107	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	105	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	106	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	98	NA
PFUdA (2058-94-8)	NR70	0.002	<0.002	NA	NA	NA	96	NA
PFDoA (307-55-1)	NR70	0.002	<0.002	NA	NA	NA	98	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	97	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	88	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	99	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	107	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	106	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	102	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	105	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	116	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	117	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	114	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	96	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	102	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	109	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	95	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	106	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	120	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	94	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	116	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	100	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	106	NA
10:2 FTS (120226-60-0)	NR70	0.002	<0.002	NA	NA	NA	105	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	100	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **16/08/2019**

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 Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date):	5 Day
OFFICE:		☐ Non Standard or urgent TAT (List due date):	
PROJECT: 60609758 2.0	ALS QUOTE NO.:	BN/112/19	
ORDER NUMBER:			
PROJECT MANAGER: James Peachey	CONTACT PH: 0426 206 362		
SAMPLER: Zoe Maskell	SAMPLER MOBILE: 0499 990 214		
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): Camden.McCosker@aecom.com; james.peachey@aecom			
Email Invoice to (will default to PM if no other addresses are listed): james.peachey@aecom.com			

COC SEQUENCE NUMBER (Circle)
COC: (1) 2 3 4 5 6 7
OF: 1 (2) 3 4 5 6 7

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:
Zoe Maskell	KSchafer	KSchafer	Ward
DATE/TIME:	DATE/TIME: 13-8-19 1400	DATE/TIME: 13-8-19 1600	DATE/TIME: 1508 19 Aug 2019

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Subcon / Forward Lab / Split WO:
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No:
Attached By PO / Internal Sheet:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)	DATE / TIME	MATRIX	CONTAINER INFORMATION TYPE & PREservative (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). SOIL: EP231X (PFAS 28)		Surface Water: EP231X-ST (PFAS 28 super trace)	Ground Water: EP231X-LL (low level)	EP071 (TOC)	EP005 (TPH)	EP003 (TPH)	EA010 (EC)		HOLD	Additional Information
LAB ID	SAMPLE ID															
1	GS_MW01_190813	13/08/19	W	P	2				X	X	X	X	X			pH, Redox + DO cancelled
2	GS_MW02_190813	↓	W	P	2				X							as per James due
3	GS_MW03_190813	↓	W	P	2				X							to holding time
4	GS_MW04_190812	12/08/19	W	P	1				X							breaches 15/8/19
5	GS_MW05_190812	↓	W	P	1				X							
6	GS_MW06_190812	↓	W	P	1				X							
7	GS_QC107_190812	↓	W	P	1				X							
8	GS_QC305_190812	↓	W	P	1				X							
9	GS_QC306_190813	13/08/19	W	P	1				X							
10	GS_SW03_190812	12/08/19	W	P	1			X								
11	GS_QC108_190813	13/08/19	S	P	1	X										
12	GS_SED1_190813	13/08/19	S	P	1	X										
				TOTAL												

Environmental Division
Sydney
Work Order Reference
ES1925572

Telephone : +61-2-8784 8555

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

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 Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date):	5 Day
OFFICE:		☐ Non Standard or urgent TAT (List due date):	
PROJECT: 60609758 2.0	**ALS QUOTE NO.:**	BN/112/19	
ORDER NUMBER:			
PROJECT MANAGER: James Peachey	**CONTACT PH:** 0426 206 362		
SAMPLER: Zoe Maskell	**SAMPLER MOBILE:** 0499 990 214		
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**		
Email Reports to (will default to PM if no other addresses are listed): Camden.McCosker@aecom.com; james.peachey@aecom			
Email Invoice to (will default to PM if no other addresses are listed): james.peachey@aecom.com			

COC SEQUENCE NUMBER (Circle)

COC:	1	(2)	3	4	5	6	7
OF:	1	(2)	3	4	5	6	7

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:
Zoe Maskell	KSchafer	KSchafer	Wand
DATE/TIME:	DATE/TIME: 13-8-19 1400	DATE/TIME: 13-8-19 1600	DATE/TIME: 15/8/19 1200

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	SOIL: EP231X (PFAS 28)		Surface Water: EP231X-ST (PFAS 28 super trace)	Ground Water: EP231X-LL (low level)				HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	GS_SS4_190813	13/08/19	S	P	1	X								
				TOTAL										

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **ES1925572**		
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: JAMES PEACHEY	Contact	: Brenda Hong
Address	: Brisbane	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: james.peachey@aecom.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 60609758 2.0	Page	: 1 of 3
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: ZOE MASKELL		

Dates

Date Samples Received	: 13-Aug-2019 14:27	Issue Date	: 01-Nov-2019
Client Requested Due Date	: 20-Aug-2019	Scheduled Reporting Date	: **20-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 8°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 13 / 13

General Comments

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

Sample Container(s)/Preservation Non-Compliances

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

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Conductivity by PC Titrator : EA010-P		
GS_MW01_190813	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_MW02_190813	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_MW03_190813	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_MW04_190812	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_MW05_190812	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_MW06_190812	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_QC107__190812	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_QC305__190812	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural
GS_QC306_190813	- HDPE (no PTFE)	- Clear Plastic Bottle - Natural

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
ES1925572-011	13-Aug-2019 00:00	GS_QC108_190813	✓	✓
ES1925572-012	13-Aug-2019 00:00	GS_SE01_190813	✓	✓
ES1925572-013	13-Aug-2019 00:00	GS_SS4_190813	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA010P Electrical Conductivity (PCT)	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)	WATER - EP231X-ST PFAS - Super Trace Waters Long Suite (28
ES1925572-001	13-Aug-2019 00:00	GS_MW01_190813	✓	✓	
ES1925572-002	13-Aug-2019 00:00	GS_MW02_190813	✓	✓	
ES1925572-003	13-Aug-2019 00:00	GS_MW03_190813	✓	✓	
ES1925572-004	12-Aug-2019 00:00	GS_MW04_190812	✓	✓	
ES1925572-005	12-Aug-2019 00:00	GS_MW05_190812	✓	✓	
ES1925572-006	12-Aug-2019 00:00	GS_MW06_190812	✓	✓	
ES1925572-007	12-Aug-2019 00:00	GS_QC107__190812	✓	✓	
ES1925572-008	12-Aug-2019 00:00	GS_QC305__190812	✓	✓	
ES1925572-009	13-Aug-2019 00:00	GS_QC306_190813	✓	✓	
ES1925572-010	13-Aug-2019 00:00	GS_SW03_190812			✓

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

CAMDEN McCOSKER

- *AU Certificate of Analysis - NATA (COA)	Email	camden.mccosker@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	camden.mccosker@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	camden.mccosker@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	camden.mccosker@aecom.com
- A4 - AU Tax Invoice (INV)	Email	camden.mccosker@aecom.com
- Chain of Custody (CoC) (COC)	Email	camden.mccosker@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	camden.mccosker@aecom.com

JAMES PEACHEY

- *AU Certificate of Analysis - NATA (COA)	Email	james.peachey@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	james.peachey@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	james.peachey@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	james.peachey@aecom.com
- A4 - AU Tax Invoice (INV)	Email	james.peachey@aecom.com
- Chain of Custody (CoC) (COC)	Email	james.peachey@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	james.peachey@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925572**	Page	: 1 of 11
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: JAMES PEACHEY	Contact	: Brenda Hong
Address	: Brisbane	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 13-Aug-2019 14:27
Order number	: 60609758 2.0	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 21-Aug-2019 11:50
Sampler	: ZOE MASKELL		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 13		
No. of samples analysed	: 13		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Evie Sidarta	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

