PFAS Detailed Site Investigation

Airlie Beach Fire Station, 2495 Shute Harbour Road, Mandalay, Queensland

Queensland Fire and Emergency Services

10 February 2020

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PFAS Detailed Site Investigation

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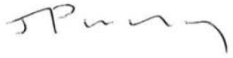
0	10-Feb-2020	Final	James Peachey Project Manager	

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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.
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.
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-fluorinated substances (PFAS) at Airlie Beach Fire Station, located at 2495 Shute Harbour Road, Mandalay, Queensland (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

QFES is conducting the environmental investigation at Airlie Beach 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 firefighting training using aqueous film forming foams (AFFF) containing PFAS occurred infrequently at the fire station between the 1990s and 2003. Based on the findings of a site inspection and anecdotal information from site staff, firefighting training using AFFF took place in the northeastern portion of the site. This area is mainly grassed and unsealed. The historical training procedures using foam was not able to be identified. The volume of foam used was not specified but was noted to be limited. It was not identified how out-of-date foam concentrate containing PFAS was disposed. No inadvertent releases of foam concentrate were identified.

The area formerly used for firefighting training exercises and foam storage areas were identified as potential PFAS source areas. The PSI identified that the site is located within the confines of a closed landfill. The landfill extended to the north and west of the site and this area is now used for recreational purposes (Whitsunday Sports Park). The landfill is considered to be a potential source of PFAS.

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 Airlie Beach 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 four soil bores that were converted to groundwater monitoring wells (drilled to between 4.5 and 6.9 metres below ground level, mbgl), advancement of five shallow soil bores to 0.5 mbgl, collection of soil and groundwater samples from the bores and wells and sediment samples with laboratory analysis for PFAS and preparation of this interpretative report. The scope included the collection and analysis of surface water samples from drainage channels, however, as the drainage channels were dry at the time of the site visits, no surface water samples were collected.

Key Findings of the DSI

The key findings of the DSI are presented below.

- Soil conditions beneath the site indicate the site is generally underlain by clay fill to 2.4 mbgl underlain by superficial deposits (silty clay or clay) which overlie rock, which was present between 4.5 and 6.9 mbgl. Landfill materials intermixed within gravelly clay fill were intersected in the bore located along the northeastern boundary (AB_BH04) between 1.0 and 1.6 mbgl. Based on

historical aerial photographs, information on the Council website and anecdotal information, it was understood that the site was built on the management area of a landfill (Airlie Beach landfill). The detection of landfill materials beneath the northeastern portion of the site indicates that the landfill extended beneath the fire station site.

- Groundwater elevations in August 2019 indicated a shallow aquifer is present beneath the site. Depth to groundwater was between 2.7 and 3.3 mbgl. Groundwater was inferred to locally flow to the northeast towards Pioneer Bay, which is approximately 300 m to the northeast.
- The primary PFAS compounds present in the soil samples were perfluorohexanesulfonic acid (PFHxS) and perfluorooctanesulfonic acid (PFOS). ∑(PFHxS+PFOS) and perfluorooctanoic acid (PFOA) concentrations in 22 soil samples collected from the nine soil bores did not exceed National Environmental Management Plan (NEMP) (HEPA, 2018) human health guidelines for commercial land use. PFOS concentrations exceeded the NEMP (HEPA, 2018) ecological guideline value for residential landuse in 14 samples of shallow fill collected from the upper 1.0 mbgl across the site. The concentration of PFOS in six soil samples exceeded the NEMP (HEPA, 2018) ecological PFOS guideline value for commercial landuse. The highest soil concentration (0.52 mg/kg PFOS at AB_SS5) was detected in a sample collected from fill material at 0.5 mbgl near the training tower within the grassed area historically used for foam training.
- PFAS concentrations in shallow fill (AB_SS3) from the central southern open grassed area to the southeast of the Engine Room (which had not been identified as a potential source area) were similar to PFAS concentrations in soil samples of shallow fill collected within the foam training area (e.g. soil samples from AB_BH03 and AB_BH04 at 1.0 mbgl). This suggests a historical source of PFAS close to sampling location AB_SS3. In the deeper soil bores, PFAS concentrations in the saturated zone soil were significantly lower (by two orders of magnitude) compared to concentrations in the 0.5 to 1.0 mbgl depth interval. This indicates attenuation of PFAS concentrations with increased depth.
- The primary PFAS compounds identified in groundwater samples from the four newly installed monitoring wells were PFHxS and PFOS, with overall compositions indicative of a PFOS-dominant AFFF product. ∑(PFHxS+PFOS) concentrations in groundwater exceeded the NEMP (HEPA 2018) human health (drinking and recreational water) quality guideline values in all four monitoring wells. The highest PFAS concentrations in groundwater (∑(PFHxS+PFOS)) were collected from the two monitoring wells (AB_MW03 (8.2 µg/L) and AB_MW04 (6.5 µg/L)) located in along the north eastern boundary of the site, down-hydraulic gradient of site source areas. AB_MW04 was advanced through landfill materials, which is a potential source of PFAS in groundwater. The two other monitoring wells (AB_MW01 and AB_MW02) were located adjacent to two other potential source areas, the area of the Case 4 Pit and the foam storage shed. ∑(PFHxS+PFOS) concentrations in these monitoring wells were approximately one order of magnitude lower compared to the concentration in the monitoring wells in the foam training area.
- As the groundwater PFAS concentration close to the northeastern down-hydraulic gradient boundary of the site are two orders of magnitude higher than the NEMP (HEPA, 2018) drinking water guideline value, it is likely that PFAS contaminants are migrating off-site at concentrations that exceed human health and ecological guideline values. The extent of PFAS in groundwater off-site is uncertain. Due to the proximity of Pioneer Bay located approximately 230 m to the northeast, and the shallow aquifer within the superficial deposits, groundwater locally flowing beneath the site has the potential to flow through the closed landfill and discharge into Pioneer Bay.
- The sediment analytical results indicated PFAS was detected at in all samples with three of the locations recording ∑(PFHxS+PFOS) concentrations relatively close to the limit of reporting (∑(PFHxS+PFOS) was in the range 0.0005 to 0.0023 mg/kg). The fourth location, AB_SED01 from an earth drain on the southern boundary had a slightly higher concentration detected, 0.0376 mg/kg ∑(PFHxS+PFOS). This suggests the potential for sediment PFAS impacts in the drain running along the southwestern boundary of the site, which may act as a preferential pathway for the migration of PFAS in surface water runoff and sediment transport. However, the risk to sediment in surface water is mitigated by the ephemeral nature of the drains and the distance of the site from the nearest creek (580 m to Campbell Creek) and Pioneer Bay (230 m).

- Total oxidisable precursor assay (TOPA) analysis was undertaken on one soil and one groundwater sample. The soil results did not identify the potential for PFAS precursors, while the groundwater results indicated a low potential for precursors. The results indicated a degraded PFAS product. Overall, it is considered unlikely that PFAS concentrations will significantly increase through biotransformation or oxidation processes.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered to be related to the historical firefighting practices at Airlie Beach Fire Station, spills from storage containers, product transfer, other maintenance activities or from landfill materials within the closed Airlie Beach landfill.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possible 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-fluorinated substances (PFAS) at Airlie Beach Fire Station, located at 2495 Shute Harbour Road, Mandalay, Queensland (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

Historical practices and operations at QFES facilities including Airlie Beach Fire Station may have involved using firefighting foam containing PFAS. PFAS are an emerging family of compounds that are highly soluble, persistent and bioaccumulative 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 Airlie Beach 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 offsite impacts.
- Stage 6: Engage an appropriately qualified third party CLA to audit the suitability of any off-site 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.

1.3 Objectives

The objectives of the works were to characterise the potential PFAS impacts in soil, groundwater and sediment at Airlie Beach 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 implementation were as follows:

- Undertaking soil, groundwater, sediment and surface water sampling at Airlie Beach 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 four soil bores (AB_BH01 to AB_BH04) to between 4.5 and 6.9 metres below ground level, (mbgl), which were converted to groundwater monitoring wells (AB_MW01 to AB_MW04). Collection of soil samples at approximately surface (or below the concrete where present), 0.5 m and thereafter at 1.0 m intervals.
    - Development of groundwater monitoring wells.
    - Collection of soil samples from five shallow soil bores (AB_SS1 to AB_SS5) that were advanced to 0.5 mbgl in unsealed grassed areas across the site.
    - Collection of groundwater samples from four new groundwater monitoring wells.
    - Collection of four sediment samples (AB_SED01 to AB_SED04) from on-site stormwater drains around the perimeter of the site. Co-located surface water samples were to be collected, however, as all drains were dry at the time of sampling these samples could not be collected.
    - Surveying of the top of the casing at each monitoring well to MGA94 coordinates and Australian Height Datum (AHD).
    - Laboratory analysis of soil, sediment and groundwater for PFAS with groundwater analysed for trace level concentrations.
- Preparation of a SIR (this report), which includes an update of the PFAS conceptual site model (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[1]). 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.

[1] Noting that the NEMP Version 2.0 is expected to be published in 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 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 for assessment purposes is presented in **Section 5.0**.

2.0 Site Setting

2.1 Site Identification

Airlie Beach Fire Station is located in located in the suburb of Mandalay, approximately 2 km southeast of Airlie Beach City Centre. Site identification details as identified in the PSI (AECOM, 2019) are shown in **Table 2**.

Table 2 Airlie Beach Fire Station site identification

Item	Details
Site Address	2495 Shute Harbour Road, Mandalay, Queensland, 4802
Registered Site Owner	The State of Queensland (Represented by Department of Community Safety, now Public Safety Business Agency)
Registered Address of the Site Owner	Public Safety Business Agency, L13 Makerston House, 30 Makerston Street, Brisbane, Queensland, 4000
Site Occupier	QFES
Local Government Area	Whitsunday Regional Council
Zoning	Special Use
Future Zoning	No change
Lot and Plan	Lot 276 / HR1926
Tenure	Freehold
Latitude / Longitude	-20.27797, 148.72772
Site Area	4,930m^2
Current / Future Site Use	The current site use is a fire station. The future site use is likely to be commercial/industrial with ongoing use as a fire station.
Environmental Management Register (EMR) / Contaminated Land Register (CLR)	A search of the DES EMR and CLR for Lot 276 Plan HR1926 indicated that the site is not included on either the EMR or CLR.
Environmentally relevant activities or notifiable activities	The PSI did not identify any environmentally relevant activities or notifiable activities at the site.

2.2 Site Layout and Features

The site layout is detailed on **Figure 2**, **Appendix A**. The site is rectangular with buildings in the western and northwestern portion of the site with the central, southern and northeastern areas consisting of roadways and grassed areas. The main buildings on-site are the Engine Room and offices (in the west) with training rooms, a storage shed and workshop/gym located along the northwestern site boundary. Training facilities (including heat and smoke training) are located in the central northern portion of the site. The Engine Room houses two fire-fighting appliances (i.e. fire trucks). The station is crewed by permanent roster of four firefighters and an ancillary crew of four firefighters after regular hours and on weekends. Approximately 40% of the site is sealed by concrete and the remainder is unsealed / grass cover.

A concrete in-ground water tank used for pump testing and water drafting training (Case 4 Pit), with dimensions 1600 x 1000 x 1800 mm and a capacity of 2,830 L, was located near the southeast site boundary. The Case 4 Pit was covered by a steel plate that did not prevent water ingress and has since been decommissioned (between 2016 and 2018) and backfilled with sand and capped with concrete.

Stormwater is collected in a concrete spoon drain located along the western boundary and an earth drain located along the eastern boundary. Surface water also flows towards the northeastern corner of the site, a topographic low point where surface water is known to pool. No evidence of an underground stormwater drainage system (i.e. manholes) was observed. In-ground hydrants are present across the site for training purposes.

Further anecdotal information on the site was provided by QFES to AECOM in November 2019. The information identified that the Airlie Beach Fire and Rescue Station was opened in 1975. It was believed that the station building was built on 'existing' land with the majority of the rear yard back from the fire station (i.e. to the north) being reclaimed land. Test holes drilled at this time behind the fire station (i.e. to the north) hit rock with other holes encountering landfill materials including glass, plastic bags and other assorted rubbish. It was believed that all the land behind the fire station (sporting fields) and part of the PCYC was built on reclaimed land that was previously a landfill. The sporting fields are at a higher level than the fire station and grounds. Historically there was also a petrol station located approximately 150 m to 200 m from the fire station, to the west, towards Shute Harbour.

The landfill is identified on the Whitsundays Regional Council (WRC) website[2] as a legacy landfill, however, a description of the landfill was not provided. The website indicated that a limited risk assessment had been completed and there was an apparent low risk of leachate impact on marine ecosystems though leachate was found to be discharging to Boat Haven Bay in 2001.

There was no information available in the PSI on the emplacement of fill material at the site or potential capping of the landfill.

2.3 Surrounding Land Use

The site is surrounded by recreational land, residential and commercial businesses. Commercial businesses continue further south-east of the site. Shute Harbour Road is located on the western site boundary. Details of surrounding land uses are provided in **Table 3** below.