- EP231X: Poor Matrix spike recoveries due to matrix interferences.
- EP231X-ST: Matrix spike recovery for "PFBA" could not be dtermined due to matrix interfernces.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	GS_QC108_190813	GS_SE01_190813	GS_SS4_190813	----	----
			Client sampling date / time	13-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	ES1925572-011	ES1925572-012	ES1925572-013	--------	--------
				Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**2.8**	**17.1**	**36.1**	**----**	**----**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	**0.0002**	<0.0002	**0.0005**	**----**	**----**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	**0.0006**	**----**	**----**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0002**	**0.0002**	**0.0074**	**----**	**----**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	**0.0031**	**----**	**----**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0048**	**0.0046**	**0.452**	**----**	**----**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	**0.0049**	**----**	**----**
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	**0.0011**	**0.0010**	**0.0006**	**----**	**----**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0005**	**0.0004**	**0.0015**	**----**	**----**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0002**	**0.0002**	**0.0004**	**----**	**----**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0002**	**0.0003**	**0.0010**	**----**	**----**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0121**	**0.0122**	**0.0059**	**----**	**----**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0028**	**0.0027**	**0.0008**	**----**	**----**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	**0.159**	**0.140**	**0.0071**	**----**	**----**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	**0.0078**	**0.0085**	**0.0010**	**----**	**----**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	**0.116**	**0.0879**	**0.0081**	**----**	**----**
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	**0.0015**	**0.0020**	**0.0005**	**----**	**----**
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	**0.0029**	**----**	**----**
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	**----**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_QC108_190813	GS_SE01_190813	GS_SS4_190813	----	----
				Client sampling date / time	13-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1925572-011	ES1925572-012	ES1925572-013	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
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	----	----
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	**0.0014**	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	**0.0041**	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0006**	**0.0006**	**0.0290**	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.308**	**0.262**	**0.533**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0050**	**0.0048**	**0.459**	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0082**	**0.0077**	**0.469**	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**85.0**	**91.5**	**87.5**	----	----
13C8-PFOA	----	0.0002	%		**80.0**	**90.0**	**77.5**	----	----

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GS_MW01_190813	GS_MW02_190813	GS_MW03_190813	GS_MW04_190812	GS_MW05_190812
				Client sampling date / time	13-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00
					ES1925572-001	ES1925572-002	ES1925572-003	ES1925572-004	ES1925572-005
					Result	Result	Result	Result	Result
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**7110**	**10700**	**3880**	**4690**	**4440**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		**10.9**	**12.2**	**0.481**	**0.183**	**0.030**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		**16.6**	**16.3**	**0.453**	**0.183**	**0.025**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		**103**	**133**	**1.09**	**0.739**	**0.110**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		**1.98**	**10.7**	**0.102**	**0.096**	**0.002**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		**2.09**	**134**	**1.38**	**0.893**	**0.014**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		**0.36**	**1.34**	**0.06**	**0.02**	<0.01
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		**3.72**	**5.88**	**0.091**	**0.089**	**0.010**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		**17.0**	**21.9**	**0.361**	**0.254**	**0.035**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		**6.51**	**4.81**	**0.057**	**0.077**	**0.013**
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		**6.81**	**8.02**	**0.091**	**0.124**	**0.014**
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		**5.16**	**97.2**	**0.059**	**0.648**	**0.038**
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.010	**0.182**	<0.002	<0.002	<0.002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		**0.012**	**0.024**	**0.002**	**0.006**	**0.004**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.025	<0.025	<0.005	<0.005	<0.005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.025	<0.025	<0.005	<0.005	<0.005

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW01_190813	GS_MW02_190813	GS_MW03_190813	GS_MW04_190812	GS_MW05_190812
				Client sampling date / time	13-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1925572-001	ES1925572-002	ES1925572-003	ES1925572-004	ES1925572-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.025	<0.025	<0.005	<0.005	<0.005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.025	<0.025	<0.005	<0.005	<0.005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.025	<0.025	<0.005	<0.005	<0.005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.010	<0.010	<0.002	<0.002	<0.002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		**0.031**	**0.386**	<0.005	<0.005	<0.005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		**2.29**	**47.6**	**0.015**	**0.079**	<0.005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.010	**0.105**	<0.005	<0.005	<0.005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.010	<0.010	<0.005	<0.005	<0.005
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		**176**	**494**	**4.24**	**3.39**	**0.295**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		**105**	**267**	**2.47**	**1.63**	**0.124**
Sum of PFAS (WA DER List)	----	0.002	µg/L		**153**	**369**	**3.63**	**2.46**	**0.226**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**78.0**	**77.0**	**90.9**	**94.7**	**100**
13C8-PFOA	----	0.002	%		**63.0**	**67.0**	**96.1**	**97.2**	**103**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW06_190812	GS_QC107__190812	GS_QC305__190812	GS_QC306_190813	GS_SW03_190812
				Client sampling date / time	12-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1925572-006	ES1925572-007	ES1925572-008	ES1925572-009	ES1925572-010
					Result	Result	Result	Result	Result
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**10200**	**4310**	<1	<1	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L		----	----	----	----	<0.0005
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		**0.022**	**0.040**	<0.002	<0.002	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L		----	----	----	----	<0.0005
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		**0.014**	**0.031**	<0.002	<0.002	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L		----	----	----	----	**0.0065**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		**0.096**	**0.139**	<0.002	<0.002	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L		----	----	----	----	<0.0005
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	**0.003**	<0.002	<0.002	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0003	µg/L		----	----	----	----	**0.0434**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		**0.013**	**0.017**	<0.002	<0.002	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L		----	----	----	----	<0.0005
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L		----	----	----	----	<0.002
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		**0.01**	<0.01	<0.01	<0.01	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L		----	----	----	----	**0.0018**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		**0.040**	**0.012**	<0.002	<0.002	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L		----	----	----	----	**0.0018**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		**0.043**	**0.045**	<0.002	<0.002	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L		----	----	----	----	<0.0005
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		**0.099**	**0.017**	<0.002	<0.002	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L		----	----	----	----	**0.0017**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW06_190812	GS_QC107__190812	GS_QC305__190812	GS_QC306_190813	GS_SW03_190812
				Client sampling date / time	12-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1925572-006	ES1925572-007	ES1925572-008	ES1925572-009	ES1925572-010
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		**0.077**	**0.017**	<0.002	<0.002	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L		----	----	----	----	**0.0048**
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		**0.258**	**0.046**	<0.002	<0.002	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L		----	----	----	----	**0.0013**
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		**0.007**	<0.002	<0.002	<0.002	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L		----	----	----	----	**0.0082**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		**0.273**	**0.004**	<0.002	<0.002	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L		----	----	----	----	**0.0010**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		**0.002**	<0.002	<0.002	<0.002	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L		----	----	----	----	**0.0020**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		**0.006**	<0.002	<0.002	<0.002	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L		----	----	----	----	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L		----	----	----	----	**0.0005**
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L		----	----	----	----	<0.001
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L		----	----	----	----	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L		----	----	----	----	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW06_190812	GS_QC107__190812	GS_QC305__190812	GS_QC306_190813	GS_SW03_190812
				Client sampling date / time	12-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1925572-006	ES1925572-007	ES1925572-008	ES1925572-009	ES1925572-010
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L		----	----	----	----	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L		----	----	----	----	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L		----	----	----	----	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L		----	----	----	----	<0.001
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L		----	----	----	----	**0.004**
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L		----	----	----	----	**0.008**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		----	----	----	----	**0.007**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
EP231P: PFAS Sums									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW06_190812	GS_QC107__190812	GS_QC305__190812	GS_QC306_190813	GS_SW03_190812
				Client sampling date / time	12-Aug-2019 00:00	12-Aug-2019 00:00	12-Aug-2019 00:00	13-Aug-2019 00:00	13-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1925572-006	ES1925572-007	ES1925572-008	ES1925572-009	ES1925572-010
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFAS	----	0.0003	µg/L		**----**	**----**	**----**	**----**	**0.0920**
Sum of PFAS	----	0.002	µg/L		**0.960**	**0.371**	<0.002	<0.002	**----**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0003	µg/L		**----**	**----**	**----**	**----**	**0.0499**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		**0.109**	**0.156**	<0.002	<0.002	**----**
Sum of PFAS (WA DER List)	----	0.0003	µg/L		**----**	**----**	**----**	**----**	**0.0672**
Sum of PFAS (WA DER List)	----	0.002	µg/L		**0.400**	**0.287**	<0.002	<0.002	**----**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%		**----**	**----**	**----**	**----**	**89.2**
13C4-PFOS	----	0.002	%		**101**	**98.4**	**91.4**	**89.7**	**----**
13C8-PFOA	----	0.0005	%		**----**	**----**	**----**	**----**	**74.5**
13C8-PFOA	----	0.002	%		**106**	**97.0**	**98.4**	**94.8**	**----**