Table 3 Airlie Beach Fire Station surrounding land use

Direction	Land Use
Southwest	Shute Harbour Road bounds the site to the southwest, beyond which are residential properties along Lemau Court and bushland. The nearest residential properties are approximately 30m from the site.
Southeast	Airlie Beach Bowls Club bounds the site to the east / southeast. Beyond are commercial properties. Adjacent to these businesses, Campbell Creek (approximately 460 m distance at its closest point) traverses from south to north beneath Shute Harbour Rd and discharges into Pioneer Bay. Shute Harbour Road bounds the site to the south. A caravan park 'Island Gateway Holiday Park' is located at the intersection of Shute Harbour Road and Jubilee Pocket Road.
Northeast	Whitsunday Sports Park bounds the site to the northeast. Beyond is bushland (nearest point is 200 m distance) that extends to a nearby creek which flows into Pioneer Bay (nearest point is 290 m). A boat yard 'Edge's Boatyard' is located approximately 470 m to the northeast. Campbell Creek is approximately 580 m to the northeast at its closest point.
Northwest	Whitsunday Sports Park (built on a closed landfill) bounds the site to the northwest, beyond which is bushland (nearest point 140 m distance) and Pioneer Bay (closest point is 230 m). Airlie Beach Skate Park and car parking areas for the sports park are present immediately beyond the northwestern boundary. Commercial properties (holiday apartments) are present approximately 450 m to the northwest. Residential properties are present to the west-northwest along Mount Whitsunday Drive.

[2] https://www.whitsunday.qld.gov.au/DocumentCenter/View/3007

2.4 Previous Environmental Investigation

A PFAS PSI was completed in 2019 (AECOM, 2019) and the key findings of this investigation are summarised below.

- Based on historical aerial photographs, the fire station has been present since 1975 (approximately 44 years). The site is surrounded by commercial and residential properties and recreational land. The aerial photographs, information on WRC website and anecdotal information indicated a landfill was present within the confines of the fire station and to the north and west of the site, with the landfill present from the 1960s to the 1990s. The majority of the area of the landfill is now used for recreational purposes (Whitsunday Sports Park).
- Based on the interview information, firefighting foams have been used at the site since at least the late 1980s. Firefighting foam containing PFAS (3M Lightwater) was used at the site between the 1990s and approximately 2003. 3M Lightwater foam is a type of foam manufactured by ECF, which breaks down to long chain PFAS such as PFOS, PFHxS and PFOA. Protein-type foams were used prior to the use of 3M Lightwater. The type of protein foam has not been identified and the potential for this foam to have contained PFAS is uncertain. Since 2003, Solberg foam has been used, which is PFAS-free[3].
- There is no information on the types of foam used prior to the late 1980s and the potential for use of other types of foam concentrates containing PFAS cannot be discounted.
- The current inventory is 120 L Solberg foam. Foam concentrate is stored in 20 L containers. There was no information suggesting infrastructure (e.g. tanks) storing foam have been present at the site historically. Fire appliances did not have on-board tanks storing foam.
- Firefighting training using foam has occurred in the northeastern portion of the site, which is mainly grassed (see **Figure 2**, **Appendix A**) with a smaller area sealed with concrete. The historical training procedures using foam have not been identified. The volume of foam used was not specified but was noted to be low due to the cost of the foam concentrate. It was not identified how out-of-date foam concentrate was disposed. No inadvertent releases of foam concentrate were identified.
- PFAS was identified in the water sample collected in 2016 (QFES, 2016) from the Case 4 Pit with 0.12 µg/L sum of 28 PFAS and PFHxS+PFOS (0.097 µg/L) detected. Two samples of tap water were also analysed and PFAS was not detected. The Case 4 Pit has since been decommissioned.
- The northern portion of the site and adjacent sports field to the northeast was identified as a former landfill which, potentially could have received waste containing PFAS. Two other potential off-site sources of PFAS have been identified, the Port of Airlie (located 600 m to the northwest) and Whitsunday Airport located approximately 3 km to the east of the site.
- The site is underlain by Airlie Volcanics with nearby registered bores indicating the standing water level to be 5.5 mbgs. Groundwater flow is likely to be towards the marine environment of Pioneer Bay located 230 m to the north. A minor watercourse, Campbell Creek, is located approximately 500m to the east.
- Stormwater drainage consists of spoon and earth drains with flow directed to the northeastern corner of the site before discharging off-site.

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

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 closest station, Hamilton Island Airport (station number 033106) for the period 2002 to 2019. Airlie Beach has a tropical climate, characterised by distinct wet and dry seasons. The wet season occurs between December and April. Mean annual rainfall is 1,449 mm.

Table 4 Monthly climate statistics at Hamilton Island Airport 2002 to 2019

Month	Mean maximum temperature (°C)	Mean minimum temperature (°C)	Mean rainfall (mm)
January	29.8	24.8	284.7
February	29.6	24.8	271.9
March	28.7	24.3	250.8
April	26.8	22.7	145.7
May	24.4	20.6	88.7
June	22.2	18.8	62.1
July	21.5	18.0	43.8
August	22.8	18.4	23.1
September	25.4	20.1	27.3
October	27.3	22.0	26.7
November	28.6	23.2	85.4
December	29.9	24.5	130.9

3.2 Site Topography

Contour mapping from the Queensland Globe online interactive mapping portal indicates the site slopes down towards the northeast. The area is generally below 10 m above sea level.

Stormwater drainage on the site consists of a concrete spoon drain on the western boundary line and an earthen drainage line on the eastern and northern boundary lines. Overland flow direction is inferred towards the northeast of the site marked as 'area of frequently pooled water' in **Figure 2**, **Appendix A**, which is likely to be a topographic low point.

3.3 Soil Type and Acid Sulfate Soils

Mapping from the Australian Soil Resource Information System (ASRIS) indicated the soil type underlying the site is Hydrosol with Chromosols and Dermosols in the surrounding area. Hydrosols are soils that are saturated with water for long periods of time—typically a grey (or greenish-grey) colour.

Acid sulfate soils (ASS) are likely to occur in low-lying areas of the site, given its proximity to low-lying coastal areas. ASRIS indicates a low probability of occurrence for ASS to be present. The Whitsunday Regional Council (WRC) interactive online mapping indicates there are areas of the site where there is a 'known presence' of ASS. The south western area is noted as 'Land above 5m above

[4] http://www.bom.gov.au/climate/averages/tables/cw_033106.shtml

Australian Height Datum (AHD) and below 20m AHD'. The presence of acidic soil conditions may inhibit the sorption of PFAS onto organic matter, thus increasing mobility (CRC CARE 2018).

3.4 Geology

Geological mapping indicates that the site is underlain by Airlie Volcanics, which is early Permian. This consists of mixed mafites and felsites (mainly volcanics), which comprises felsic to intermediate volcaniclastics and lavas.

The nearest registered groundwater bore with geological information is RN63581 located approximately 250 m to the northwest. The geology at this bore consists of Airlie Volcanics from surface to 25 mbgl (the maximum depth drilled).

3.5 Hydrology

Campbell Creek is listed as 'minor' in Queensland Globe and is located approximately 460 m to the southeast and 580 m to the northeast of the site at its closest points. The coastline (Pioneer Bay) is located 230 m to the north. There are no other surface water features within 500 m of the site. WRC online interactive mapping[5] indicates the site and adjacent land is not within a flood risk area ('property not affected').

Standing water is noted to pool in the northeastern corner of the site on a seasonal basis.

3.6 Hydrogeology

The Groundwater Resources of Queensland 1:2,500,000 mapping indicates the aquifer beneath the site to comprise acid to intermediate volcanics, with a yield of <5 L/s and salinity of 500 to 1500 mg/L, the groundwater is noted to be suitable for most purposes, marginal for human consumption and low salt tolerant crops. Based upon the proximity of surface water features to the site, the inferred groundwater flow direction is to the north.

A search of the Department of Natural Resources, Mining and Energy (NRME) registered groundwater bore database was completed in February 2019 (AECOM, 2019) and identified ten existing bores within 1 km of the site. The registered bore locations are shown on **Figure 1**, **Appendix A**. There is the potential for unregistered bores to be present in the areas bores that are less than 6m deep do not need to be registered.

Of the registered bores located within 1 km of the site at least two are potentially used for water supply, see **Table 5**. As all of the existing registered bores are to the south and southeast of the site, they are likely to be up-hydraulic gradient of the site and unlikely to be impacted by groundwater contamination sourced from the site.

[5] https://mapping.whitsundayrc.qld.gov.au/connect/analyst/

Table 5 Registered groundwater bores within 1 km of Airlie Beach Fire Station

Bore ID	Distance and Direction	Screened Depth	Additional Comments / Use if Known
RN63581	250 m northwest	Abandoned and destroyed	
RN63942	330 m southeast	Not Specified	Not specified
RN63950	400 m southeast	Abandoned and destroyed	
RN63423	460 m southeast	Unclear – Plastic casing to 16.8 m	Well depth could be up to 183 m.
RN63949	600 m southeast	11.8 to 14.0 m in conglomerate.	Abandoned but still usable.
RN141307	520 m south	Open hole from 18.5 – 52.0 m within rock	Static water level (SWL) noted as 5.5 mbgl.
RN162365	650 m southwest	15.5 – 21.5 m in fractured rock and clay layers	For water supply. SWL noted as 4.5 mbgl. Volcanic aquifer at 18 m.
RN131648	900 m south	15.0 to 31.0 m within Deco Basalt	Used for water supply. SWL at 15 mbgl.
RN46384	900 m south	0 to 9.7 m within Alluvium.	Abandoned but still usable.
RN43553	1000 m to the southeast	Abandoned and destroyed	

3.7 Environmental Values

Campbell Creek is located approximately 460m to the southeast of the site and flows in a northerly direction into Pioneer Bay. The creek falls into the Proserpine River Basin, and the site falls into the Whitsunday coastal creeks fresh waters. Environmental Protection (Water) Policy 2009 (EPP Water) defines the Proserpine River fresh waters as an aquatic ecosystem with high ecological value and outlines environmental values (EVs) associated with the catchment area (DNRM), 2010). The relevant EVs are listed in **Table 6**.

Table 6 Surface water environmental values for the Whitsunday Coastal Creek Freshwaters

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
Whitsunday coastal creeks freshwaters	X	X	X	X		X	X		X	X		X

3.8 Groundwater Dependent Ecosystems

A search of the groundwater dependent ecosystems (GDE) database[6] indicated the following aquatic ecosystems are present within 4 km of the site:

- Wetlands
    - Wetland- fractured rocks - low potential GDE
    - Wetland- Alluvia with groundwater connectivity to underlying fractured rock aquifers- moderate potential GDE
- Campbell Creek
    - Wetland - Alluvia with groundwater connectivity to underlying fractured rock aquifers- moderate potential GDE
    - Wetland- fractured rocks – low potential GDE
- Airlie Creek
    - Wetland- fractured rocks – low potential GDE
    - Alluvia with groundwater connectivity to underlying fractured rock aquifers- moderate potential GDE
- Flame Tree Creek
    - Wetland- fractured rocks – low potential GDE

Terrestrial ecosystems for riparian vegetation were identified – low and moderate potential GDE.

No subterranean GDEs were identified.

A search of the environmentally sensitive areas (ESAs)[7] indicated that the site is classed as a river improvement area (Category C). An area to the south of the site is classed as Category B endangered regional ecosystems (biodiversity status). The coastal area is also classed as marine plants (Category B).

[6] http://www.bom.gov.au/water/groundwater/gde/map.shtml
[7] 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 tasks completed are shown in **Table 7**.

Table 7 Summary of fieldwork

Activity	Dates
Service clearance and drilling of four (4) soil bores (AB_BH01 to AB_BH04), conversion to groundwater monitoring wells (AB_MW01 to AB_MW04), well development	29 – 30 July 2019
Advancement of five shallow soil bores (AB_SS1 to AB_SS5)	29 July 2019
Groundwater monitoring of four wells and collection of five sediment samples (AB_SED01 to AB_SED05).	08 August 2019
Surveying of the groundwater wells	08 August 2019

Co-located surface water and sediment samples were to be collected from the on-site drainage lines, however, as water was not present at the time of sampling, only sediment samples were collected.

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 C**.

Table 8 Sampling rationale

Location ID	Location/Rationale
AB_BH01 / AB_MW01	Along the southeastern site boundary, down-hydraulic gradient of (and to the northeast) of the Case 4 Pit.
AB_BH02 / AB_MW02	Close to the central portion of the northwestern site boundary adjacent to (and southeast of) the foam storage shed.
AB_BH03 / AB_MW03	In the northeastern corner of site within the foam training area. The location of this bore is adjacent to (and south of) the area of frequently pooled surface water.
AB_BH04 / AB_MW04	Along northeastern site boundary, down-hydraulic gradient of foam training area and other site features.
AB_SS1	To characterise shallow soil quality within the area potentially used for foam training exercises, close to the northeastern corner.
AB_SS2	To characterise shallow soil quality within the area potentially used for foam training exercises, close to northeastern site boundary.
AB_SS3	To characterise shallow soil quality within a grassed open area in the southwestern portion of site, to the southeast of the Engine Room.
AB_SS4	To characterise shallow soil quality within the area potentially used for foam training exercises, in the northwestern corner of site.
AB_SS5	To characterise shallow soil quality in the area potentially used for foam training in the northeastern corner of site, close to the training tower.
AB_SED01	To characterise the potential presence of PFAS in sediment in a drain located on the southeastern boundary of the site.
AB_SED02	To characterise the potential presence of PFAS in sediment in a drain located along the northwestern boundary of the site.
AB_SED03	To characterise the potential presence of PFAS in sediment in a drain located on the northeastern boundary of the site.
AB_SED04	To characterise the potential presence of PFAS in sediment in the area of frequently pooled water in the northeastern corner of the site.