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1925572**	Page	: 1 of 13
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: JAMES PEACHEY	Contact	: Brenda Hong
Address	: Brisbane	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 13-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 21-Aug-2019
Sampler	: ZOE MASKELL		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 13		
No. of samples analysed	: 13		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Evie Sidarta	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2529960)									
ES1925572-011	GS_QC108_190813	EA055: Moisture Content	----	0.1	%	2.8	3.0	6.80	0% - 20%
ES1926047-001	Anonymous	EA055: Moisture Content	----	0.1	%	10.2	10.8	5.24	0% - 50%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2530564)									
ES1925572-011	GS_QC108_190813	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0048	0.0047	0.00	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2530564)									
ES1925572-011	GS_QC108_190813	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0011	0.0011	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0005	0.0004	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0002	0.0003	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0121	0.0130	6.44	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0028	0.0029	0.00	0% - 50%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.159	0.147	7.85	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0078	0.0084	6.59	0% - 20%
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.116	0.111	4.98	0% - 20%
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	0.0015	0.0016	6.64	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	0.001	0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2530564)									
ES1925572-011	GS_QC108_190813	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2530564) - continued									
ES1925572-011	GS_QC108_190813	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2530564)									
ES1925572-011	GS_QC108_190813	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0006	0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA010P: Conductivity by PC Titrator (QC Lot: 2529863)									
ES1925572-001	GS_MW01_190813	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	7110	7030	1.12	0% - 20%
ES1925942-002	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3280	3280	0.00	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2527669)									
ES1925572-001	GS_MW01_190813	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	10.9	10.8	1.36	0% - 20%
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	16.6	14.4	13.7	0% - 20%
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	103	94.4	8.92	0% - 20%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	1.98	1.92	2.77	0% - 20%
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	2.09	2.07	0.914	0% - 20%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.010	<0.010	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2530608)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2530608) - continued									
ES1925564-001	Anonymous	EP231X-ST: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0003	µg/L	0.0081	0.0080	0.00	0% - 20%
		EP231X-ST: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	0.0017	0.0017	0.00	No Limit
		EP231X-ST: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0016	0.0016	0.00	No Limit
		EP231X-ST: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2527669)									
ES1925572-001	GS_MW01_190813	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	3.72	3.70	0.512	0% - 20%
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	17.0	15.5	9.04	0% - 20%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	6.51	6.00	8.24	0% - 20%
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	6.81	6.46	5.26	0% - 20%
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	5.16	5.06	1.92	0% - 20%
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	0.012	0.012	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	0.36	0.35	0.00	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2530608)									
ES1925564-001	Anonymous	EP231X-ST: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0007	0.0008	0.00	No Limit
		EP231X-ST: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2527669)									
ES1925572-001	GS_MW01_190813	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.010	<0.010	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2527669) - continued									
ES1925572-001	GS_MW01_190813	EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.025	<0.025	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2530608)									
ES1925564-001	Anonymous	EP231X-ST: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	0.0005	<0.0005	0.00	No Limit
		EP231X-ST: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-ST: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-ST: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-ST: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-ST: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2527669)									
ES1925572-001	GS_MW01_190813	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	0.031	0.029	6.67	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	2.29	2.17	5.52	0% - 20%
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.010	<0.010	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2530608)									
ES1925564-001	Anonymous	EP231X-ST: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-ST: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2530608) - continued									
ES1925564-001	Anonymous	EP231X-ST: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-ST: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2530608)									
ES1925564-001	Anonymous	EP231X-ST: Sum of PFAS	----	0.0003	µg/L	0.0126	0.0121	4.05	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2530564)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.2	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.4	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.4	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.4	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2530564)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	62.6	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	66.0	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.4	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	81.2	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.4	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	86.4	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	69.4	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2530564)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	73.6	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	70.2	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	72.4	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	65.9	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.0	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530564)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	78.0	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	75.2	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	86.0	62	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	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530564) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	88.8	60	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EA010P: Conductivity by PC Titrator (QCLot: 2529863)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2100 µS/cm	# 91.0	95	113
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2527669)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.05 µg/L	84.4	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.05 µg/L	78.4	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.05 µg/L	79.2	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.05 µg/L	82.4	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.05 µg/L	72.6	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.05 µg/L	68.4	40	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2530608)								
EP231X-ST: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.01 µg/L	74.8	50	130
EP231X-ST: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.01 µg/L	72.0	50	130
EP231X-ST: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.01 µg/L	70.8	50	130
EP231X-ST: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.01 µg/L	97.4	50	130
EP231X-ST: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0003	µg/L	<0.0003	0.01 µg/L	67.6	50	130
EP231X-ST: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.01 µg/L	51.0	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2527669)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	74.8	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	86.2	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	87.0	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	82.2	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	84.0	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	83.6	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	83.6	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	74.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	83.6	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	59.8	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	90.4	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2530608)								
EP231X-ST: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.002	0.05 µg/L	65.0	30	130
EP231X-ST: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.01 µg/L	79.4	50	130
EP231X-ST: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.01 µg/L	80.0	50	130
EP231X-ST: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.01 µg/L	89.4	50	130
EP231X-ST: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.01 µg/L	88.0	50	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2530608) - continued								
EP231X-ST: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.01 µg/L	71.4	50	130
EP231X-ST: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.01 µg/L	57.6	50	130
EP231X-ST: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.01 µg/L	56.6	40	130
EP231X-ST: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.01 µg/L	51.4	40	130
EP231X-ST: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.01 µg/L	41.0	40	130
EP231X-ST: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.025 µg/L	65.8	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2527669)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	78.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	53.4	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	63.2	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	74.3	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	70.4	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	85.4	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	82.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2530608)								
EP231X-ST: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.01 µg/L	57.6	40	130
EP231X-ST: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.025 µg/L	56.1	40	130
EP231X-ST: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.025 µg/L	55.4	40	130
EP231X-ST: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.025 µg/L	57.6	40	130
EP231X-ST: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.025 µg/L	52.4	40	130
EP231X-ST: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.01 µg/L	50.4	40	130
EP231X-ST: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.01 µg/L	50.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527669)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.05 µg/L	89.0	50	130
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.05 µg/L	79.0	50	130
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.05 µg/L	83.2	50	130
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.05 µg/L	90.4	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530608)								
EP231X-ST: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.01 µg/L	85.6	50	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530608) - continued								
EP231X-ST: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.01 µg/L	90.4	50	130
EP231X-ST: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.01 µg/L	67.6	50	130
EP231X-ST: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.01 µg/L	56.8	50	130
EP231P: PFAS Sums (QCLot: 2530608)								
EP231X-ST: Sum of PFAS	----	0.0003	µg/L	<0.0003	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2530564)							
ES1925572-011	GS_QC108_190813	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	94.8	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	76.8	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	64.8	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	76.0	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	99.2	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	50.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2530564)							
ES1925572-011	GS_QC108_190813	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	55.8	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	62.4	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	82.4	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	73.2	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	71.6	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	# Not Determined	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	76.8	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	# Not Determined	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# Not Determined	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	# Not Determined	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	41.2	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2530564)							
ES1925572-011	GS_QC108_190813	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	69.2	50	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2530564) - continued							
ES1925572-011	GS_QC108_190813	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	61.7	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	56.1	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	57.8	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	55.9	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	74.4	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	77.2	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530564)							
ES1925572-011	GS_QC108_190813	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	74.4	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	69.2	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	70.0	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	98.0	50	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2527669)							
ES1925572-002	GS_MW02_190813	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	77.0	30	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2530608)							
ES1925651-001	Anonymous	EP231X-ST: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.01 µg/L	105	50	130
		EP231X-ST: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.01 µg/L	84.6	50	130
		EP231X-ST: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01 µg/L	82.6	50	130
		EP231X-ST: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.01 µg/L	86.0	50	130
		EP231X-ST: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01 µg/L	72.0	50	130
		EP231X-ST: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.01 µg/L	41.6	30	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2527669)							
ES1925572-002	GS_MW02_190813	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	# Not Determined	30	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	# 46.0	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	48.0	30	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	96.0	30	130
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	70.8	30	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	118	30	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2530608)							
ES1925651-001	Anonymous	EP231X-ST: Perfluorobutanoic acid (PFBA)	375-22-4	0.05 µg/L	# 0.00	30	130
		EP231X-ST: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.01 µg/L	# Not Determined	50	130
		EP231X-ST: Perfluorohexanoic acid (PFHxA)	307-24-4	0.01 µg/L	91.0	50	130
		EP231X-ST: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.01 µg/L	97.8	50	130
		EP231X-ST: Perfluorooctanoic acid (PFOA)	335-67-1	0.01 µg/L	87.4	50	130
		EP231X-ST: Perfluorononanoic acid (PFNA)	375-95-1	0.01 µg/L	98.0	50	130
		EP231X-ST: Perfluorodecanoic acid (PFDA)	335-76-2	0.01 µg/L	84.0	50	130
		EP231X-ST: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.01 µg/L	46.2	30	130
		EP231X-ST: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.01 µg/L	43.2	30	130
		EP231X-ST: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.01 µg/L	38.4	30	130
		EP231X-ST: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.025 µg/L	70.8	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2527669)							
ES1925572-002	GS_MW02_190813	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	99.2	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	63.0	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	70.5	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	89.8	30	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2527669) - continued							
ES1925572-002	GS_MW02_190813	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	90.3	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	79.2	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	93.8	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2530608)							
ES1925651-001	Anonymous	EP231X-ST: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.01 µg/L	63.2	30	130
		EP231X-ST: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.025 µg/L	36.2	30	130
		EP231X-ST: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.025 µg/L	41.1	30	130
		EP231X-ST: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.025 µg/L	43.0	30	130
		EP231X-ST: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.025 µg/L	36.0	30	130
		EP231X-ST: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.01 µg/L	41.0	30	130
		EP231X-ST: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.01 µg/L	62.2	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527669)							
ES1925572-002	GS_MW02_190813	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	# 38.0	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	112	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2530608)							
ES1925651-001	Anonymous	EP231X-ST: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.01 µg/L	102	50	130
		EP231X-ST: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.01 µg/L	108	50	130
		EP231X-ST: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.01 µg/L	98.2	50	130
		EP231X-ST: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.01 µg/L	52.0	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1925572**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: JAMES PEACHEY	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 13-Aug-2019
Site	: ----	Issue Date	: 21-Aug-2019
Sampler	: ZOE MASKELL	No. of samples received	: 13
Order number	: 60609758 2.0	No. of samples analysed	: 13