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 G**.

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 plans before the start of the works. A contractor (Copp and Co) conducted service location and cleared proposed bore locations for services. Concrete coring was conducted at two of the locations (AB_MW01, and AB_MW02). All soil bores were advanced by non-destructive digging (vacuum extraction using a water lance) to 1.5 mbgl to confirm the absence / presence of underground utilities.
Drilling method and target depth	Soil bores (for conversion to groundwater monitoring wells) were advanced with a Geoprobe drilling rig using solid stem augers to the target depth (approximately 4.5 – 6.9 mbgl). The five shallow soil bores were advanced using a hand auger to the target depth of 0.5 mbgl.
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 D**.
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 prepared PFAS sample containers. All samples 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 analysis 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[8] 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 re-useable 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.

[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/

4.2.2 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 plain casing with screw fittings installed in an approximately 150 mm diameter bore. Wells were installed to depths between 4.5 and 6.9 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 minimum 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 bailer. 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 E**.
Field Parameters	Groundwater physicochemical properties were measured in the field prior to sample collection using a calibrated YSI water quality meter. Groundwater pH, temperature, electrical conductivity, redox potential and dissolved oxygen concentrations were measured. Groundwater physicochemical parameters are presented in **Table T3, Appendix B**. Water quality meter calibration certificates are presented in **Appendix E**.
Groundwater sampling	The groundwater sampling procedure is described 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. 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. Samples were delivered to the lab via air freight. Samples were submitted with chain of custody documentation to a laboratory NATA-accredited for the analysis requested.
Decon-tamination procedures	The oil/water interface probe was decontaminated by scrubbing in a solution of Liquinox[9] 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 during the monitoring of each well to minimise the potential for cross-contamination and appropriate silicone and HDPE tubing were used which was PFAS-free. A new pair of nitrile gloves was 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. The surveying report is presented in **Appendix F**.

[9] 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 samples 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 Samples were stored in an esky 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.

4.3 Laboratory Analysis and Quality Assurance / Quality Control

A summary of samples analysed for this DSI is shown in **Table 12**. The laboratory analyses were conducted by Australian Laboratory Services (ALS) (primary laboratory) and National Measurement Institute (NMI) (secondary laboratory).

Table 12 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	22	3	3	4
Groundwater	4	1	1	1
Sediment	4	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 G**.

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 G** and the laboratory quality control reports are included in **Appendix H**. 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

Section 3.7 identified the Whitsunday coastal creeks (fresh waters) has the following EVs: aquatic ecosystems, irrigation, farm supply/use, stock water, human consumer, primary recreation, visual recreation, drinking water and cultural and spiritual values. Guidelines values need to be suitably protection of the above EVs. The guideline values relevant for the site that have been adopted for this investigation are identified in **Table 13**. The guideline values are considered to provide a suitable level of protection for all EVs identified (refer to **Section 3.7**).

Table 13 Adopted investigation levels for PFAS

Media	Environmental Value	PFAS	Guideline Value
Soil	Human health- industrial / commercial landuse	∑(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	Marine aquatic ecosystem protection (99% species protection)[B]	PFOS	0.00023 µg/L[A]
			0.051 µg/L[C]
		PFOA	19 µg/L[A]
	Human health- recreational contact with waters	∑(PFHxS+PFOS)	2.0 µg/L[D]
		PFOA	10 µg/L[D]
Sediment	No applicable sediment guidelines are available for PFAS.		

Notes:

A - NEMP (HEPA, 2018)

B – Due to the proximity of the marine environment, the interim marine guidelines are included. It is noted that these currently use freshwater values on an interim basis until final marine guideline values can be set using the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

C - It is noted, that the 99% species protection guideline value for PFOS 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

D - 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 nine soil bores (AB_BH01 to AB_BH04 and AB_SS1 to AB_SS5) drilled in July 2019 are shown in **Appendix D**. Soil bores AB_BH01 to AB_BH04 were drilled to between 4.5 and 6.9 mbgl, soil bores AB_SS1 to AB_SS5 were drilled to 0.5 mbgl. Fill or disturbed natural (i.e. reworked soil) was present between 1.8 m and 4.3 mbgl. At all bores, with the exception of AB_BH04, the fill consisted of silty sandy or gravelly clay. At AB_BH04, located adjacent to the northeastern site boundary, landfill materials were present between 1.0 and 1.6 mbgl consisting of plastic bags, glass, concrete, brick, tile, rope cloth and assorted other plastic waste products. The fill material was underlain by natural clay and silty clays, which was underlain by rock between 4.5 and 6.9 mbgl. The geology of the bedrock is not known.

The identified clay horizons are considered to be indicative of the hydrosol type soils expected throughout the area.

With the exception of the landfill materials identified within AB_BH04, no other indication of visual or olfactory contamination was identified in the soil samples during drilling.

6.2 Hydrogeology

6.2.1 Observations during Drilling

Groundwater was encountered within the natural clay soil (or disturbed natural soil at AB_BH04) in the four deeper soil bores. The depths of the groundwater strikes (initial water level, IWL) were between 2.4 and 5.0 mbgl as shown on the bore logs in **Appendix D** and in **Table T1**, **Appendix B**.

6.2.2 Groundwater Elevations and Groundwater Flow Direction

The four 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 0.861 and 1.168 metres below top of casing (mbtoc). The groundwater elevations were between 2.709 and 3.313 m AHD. The SWL and groundwater elevations are presented in **Table T2**, **Appendix B**. As the IWL were deeper than the SWL, this indicates semi-confined aquifer conditions. At AB_MW04, the aquifer is noted to be below the layer of landfill materials.

The inferred groundwater contours and local groundwater flow direction at the site are shown on **Figure 3**, **Appendix A**. Based on the available data, groundwater is inferred to locally flow towards the northeast in the direction of Pioneer Bay. This distance to Pioneer Bay in the down-hydraulic gradient (northeast) direction is approximately 300 m, while the nearest point of Pioneer Bay is approximately 230 m to the north of the northeastern site boundary.

6.2.3 Water Quality Parameters

Table T3, **Appendix B** presents the field water quality parameter results for groundwater collected during the groundwater monitoring event. The raw data were recorded on the field sheets presented in **Appendix E**. The water quality results are presented in **Table 14**.

Table 14 Groundwater quality parameter results

Well ID	Units	AB_MW01	AB_MW02	AB_MW04
		8/08/2019	8/08/2019	8/08/2019
pH	pH units	6.87	7.39	7.63
Temperature	°C	27.6	27.1	25.9
Electrical Conductivity	µS/cm	3875	1380	1592
Total Dissolved Solids	mg/L	2518.8	897.0	1034.8
Dissolved Oxygen	mg/L	0.76	0.42	3.57
Field Oxidation Reduction Potential	mV	138.5	35.7	161.1
Oxidation Reduction Potential	mV	344.4	203.3	264.2

The results indicate that the groundwater is near neutral to slightly alkaline, brackish, poorly oxygenated with mildly reducing conditions. The concentration of dissolved oxygen at AB_MW04 was noted to be higher (3.6 mg/L) compared to the other monitoring wells which recorded <0.8 mg/L.

6.2.4 Groundwater Field Observations

There was no visual or olfactory indication of contamination in the monitoring wells during the groundwater monitoring, including no identification of non-aqueous phase liquids, foaming or odours.

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 H**. PFAS compounds were detected in 21 of the 22 soil samples analysed.

There were no exceedances of the human health guideline values for ∑(PFHxS+PFOS) and PFOA for commercial land use in the soil samples analysed. A summary 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*	Max. concen-tration (mg/kg)	Human health guideline value (mg/kg)	No. of samples exceeding human health guideline value
∑(PFHxS+PFOS)	22	21	0.529	20	0
PFOS	22	21	0.523	No guideline	No guideline
PFOA	22	13	0.0021	50	0
Sum of PFAS	22	21	0.548	No guideline	No guideline

*LOR = limit of reporting

A summary of the soil analytical results compared to ecological guidelines is presented in **Table 17**. There were six exceedances of the ecological guideline value for PFOS for indirect exposure for commercial land use. The exceedance occurred in the soil samples from AB_SS3 and AB_SS5 (both

soil samples from 0.1 and 0.5 mbgl), and soil samples at 1.0 mbgl from AB_BH03 and AB_BH04. These soil bores are located across the site in the southern, eastern and northeastern portions in unsealed areas. The maximum PFOS concentration was detected in the sample from AB_SS5_0.5 at 0.5 mbgl (0.523 mg/kg).

A comparison of the PFAS concentrations to the residential land use ecological guidelines for indirect exposure was also performed, as the site contains open ground/landscaped areas where secondary consumers such as insectivorous birds and mammals may forage. There were 14 exceedances of the ecological guideline value for PFOS for indirect exposure for residential landuse. The exceedances occurred in soil samples from all five shallow soil bore locations (AB_SS1 to AB_SS5) and from AB_BH03 and AB_BH04.

Table 16 Summary of PFAS soil analytical results and assessment with ecological guideline values

Compound	No. of samples analysed	No. of samples >LOR*	Max. concen-tration (mg/kg)	Ecological guideline value commercial / residential (mg/kg)	No. of samples exceeding of commercial guideline value	No. of samples exceeding of residential guideline value
∑(PFHxS+PFOS)	22	21	0.529	No guideline value	No guideline value	No guideline value
PFOS	22	21	0.523	0.14 / 0.01	6	14
PFOA	22	13	0.007	No guideline value	No guideline value	No guideline value
Sum of PFAS	22	21	0.548	No guideline value	No guideline value	No guideline value

*LOR = limit of reporting

The triplicate sample for AB_SS1 from 0.1 mbgl reported 0.64 mg/kg PFBA. This result is anomalous as PFBA was not detected in either the primary or duplicate sample (reporting <0.0002 mg/kg). There are no guideline values for PFBA in soil.

6.3.2 Groundwater

The groundwater analytical results for samples collected from monitoring wells are presented in **Table T5**, **Appendix B.** The laboratory analytical reports are presented in **Appendix H**. A summary of an assessment of the results with human health guideline values is presented in **Table 17** below.

Table 17 Summary of groundwater analytical results and assessment with human health guideline values

Compound	No. of samples analysed	No. of samples >LOR	Maximum concentration (µg/L)	Guideline values drinking water / recreational water	No. of samples exceeding drinking water guideline value	No. of samples exceeding recreational water guideline value
∑(PFHxS+PFOS)	4	4	8.15	0.07 / 2.0	4	4
PFOA	4	4	0.51	0.56 / 10.0	0	0
Sum of PFAS	4	4	12.2	No guideline		

The groundwater analytical results for ∑(PFHxS+PFOS) and PFOA concentrations are presented on **Figure 5, Appendix A**. Groundwater samples from all four monitoring wells exceeded the human health guideline values for drinking water for ∑(PFHxS+PFOS) with the maximum ∑(PFHxS+PFOS) concentration (8.15 µg/L) detected in AB_MW03, located in the centre of the approximate area used for firefighting training exercises. All four of these samples also exceeded the recreational water guideline value for ∑(PFHxS+PFOS).

There was no exceedance of the human health guideline value for drinking water for PFOA concentrations in the samples from the four new monitoring wells, although one of the samples (AB_MW03 had 0.505 µg/L) was noted to be approaching the guideline value (0.56 µg/L).

There were exceedances of the ecological guideline value for 99% species protection for fresh water and marine water for PFOS in all four samples. 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 also analysed for TOPA to understand the potential presence of precursors. The results are summarised in **Table 18** below.

Table 18 Assessment of soil and groundwater TOPA analytical results

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
AB_SS5_0.5_190729	mg/kg	0.548	0.421	0.421	-23%
AB_MW03_190808	µg/L	12.2	12.6	12.6	+3%

Comparison of the results for the soil sample (AB_SS5 at 0.5 mbgl) indicates the sum of 28 PFAS by TOPA was 23% lower than the sum of 28 PFAS by standard analysis, which also indicates minor depletion of oxidation by compounds other than PFAS. The result is indicative of a degraded PFAS product.

As the sum of the 28 PFAS by TOPA is slightly higher (by 3%) than the sum of the 28 PFAS by standard analysis for the groundwater sample (AB_MW03), this indicates low potential for transformation of precursor compounds in groundwater at this location. Overall, it is considered unlikely that PFAS concentrations will significantly increase through biotransformation or oxidation processes.