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
Matrix Spike (MS) Recoveries							
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--011	GS_QC108_190813	**Perfluorononanoic acid (PFNA)**	375-95-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--011	GS_QC108_190813	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--011	GS_QC108_190813	**Perfluorododecanoic acid (PFDoDA)**	307-55-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--011	GS_QC108_190813	**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EA010P: Conductivity by PC Titrator	QC-MRG2-25298630	----	**Electrical Conductivity @ 25°C**	----	91.0 %	95-113%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES1925572--002	GS_MW02_190813	**Perfluorobutane sulfonic acid (PFBS)**	375-73-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1925572--002	GS_MW02_190813	**Perfluoropentane sulfonic acid (PFPeS)**	2706-91-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1925572--002	GS_MW02_190813	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1925572--002	GS_MW02_190813	**Perfluoroheptane sulfonic acid (PFHpS)**	375-92-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1925572--002	GS_MW02_190813	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--002	GS_MW02_190813	**Perfluorobutanoic acid (PFBA)**	375-22-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--002	GS_MW02_190813	**Perfluoropentanoic acid (PFPeA)**	2706-90-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--002	GS_MW02_190813	**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	ES1925572--002	GS_MW02_190813	**Perfluoroheptanoic acid (PFHpA)**	375-85-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--002	GS_MW02_190813	**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	ES1925572--002	GS_MW02_190813	**Perfluorononanoic acid (PFNA)**	375-95-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925572--002	GS_MW02_190813	**Perfluorodecanoic acid (PFDA)**	335-76-2	46.0 %	50-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925651--001	Anonymous	**Perfluorobutanoic acid (PFBA)**	375-22-4	0.00 %	30-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	ES1925651--001	Anonymous	**Perfluoropentanoic acid (PFPeA)**	2706-90-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	ES1925572--002	GS_MW02_190813	**4:2 Fluorotelomer sulfonic acid (4:2 FTS)**	757124-72-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	ES1925572--002	GS_MW02_190813	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	ES1925572--002	GS_MW02_190813	**8:2 Fluorotelomer sulfonic acid (8:2 FTS)**	39108-34-4	38.0 %	50-130%	**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	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*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)								
HDPE Soil Jar (EA055)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**----**	----	----	**16-Aug-2019**	27-Aug-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	28-Sep-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	28-Sep-2019	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	28-Sep-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	28-Sep-2019	✓
EP231P: PFAS Sums								
HDPE Soil Jar (EP231X)								
GS_QC108_190813, GS_SS4_190813	GS_SE01_190813,	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	28-Sep-2019	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator								
HDPE (no PTFE) (EA010-P)								
GS_MW04_190812, GS_MW06_190812, GS_QC305__190812	GS_MW05_190812, GS_QC107__190812,	**12-Aug-2019**	**----**	----	----	**16-Aug-2019**	09-Sep-2019	✓
HDPE (no PTFE) (EA010-P)								
GS_MW01_190813, GS_MW03_190813,	GS_MW02_190813, GS_QC306_190813	**13-Aug-2019**	**----**	----	----	**16-Aug-2019**	10-Sep-2019	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) GS_MW04_190812, GS_MW05_190812, GS_MW06_190812, GS_QC107__190812, GS_QC305__190812	**12-Aug-2019**	**16-Aug-2019**	08-Feb-2020	✓	**16-Aug-2019**	08-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) GS_MW01_190813, GS_MW02_190813, GS_MW03_190813, GS_QC306_190813	**13-Aug-2019**	**16-Aug-2019**	09-Feb-2020	✓	**16-Aug-2019**	09-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) GS_SW03_190812	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	09-Feb-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) GS_MW04_190812, GS_MW05_190812, GS_MW06_190812, GS_QC107__190812, GS_QC305__190812	**12-Aug-2019**	**16-Aug-2019**	08-Feb-2020	✓	**16-Aug-2019**	08-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) GS_MW01_190813, GS_MW02_190813, GS_MW03_190813, GS_QC306_190813	**13-Aug-2019**	**16-Aug-2019**	09-Feb-2020	✓	**16-Aug-2019**	09-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) GS_SW03_190812	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	09-Feb-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) GS_MW04_190812, GS_MW05_190812, GS_MW06_190812, GS_QC107__190812, GS_QC305__190812	**12-Aug-2019**	**16-Aug-2019**	08-Feb-2020	✓	**16-Aug-2019**	08-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) GS_MW01_190813, GS_MW02_190813, GS_MW03_190813, GS_QC306_190813	**13-Aug-2019**	**16-Aug-2019**	09-Feb-2020	✓	**16-Aug-2019**	09-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) GS_SW03_190812	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	09-Feb-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) GS_MW04_190812, GS_MW05_190812, GS_MW06_190812, GS_QC107__190812, GS_QC305__190812	**12-Aug-2019**	**16-Aug-2019**	08-Feb-2020	✓	**16-Aug-2019**	08-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) GS_MW01_190813, GS_MW02_190813, GS_MW03_190813, GS_QC306_190813	**13-Aug-2019**	**16-Aug-2019**	09-Feb-2020	✓	**16-Aug-2019**	09-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) GS_SW03_190812	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	09-Feb-2020	✓

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-LL)							
GS_MW04_190812, GS_MW05_190812, GS_MW06_190812, GS_QC107__190812, GS_QC305__190812	**12-Aug-2019**	**16-Aug-2019**	08-Feb-2020	✓	**16-Aug-2019**	08-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)							
GS_MW01_190813, GS_MW02_190813, GS_MW03_190813, GS_QC306_190813	**13-Aug-2019**	**16-Aug-2019**	09-Feb-2020	✓	**16-Aug-2019**	09-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)							
GS_SW03_190812	**13-Aug-2019**	**19-Aug-2019**	09-Feb-2020	✓	**19-Aug-2019**	09-Feb-2020	✓

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
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	3	**33.33**	**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)							
Conductivity by PC Titrator	EA010-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Conductivity by PC Titrator	EA010-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	3	**33.33**	**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 (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. 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. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. 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. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. 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. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

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 Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): 5 Day	**FOR LABORATORY USE ONLY (Circle)**
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: 60609758 2.0	**ALS QUOTE NO.:** BN/112/19	**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: James Peachey	**CONTACT PH:** 0426 206 362	OF: (1) (2) 3 4 5 6 7	Other comment:
SAMPLER: Zoe Maskell	**SAMPLER MOBILE:** 0499 990 214	**RELINQUISHED BY:** Zoe Maskell	**RECEIVED BY:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**	DATE/TIME:	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): Camden.McCosker@aecom.com; james.peachey@aecom		**RELINQUISHED BY:**	**RECEIVED BY:**
Email Invoice to (will default to PM if no other addresses are listed): james.peachey@aecom.com		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	SOIL: EP231X (PFAS 28)		Surface Water: EP231X-ST (PFAS 28 super trace)	Ground Water: EP231X-LL (low level)	EP025 (DO)	EA075 (Redox)	EA005 (pH)	EA010 (EC)		HOLD	
X	GS_QC207_190812	~~12/08/19~~ 15:00, 12/08/19	W	P	1				X	X	X	X	X			Please send to
X	GS_QC208_190813	13/08/19, 1115	S	P	1	X										NMI for testing.
X																
X																
X																
X																
X																
X																
X																
X																
X																
				TOTAL												

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

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

SAMPLE RECEIPT NOTIFICATION

CUSTOMER DETAILS

Attention: JAMES PEACHEY

Customer: AECOM AUSTRALIA PTY LTD

Address: LEVEL 8
FORTITUDE VALLEY QLD 4006

Email: james.peachey@aecom.com

Telephone:

Fax:

LABORATORY DETAILS

Lab: National Measurement Institute

Contact: Susanne Neuman

Address: 105 Delhi Road, North Ryde, NSW
NSW 2113

Email: Susanne.Neuman@measurement.gov.au

Telephone: 02 9449 0181

Fax:

SAMPLE DETAILS

NMI Job Name: **AECO06/190816/2**

Total No. of Samples: **2**

LRNs	Customer Sample ID	Lab Sample Description
N19/020841	GS_QC207_190812	WATER 12/08/2019
N19/020842	GS_QC208_190813	SOIL 13/08/2019 11:15

SAMPLE RECEIVED CONDITION

Date samples received:	16-AUG-2019
Sample received in good order:	Yes
NMI Quotation no. provided:	
Client purchase order number:	60609758_2_0
Temperature of samples:	Chilled
Comments:	WE DON'T DO (DO & REDOX)
Estimated report date:	27-AUG-2019
Mode of Delivery:	Courier

Additional Terms and Conditions

Incomplete / unclear information about samples or required testing will delay the start of the analysis work

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission and before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

The lodgement of an order or receipt of samples for NMI services referenced in this Sample Receipt Notification constitutes an acceptence of the current version of NMI Terms and Conditions or other applicable Terms referenced in the NMI Quotation. NMI Terms and Conditions are available on the web at http://www.measurement.gov.au/Services/EnvironmentalTesting/Pages/Terms-and-Conditions.aspx

REPORT OF ANALYSIS

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/2
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609758_2_0
		Date Received	: 16-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758_2_0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/020842	GS_QC208_190813	SOIL 13/08/2019 11:15

Lab Reg No.		N19/020842				
Date Sampled		13-AUG-2019				
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
PFBA (375-22-4)	mg/kg	<0.002				NR70
PFPeA (2706-90-3)	mg/kg	<0.002				NR70
PFHxA (307-24-4)	mg/kg	<0.001				NR70
PFHpA (375-85-9)	mg/kg	<0.001				NR70
PFOA (335-67-1)	mg/kg	<0.001				NR70
PFNA (375-95-1)	mg/kg	0.015				NR70
PFDA (335-76-2)	mg/kg	0.0037				NR70
PFUdA (2058-94-8)	mg/kg	0.23				NR70
PFDoA (307-55-1)	mg/kg	0.010				NR70
PFTrDA (72629-94-8)	mg/kg	0.15				NR70
PFTeDA (376-06-7)	mg/kg	0.0029				NR70
PFHxDA (67905-19-5)	mg/kg	<0.002				NR70
PFODA (16517-11-6)	mg/kg	<0.005				NR70
FOUEA (70887-84-2)	mg/kg	<0.001				NR70
PFBS (375-73-5)	mg/kg	<0.001				NR70
PFPeS (2706-91-4)	mg/kg	<0.001				NR70
PFHxS (355-46-4)	mg/kg	<0.001				NR70
PFHpS (375-92-8)	mg/kg	<0.001				NR70
PFOS (1763-23-1)	mg/kg	0.0062				NR70
PFNS (68259-12-1)	mg/kg	<0.001				NR70
PFDS (335-77-3)	mg/kg	<0.001				NR70
PFOSA (754-91-6)	mg/kg	<0.001				NR70
N-MeFOSA (31506-32-8)	mg/kg	<0.002				NR70
N-EtFOSA (4151-50-2)	mg/kg	<0.002				NR70
N-MeFOSAA (2355-31-9)	mg/kg	<0.002				NR70
N-EtFOSAA(2991-50-6)	mg/kg	<0.002				NR70
N-MeFOSE (24448-09-7)	mg/kg	<0.005				NR70
N-EtFOSE (1691-99-2)	mg/kg	<0.005				NR70
4:2 FTS (757124-72-4)	mg/kg	<0.001				NR70