6.4 Sediment

The sediment analytical results for samples collected from three on-site drainage lines and from the area of frequently pooled water are presented in **Table T6, Appendix B.** The laboratory analytical reports are presented in **Appendix H**. A summary of the results is presented in **Table 19** below.

Table 19 Summary of sediment analytical results

Compound	No. of samples analysed	No. of samples >LOR	Maximum concentration (mg/kg)
∑(PFHxS+PFOS)	4	4	0.0376
PFOS	4	4	0.0359
PFOA	4	1	0.0006
Sum of PFAS	4	4	0.0418

The sediment analytical results for ∑(PFHxS+PFOS) and PFOA concentrations are presented on **Figure 6, Appendix A**. No suitable criteria are available for assessing human and ecological risk from sediment.

7.0 Discussion

7.1 Geological and Hydrogeological Conditions

7.1.1 Soil / Geological Conditions

The site and the adjacent sports field to the northeast and northwest (Whitsunday Sports Park owned by WRC) was formerly part of the management area for the Airlie Beach landfill. Based on the soil conditions recorded in soil bore, AB_MW04, the subsurface lithology along the northeastern site boundary has landfill materials intermixed within gravelly clay fill between 1.0 and 1.6 mbgl indicating the closed landfill extended onto the area currently occupied by the fire station.

The lithology consisted of fill and / or disturbed natural (i.e. reworked) clay to between 1.8 and 4.3 mbgl underlain by natural silty clay or clay. The superficial deposits overlie rock, which was present between 4.5 and 6.9 mbgl. All soil bores terminated on rock. The geology of the bedrock is not known.

7.1.2 Hydrogeology

Measured groundwater elevations indicate the presence of a semi-confined shallow aquifer within the superficial deposits between 2.5 and 5.0 mbgl. Based on the limited groundwater elevation data (four locations), the inferred contours indicate local groundwater flow is towards the northeast towards Pioneer Bay. Given the shallowness of the aquifer and the proximity of the foreshore of Pioneer Bay to the site (230 m at its closest point), regional groundwater flow is likely to be towards Pioneer Bay with groundwater likely to discharging into the tidally-influenced marine environment. Clay is the more dominant soil type present and is likely to have a low hydraulic conductivity that may limit (retard) vertical and lateral migration of PFAS from the unsaturated zone.

Surface cover at the site is a combination of concrete (approximately 60% coverage) and grassed areas (approximately 40% coverage). The majority of the area used for firefighting training exercises in the northeastern portion of the site is unpaved and grassed (approximately 80%). A grassed area in the eastern corner of the site has been identified as an area where surface water is frequently pooled, which suggests it is the topographic low point on the site. It is likely that the majority of the training completed using AFFF would have directly applied foam to the surface and AFFF may have infiltrated to the subsurface directly. Potentially, the finished foam would have pooled in the northeastern corner of the site where it infiltrated into the subsurface. PFAS may have infiltration vertically through the subsurface soils (unsaturated zone) to the underlying groundwater (saturated zone).

PFAS contamination underneath the concrete area may have occurred via seepage through joints and cracks in the concrete cover to the underlying fill and natural soil below. The presence of underground services and presence of the Case 4 Pit may create preferential pathways for contaminant migration in areas where clay is the predominant soil type.

7.2 Soil Analytical Results

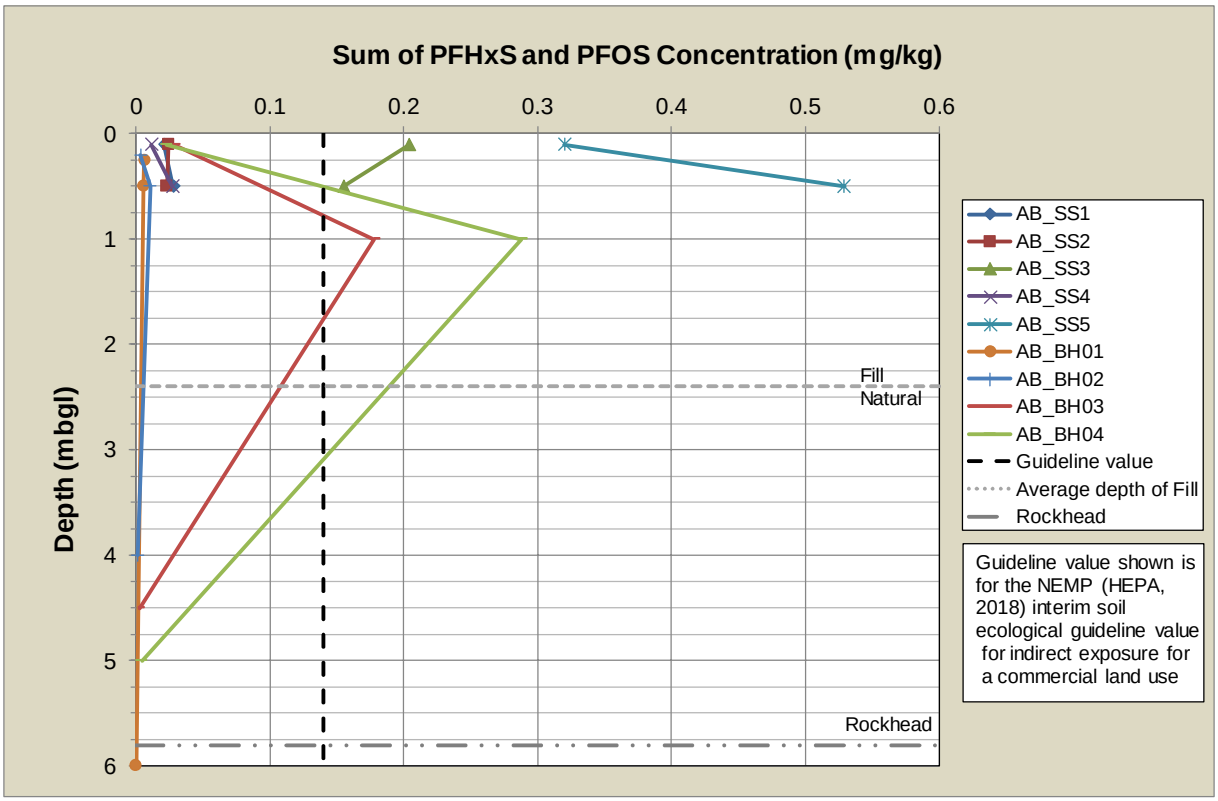
The soil bores drilled as part of this PFAS DSI were located at potential source areas including the area used for foam training exercises (AB_MW03, AB_MW04, AB_SS1, AB_SS2, AB_SS4, AB_SS5), the area adjacent to the Case 4 Pit (AB_MW01) and the foam storage area (AB_BH02). Soil samples were also collected from other areas of the site including the southern open grassed area (AB_SS3). **Table 20** presents a summary of the soil analytical results for different areas of the site by depth. This is shown graphically in **Chart 1**.