REPORT OF ANALYSIS

Lab Reg No.		N19/020842				
Date Sampled		13-AUG-2019				
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
6:2 FTS (27619-97-2)	mg/kg	<0.001				NR70
8:2 FTS (39108-34-4)	mg/kg	<0.001				NR70
10:2 FTS (120226-60-0)	mg/kg	<0.002				NR70
8:2 diPAP (678-41-1)	mg/kg	<0.002				NR70
PFBA (Surrogate Recovery)	%	115				NR70
PFPeA (Surrogate Recovery)	%	107				NR70
PFHxA (Surrogate Recovery)	%	104				NR70
PFHpA (Surrogate Recovery)	%	104				NR70
PFOA (Surrogate Recovery)	%	110				NR70
PFNA (Surrogate Recovery)	%	119				NR70
PFDA (Surrogate Recovery)	%	118				NR70
PFUdA (Surrogate Recovery)	%	97				NR70
PFDoA (Surrogate Recovery)	%	112				NR70
PFTeDA (Surrogate Recovery)	%	114				NR70
PFHxDA (Surrogate Recovery)	%	96				NR70
FOUEA (Surrogate Recovery)	%	66				NR70
PFBS (Surrogate Recovery)	%	102				NR70
PFHxS (Surrogate Recovery)	%	104				NR70
PFOS (Surrogate Recovery)	%	117				NR70
PFOSA (Surrogate Recovery)	%	105				NR70
N-MeFOSA (Surrogate Recovery)	%	110				NR70
N-EtFOSA (Surrogate Recovery)	%	86				NR70
N-MeFOSAA (Surrogate Recovery)	%	127				NR70
N-EtFOSAA (Surrogate Recovery)	%	112				NR70
N-MeFOSE (Surrogate Recovery)	%	108				NR70
N-EtFOSE (Surrogate Recovery)	%	79				NR70
4:2 FTS (Surrogate Recovery)	%	70				NR70
6:2 FTS (Surrogate Recovery)	%	89				NR70
8:2 FTS (Surrogate Recovery)	%	95				NR70
8:2 diPAP (Surrogate Recovery)	%	46				NR70
Dates						
Date extracted		19-AUG-2019				
Date analysed		21-AUG-2019				

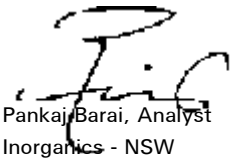
N19/020842
PFOS is quantified using a combined branched and linear standard,
linear and branched isomers are totalled for reporting.
All results corrected for labelled surrogate recoveries.

Selected PFAS surrogate recoveries are biased due to matrix effects.

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

28-AUG-2019

Lab Reg No.		N19/020842				
Date Sampled		13-AUG-2019				
	Units					Method
Trace Elements						
Total Solids	%	97.1				NT2_49



Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

28-AUG-2019

All results are expressed on a dry weight basis.

REPORT OF ANALYSIS

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/2
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609758_2_0
		Date Received	: 16-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758_2_0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/020841	GS_QC207_190812	WATER 12/08/2019

Lab Reg No.			N19/020841				
Date Sampled			12-AUG-2019				
		Units					Method
PFAS (per-and poly-fluoroalkyl substances)							
PFBA (375-22-4)		ug/L	0.0054				NR70
PFPeA (2706-90-3)		ug/L	0.0088				NR70
PFHxA (307-24-4)		ug/L	0.031				NR70
PFHpA (375-85-9)		ug/L	0.011				NR70
PFOA (335-67-1)		ug/L	0.013				NR70
PFNA (375-95-1)		ug/L	0.031				NR70
PFDA (335-76-2)		ug/L	<0.001				NR70
PFUdA (2058-94-8)		ug/L	0.0019				NR70
PFDoA (307-55-1)		ug/L	<0.001				NR70
PFTrDA (72629-94-8)		ug/L	<0.002				NR70
PFTeDA (376-06-7)		ug/L	<0.002				NR70
PFHxDA (67905-19-5)		ug/L	<0.002				NR70
PFODA (16517-11-6)		ug/L	<0.005				NR70
FOUEA (70887-84-2)		ug/L	<0.001				NR70
PFBS (375-73-5)		ug/L	0.026				NR70
PFPeS (2706-91-4)		ug/L	0.023				NR70
PFHxS (355-46-4)		ug/L	0.11				NR70
PFHpS (375-92-8)		ug/L	0.0014				NR70
PFOS (1763-23-1)		ug/L	0.018				NR70
PFNS (68259-12-1)		ug/L	<0.001				NR70
PFDS (335-77-3)		ug/L	<0.001				NR70
PFOSA (754-91-6)		ug/L	<0.001				NR70
N-MeFOSA (31506-32-8)		ug/L	<0.002				NR70
N-EtFOSA (4151-50-2)		ug/L	<0.002				NR70
N-MeFOSAA (2355-31-9)		ug/L	<0.002				NR70
N-EtFOSAA(2991-50-6)		ug/L	<0.002				NR70
N-MeFOSE (24448-09-7)		ug/L	<0.005				NR70
N-EtFOSE (1691-99-2)		ug/L	<0.005				NR70
4:2 FTS (757124-72-4)		ug/L	<0.001				NR70

REPORT OF ANALYSIS

Lab Reg No.			N19/020841				
Date Sampled			12-AUG-2019				
		Units					Method
PFAS (per-and poly-fluoroalkyl substances)							
6:2 FTS (27619-97-2)		ug/L	<0.001				NR70
8:2 FTS (39108-34-4)		ug/L	<0.001				NR70
10:2 FTS (120226-60-0)		ug/L	<0.001				NR70
8:2 diPAP (678-41-1)		ug/L	<0.002				NR70
PFBA (Surrogate Recovery)		%	109				NR70
PFPeA (Surrogate Recovery)		%	121				NR70
PFHxA (Surrogate Recovery)		%	110				NR70
PFHpA (Surrogate Recovery)		%	121				NR70
PFOA (Surrogate Recovery)		%	110				NR70
PFNA (Surrogate Recovery)		%	107				NR70
PFDA (Surrogate Recovery)		%	102				NR70
PFUdA (Surrogate Recovery)		%	116				NR70
PFDoA (Surrogate Recovery)		%	93				NR70
PFTeDA (Surrogate Recovery)		%	101				NR70
PFHxDA (Surrogate Recovery)		%	167				NR70
FOUEA (Surrogate Recovery)		%	62				NR70
PFBS (Surrogate Recovery)		%	114				NR70
PFHxS (Surrogate Recovery)		%	112				NR70
PFOS (Surrogate Recovery)		%	104				NR70
PFOSA (Surrogate Recovery)		%	81				NR70
N-MeFOSA (Surrogate Recovery)		%	93				NR70
N-EtFOSA (Surrogate Recovery)		%	87				NR70
N-MeFOSAA (Surrogate Recovery)		%	112				NR70
N-EtFOSAA (Surrogate Recovery)		%	85				NR70
N-MeFOSE (Surrogate Recovery)		%	112				NR70
N-EtFOSE (Surrogate Recovery)		%	101				NR70
4:2 FTS (Surrogate Recovery)		%	70				NR70
6:2 FTS (Surrogate Recovery)		%	80				NR70
8:2 FTS (Surrogate Recovery)		%	63				NR70
8:2 diPAP (Surrogate Recovery)		%	103				NR70
Dates							
Date extracted			23-AUG-2018				
Date analysed			23-AUG-2019				

N19/020841

REPORT OF ANALYSIS

Lab Reg No.			N19/020841				
Date Sampled			12-AUG-2019				
		Units					Method

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

28-AUG-2019

Lab Reg No.			N19/020841				
Date Sampled			12-AUG-2019				
		Units					Method
Miscellaneous							
Conductivity	uS/cm		4800				NW_B9
pH	pH_unit		7.3				NW_S11

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

28-AUG-2019

ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

REPORT OF ANALYSIS

This Report supersedes reports: *RN1243808* *RN1244216*

Measurement Uncertainty is available upon request.

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190816/2 **Sample Matrix:** Liquid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		ug/L	ug/L	ug/L	ug/L	%	%	%
PFBA (375-22-4)	NR70	0.005	<0.005	NA	NA	NA	130	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	97	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFUdA (2058-94-8)	NR70	0.001	<0.001	NA	NA	NA	83	NA
PFDoA (307-55-1)	NR70	0.001	<0.001	NA	NA	NA	80	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	90	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	106	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	86	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	85	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	90	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	101	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	99	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	98	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	96	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	93	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	108	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	91	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	98	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	109	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	91	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	98	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	97	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	106	NA
10:2 FTS (120226-60-0)	NR70	0.001	<0.001	NA	NA	NA	112	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	103	NA

Results expressed in percentage (%) or ug/L wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **27/08/2019**

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190816/2 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
PFBA (375-22-4)	NR70	0.002	<0.002	NA	NA	NA	110	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	97	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	101	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	86	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFUdA (2058-94-8)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFDoA (307-55-1)	NR70	0.002	<0.002	NA	NA	NA	106	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	104	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	89	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	86	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	92	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	110	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	99	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	101	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	90	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	102	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	91	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	87	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	79	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	91	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	86	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	100	NA
10:2 FTS (120226-60-0)	NR70	0.002	<0.002	NA	NA	NA	94	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	93	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **27/08/2019**

Australian Government
National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Pty Ltd

NMI QA Report No: AECO06/190816/2 QA **Sample Matrix:** Water

Analyte	Method	LOR	Blank	Duplicates			Recoveries	
				Sample	Duplicate	RPD	Matrix spk	LCS
		mg/L	mg/L	mg/L	mg/L	%	%	%
Waters Section				N19/020841			N19/020841	
pH (pH units)	NW_S11	NA	NA	7.3	NA	NA	NA	103
Conductivity (uS/cm)	NW_B9	1	<1	4800	NA	NA	NA	96

Filename = K:\Inorganics\Records\2019\Waters Section\19B33\

Legend
Acceptable recovery is 80-120%.
Acceptable RPDs on duplicates is 30% at > 5 times LOR. Greater RPD may be expected at < 5 LOR.
LOR = Limit Of Reporting
RPD = Relative Percent Difference
LCS = Laboratory Control Sample.
ND = Not Determined
NA = Not Applicable

Comments
This report shall not be reproduced except in full.
Results greater than ten times LOR have been rounded to two significant figures.

Signed:

Dr Andrew Evans
Inorganics Manager, NMI-North Ryde
Date: **23/08/2019**

From: Peachey, James <james.peachey@aecom.com>
Sent: Tuesday, 13 August 2019 3:34 PM
To: Carsten Emrich <Carsten.Emrich@alsglobal.com>
Subject: [EXTERNAL] - Additional analysis

Hi Carsten

Please could you arrange for the following samples to be analysed for TOPA (EP231X-TOP):

Environmental Division
Brisbane
Work Order Reference
EB1921187

Telephone : +61-7-3243 7222

Regards

James Peachey
Associate Director - Environment
D +61 7 3553 3909 M +61 426 206 362
james.peachey@aecom.com

AECOM
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006
PO Box 1307 Fortitude Valley QLD 4006
T +61 7 3553 2000 F +61 7 3553 2050
aecom.com

Imagine it. Delivered.

LinkedIn Twitter Facebook Instagram

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1921187-AA**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758 _GS	Date Samples Received	: 13-Aug-2019 15:34
Order number	: 60609758	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 27-Aug-2019 13:01
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- EP231X(TOP): Sample 'GS_BH02_0.5_190801' shows poor duplicate results due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- Amendment (27/8/19): This report has been amended to split samples into individual work orders. All analysis results are as per the previous report

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH02_0.5_190801	----	----	----	----
				Client sampling date / time	01-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-001	--------	--------	--------	--------
					Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**14.6**	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		**0.0093**	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0064**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.101**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0162**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**1.83**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		**0.028**	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0883**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.109**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0241**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0357**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.183**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0344**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0246**	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		**0.0002**	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		**0.0012**	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	----	----	----	----
EP231_TOP_C: 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	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	GS_BH02_0.5_190801	----	----	----	----
				Client sampling date / time	01-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued									
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	----	----	----	----
EP231_TOP_D: (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	----	----	----	----
EP231_TOP_P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**2.49**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**1.93**	----	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.0002	mg/kg		**2.49**	----	----	----	----
Sum of TOP C4 - C14 as Fluorine	----	0.0002	mg/kg		**1.62**	----	----	----	----
EP231_TOP_S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**79.5**	----	----	----	----
13C8-PFOA	----	0.0002	%		**94.0**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1921187-AA**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758 _GS	Date Samples Received	: 13-Aug-2019
Order number	: 60609758	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 27-Aug-2019
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2527602)									
EB1921187-001	GS_BH02_0.5_190801	EA055: Moisture Content	----	0.1	%	14.6	14.5	0.706	0% - 20%
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2527289)									
EB1921187-001	GS_BH02_0.5_190801	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0093	0.0102	9.42	0% - 20%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0064	0.0072	10.7	0% - 20%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.101	0.106	4.32	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0162	0.0148	9.04	0% - 20%
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	1.83	2.05	11.3	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2527289)									
EB1921187-001	GS_BH02_0.5_190801	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0883	0.105	17.4	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.109	0.119	8.85	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0241	0.0253	5.06	0% - 20%
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0357	0.0361	1.08	0% - 20%
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.183	0.164	11.3	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0344	# 0.0258	28.6	0% - 20%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0246	# 0.0186	27.7	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0012	0.0013	9.02	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	0.028	0.030	4.66	0% - 20%
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2527289)									
EB1921187-001	GS_BH02_0.5_190801	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2527289) - continued									
EB1921187-001	GS_BH02_0.5_190801	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2527289)									
EB1921187-001	GS_BH02_0.5_190801	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2527289)									
EB1921187-001	GS_BH02_0.5_190801	EP231X: Sum of PFAS	----	0.0002	mg/kg	2.49	2.71	8.53	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	1.93	2.16	11.0	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.0002	mg/kg	2.49	2.71	8.53	0% - 20%
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.0002	mg/kg	1.62	1.76	8.36	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2527289)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00236 mg/kg	71.6	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00232 mg/kg	64.2	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2527289)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.0025 mg/kg	72.2	50	150
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2527289)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527289)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00018 mg/kg	0.00	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527289) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----

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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1921187**	Page	: 1 of 6
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758_ _GS	Date Samples Received	: 13-Aug-2019
Site	: ----	Issue Date	: 21-Aug-2019
Sampler	: CAMDEN McCOSKER	No. of samples received	: 4
Order number	: 60609758	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 Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **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

- **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
Duplicate (DUP) RPDs							
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids	EB1921187--001	GS_BH02_0.5_190801	**Perfluorodecanoic acid (PFDA)**	335-76-2	28.6 %	0% - 20%	**RPD exceeds LOR based limits**
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids	EB1921187--001	GS_BH02_0.5_190801	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	27.7 %	0% - 20%	**RPD exceeds LOR based limits**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
HDPE Soil Jar GS_BH02_0.5_190801	----	----	----	16-Aug-2019	15-Aug-2019	**1**
HDPE Soil Jar	----	----	----	16-Aug-2019	07-Aug-2019	**9**
HDPE Soil Jar	----	----	----	16-Aug-2019	10-Aug-2019	**6**
HDPE Soil Jar	----	----	----	16-Aug-2019	12-Aug-2019	**4**

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: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) GS_BH02_0.5_190801	**01-Aug-2019**	**----**	----	----	**16-Aug-2019**	15-Aug-2019	×
HDPE Soil Jar (EA055)	**24-Jul-2019**	**----**	----	----	**16-Aug-2019**	07-Aug-2019	×
HDPE Soil Jar (EA055)	**27-Jul-2019**	**----**	----	----	**16-Aug-2019**	10-Aug-2019	×
HDPE Soil Jar (EA055)	**29-Jul-2019**	**----**	----	----	**16-Aug-2019**	12-Aug-2019	×

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
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X (TOP)) GS_BH02_0.5_190801	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X (TOP)) GS_BH02_0.5_190801	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X (TOP)) GS_BH02_0.5_190801	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X (TOP)) GS_BH02_0.5_190801	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓

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
EP231_TOP_P: PFAS Sums							
HDPE Soil Jar (EP231X (TOP)) GS_BH02_0.5_190801	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓

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	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**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 (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	SOIL	In house, following oxidation per Houtz,Erika F.; Sedlak,David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342¿9349.: A portion of the oxidised sample is mixed with methanol (1:1) prior to analysis by LC-Electrospray-MS-MS,Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house

To: Carsten Emrich <Carsten.Emrich@alsglobal.com>; ALSEnviro Brisbane <ALSEnviro.Brisbane@alsglobal.com>
Subject: [EXTERNAL] - Rebatch ES1925572 | Your Reference: 60609758 2.0

LC141 #2

T-431 21/8/19 5pm

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.

Hi Carsten

Please could you arrange for sample ES1925572-002 to be rebatched for TOPA (EP231X-TOP).

Regards

1. GS-MW02-190813

James Peachey
Associate Director - Environment
D +61 7 3553 3909 M +61 426 206 362
james.peachey@aecom.com

AECOM
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006
PO Box 1307 Fortitude Valley QLD 4006
T +61 7 3553 2000 F +61 7 3553 2050
aecom.com

Imagine it. Delivered.

LinkedIn Twitter Facebook Instagram

Environmental Division
Sydney
Work Order Reference
ES1926853

Telephone : +61-2-8784 8555

From: angel-no-reply@alsglobal.com [mailto:angel-no-reply@alsglobal.com]
Sent: Wednesday, 21 August 2019 11:51 AM
To: Peachey, James
Subject: RESULTS & EDD & INVOICE for ALS Workorder : ES1925572 | Your Reference: 60609758 2.0

ALS Environmental

Deliverables for ALS Workorder ES1925572

Project: 60609758 2.0

Dear JAMES PEACHEY,

Please find enclosed the following deliverables for **ES1925572**:

- L920488_INV.pdf
- ES1925572_0_QCI.pdf
- ES1925572_0_QC.pdf
- ES1925572_0_COA.pdf
- 60609758 2 0.ESDAT_ES1925572_0.Chemistry2e.CSV
- 60609758 2 0.ESDAT_ES1925572_0.Header.XML
- 60609758 2 0.ESDAT_ES1925572_0.Sample2e.CSV
- ES1925572_COC.pdf
- ES1925572_COC_1.pdf

Report Recipients

- JAMES PEACHEY
  - L920488_INV.pdf (Email)
  - ES1925572_0_QCI.pdf (Email)
  - ES1925572_0_QC.pdf (Email)
  - ES1925572_0_COA.pdf (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Chemistry2e.CSV (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Header.XML (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Sample2e.CSV (Email)
  - ES1925572_COC.pdf (Email)
  - ES1925572_COC_1.pdf (Email)
- ACCOUNTS PAYABLE
  - L920488_INV.pdf (Email)
  - ES1925572_COC.pdf (Email)

- ES1925572_COC_1.pdf (Email)

- CAMDEN McCOSKER
  - L920488_INV.pdf (Email)
  - ES1925572_0_QCI.pdf (Email)
  - ES1925572_0_QC.pdf (Email)
  - ES1925572_0_COA.pdf (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Chemistry2e.CSV (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Header.XML (Email)
  - 60609758 2 0.ESDAT_ES1925572_0.Sample2e.CSV (Email)
  - ES1925572_COC.pdf (Email)
  - ES1925572_COC_1.pdf (Email)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1926853**	Page	: 1 of 5
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES PEACHEY	Contact	: Brenda Hong
Address	: Brisbane	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 07 3553 2000	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 21-Aug-2019 17:00
Order number	: 60609758 2.0	Date Analysis Commenced	: 28-Aug-2019
C-O-C number	: ----	Issue Date	: 29-Aug-2019 16:48
Sampler	: ZOE SMITH		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW02_190813	----	----	----	----
				Client sampling date / time	13-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1926853-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**17.3**	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**17.0**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**149**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		**9.51**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**119**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.10	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**9.8**	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**18.4**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**44.6**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**6.09**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**10.1**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**91.9**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.15**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.10	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.10	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.10	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.25	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.10	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.25	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.25	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GS_MW02_190813	----	----	----	----
				Client sampling date / time	13-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1926853-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.25	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.25	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.10	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.10	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.10	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**1.04**	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.10	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.10	----	----	----	----
EP231_TOP_P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**494**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**268**	----	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L		**493**	----	----	----	----
^ **Sum of TOP C4 - C14 as Fluorine**	----	0.01	µg/L		**318**	----	----	----	----
EP231_TOP_S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**95.5**	----	----	----	----
13C8-PFOA	----	0.02	%		**89.5**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1926853**	Page	: 1 of 5
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES PEACHEY	Contact	: Brenda Hong
Address	: Brisbane	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 07 3553 2000	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 21-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 28-Aug-2019
C-O-C number	: ----	Issue Date	: 29-Aug-2019
Sampler	: ZOE SMITH		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2550209)									
ES1926853-001	GS_MW02_190813	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	119	116	2.04	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	17.3	19.5	11.7	0% - 20%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	17.0	19.8	14.8	0% - 20%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	149	144	3.69	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	9.51	10.8	12.3	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.10	<0.10	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2550209)									
ES1926853-001	GS_MW02_190813	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	10.1	11.1	9.33	0% - 20%
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	18.4	20.8	12.3	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	44.6	49.5	10.4	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	6.09	7.00	13.9	0% - 20%
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	91.9	102	10.6	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	0.15	0.17	12.5	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	9.8	8.6	12.8	0% - 20%
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2550209)									
ES1926853-001	GS_MW02_190813	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.10	<0.10	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2550209) - continued									
ES1926853-001	GS_MW02_190813	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.25	<0.25	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2550209)									
ES1926853-001	GS_MW02_190813	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	1.04	0.80	26.1	0% - 50%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.10	<0.10	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2550209)									
ES1926853-001	GS_MW02_190813	EP231X: Sum of PFAS	----	0.01	µg/L	494	510	3.22	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	268	260	3.03	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	493	509	3.28	0% - 20%

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2550209)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	1 µg/L	114	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	1 µg/L	110	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2550209)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	1 µg/L	119	50	150
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2550209)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2550209)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.05 µg/L	0.00	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2550209) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2550209)								
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 TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1926853**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES PEACHEY	Telephone	: +61 2 8784 8555
Project	: 60609758 2.0	Date Samples Received	: 21-Aug-2019
Site	: ----	Issue Date	: 29-Aug-2019
Sampler	: ZOE SMITH	No. of samples received	: 1
Order number	: 60609758 2.0	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

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: **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
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP))							
GS_MW02_190813	**13-Aug-2019**	**28-Aug-2019**	09-Feb-2020	✓	**28-Aug-2019**	09-Feb-2020	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X (TOP))							
GS_MW02_190813	**13-Aug-2019**	**28-Aug-2019**	09-Feb-2020	✓	**28-Aug-2019**	09-Feb-2020	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X (TOP))							
GS_MW02_190813	**13-Aug-2019**	**28-Aug-2019**	09-Feb-2020	✓	**28-Aug-2019**	09-Feb-2020	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP))							
GS_MW02_190813	**13-Aug-2019**	**28-Aug-2019**	09-Feb-2020	✓	**28-Aug-2019**	09-Feb-2020	✓
EP231_TOP_P: PFAS Sums							
HDPE (no PTFE) (EP231X (TOP))							
GS_MW02_190813	**13-Aug-2019**	**28-Aug-2019**	09-Feb-2020	✓	**28-Aug-2019**	09-Feb-2020	✓

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: **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)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	1	**100.00**	**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
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	WATER	In house, following oxidation per Houtz,Erika F.; Sedlak,David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17),pp. 9342¿9349.: A portion of the oxidised sample is mixed with methanol (1:1) prior to analysis by LC-Electrospray-MS-MS,Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	Method	Matrix	Method Descriptions
Total Oxidisable Precursor Digest for PFAS	* ORG70-W	WATER	In-House with oxidation per Houtz, Erika F.; Sedlak, David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342¿9349: A 5 mL sample is digested with persulfate under alkaline conditions, neutralised and prepared for analysis per EP231.