Table 20 Summary of soil analytical results

Soil sample (mbgl)	∑(PFHxS+PFOS) (mg/kg)			
	Foam training area[A]	Area adjacent to the Case 4 Pit[B]	Foam storage area[C]	Southern grassed area[D]
0.1-0.25	0.0112 to 0.312	0.0044	0.0036	0.201
0.5-1.0	0.0134 to 0.523	0.008	0.0088	0.152
4.0-6.0	0.0016 to 0.0041	<0.0002	0.0006	No sample

[A] AB_SS1, SS2, SS4, SS5, AB_BH03, BH04, [B] AB_BH01, [C] AB_BH02, [D] AB_SS3

Chart 1 Concentration of ∑(PFHxS+PFOS) with depth in soil bores at Airlie Beach Fire Station



The higher concentrations of ∑(PFHxS+PFOS) detected in soil were in shallow samples of fill between 0 and 1.0 mbgl, from soil bores within the foam training area (e.g. the sample from 0.5 mbgl at AB_SS5 had 0.53 mg/kg ∑(PFHxS+PFOS)) and the open grassed area in the central southern portion of the site (AB_SS3 at 0.1 mbgl had 0.20 mg/kg ∑(PFHxS+PFOS)), where foam training could potentially have occurred.. PFAS concentrations in deeper soil samples from 4.0 to 5.0 mbgl from AB_BH03 and AB_BH04 were two orders of magnitude lower compared to the shallower samples indicating attenuation with depth. The deeper soil samples are in the saturated zone and may reflect PFAS in groundwater adsorbing onto soil. PFAS is understood to readily adsorb to organic material in an aquifer, and further investigation of the organic carbon content of saturated zone would be required to understanding the potential for sorption by organic material.

The results indicate PFAS concentrations in the shallow fill in the southern grassed area (i.e. AB_SS3) are similar to the PFAS concentrations in the area identified as used for firefighting exercises. This may suggest the presence of a historical local source in southern grassed area to the east of the Engine Room such as foam training.

The presence of gravelly fill containing landfill waste materials along the northeastern site boundary may create preferential pathways for the migration of PFAS within the unsaturated zone. The landfill

waste materials may also represent a source of PFAS. Localised areas of excavations and infilling are likely to be present in the vicinity of underground structures such as the Case 4 Pit (a water tank) and underground services such as sewer lines. The presence of these areas, which are likely to contain coarser material such as sand as backfill, may also create preferential pathways for the migration of PFAS.

7.3 Groundwater Analytical Results

PFAS concentrations in groundwater have been detected in all four groundwater monitoring wells (AB_MW01 to AB_MW04) with the highest concentrations detected at AB_MW03 (8.2 µg/L ∑(PFHxS+PFOS)) and AB_MW04 (6.5 µg/L ∑(PFHxS+PFOS)), which are both located within the foam training area and are down-hydraulic gradient of the majority of the site features.

Concentrations of ∑(PFHxS+PFOS) were an order of magnitude lower at AB_MW01 (close to the area of the Case 4 Pit and up-hydraulic gradient of the foam training area) and AB_MW02 (adjacent to the foam storage shed, cross gradient of the foam storage area) indicating large sources of PFAS are not likely to be associated with the foam storage shed. The groundwater results indicate the foam training area to be the most likely source area at the site. Soil results indicated the southern grassed area in the vicinity of AB_SS3 indicate this the presence of a local source area of PFAS, such as foam training. Landfill materials associated with the former landfill to the north may also represent another source of PFAS to groundwater.

As the groundwater PFHxS and PFOS concentrations close to the down-hydraulic gradient (northeastern) boundary of the site are two orders of magnitude higher than the NEMP (HEPA, 2018) drinking water guideline value, it is likely that PFAS contaminants are migrating off-site towards the northeast at concentrations that exceed human health and ecological guideline values. The extent of PFAS in groundwater off-site is uncertain. Due to the proximity of Pioneer Bay, located approximately 230m to the northeast, and the shallow aquifer within the superficial deposits, groundwater flowing beneath the site is likely to discharge into Pioneer Bay. As the landfill is present between the site and Pioneer Bay, groundwater will potentially flow through the landfill.

Shorter chain compounds (i.e. compounds with six or fewer perfluorinated carbons) have higher mobility in groundwater relative to longer chain compounds. Due to the main source area (foam training area) being located close to the down-gradient (northeastern) boundary, no wells were positioned down-gradient of this area and therefore there is limited information on the potential mobility of shorter chain compounds. Groundwater samples from monitoring wells positioned within the foam training area (AB_MW03 and AB_MW04) are noted to have the highest concentrations of shorter chain compounds including PFHxS, PFBS, PFPeS, PFBA, PFPeA and PFHxA. These compounds are considered to have a higher potential to migrate in groundwater at distance beyond the site boundary.

7.4 Comparison of PFAS composition in soil and groundwater samples

The table below presents a comparison of the compounds detected in soil and groundwater samples.

Table 21 PFAS composition in soil and groundwater samples at Airlie Beach Fire Station

PFAS	Carbon Chain Length	Average soil ratios for different depth intervals			Average groundwater ratios (n=4)
		0.1-0.25 mbgl (n = 9)	0.5-1.0 mbgl (n = 8)	4.0-5.8 mbgl (n = 3)	
PFBA	4	0%	0%	0%	2.2%
PFBS	4	0.2%	0.5%	0%	9.6%
PFPeS	5	0.1%	0.5%	0%	7.3%
PFPeA	5	1.6%	0.9%	0%	2.6%
PFHxS	6	6.0%	7.5%	29.5%	28.9%
PFHxA	6	1.5%	1.6%	9.7%	7.1%
6:2 FTS	6	0%	0%	0%	0.6%
PFHpS	7	0.1%	0.7%	0%	1.6%
PFHpA	7	1.4%	0.7%	0%	2.0%
PFOS	8	68.3%	82.1%	60.8%	32.6%
PFOA	8	1.3%	1.1%	0%	2.8%
PFNA	8	1.8%	1.3%	0%	2.4%
FOSA	8	0.8%	0.5%	0%	0%
8:2 FTS	8	0%	0%	0%	0.1%
PFDS	10	1.9%	0.9%	0%	0%
PFDcA	10	0.8%	0.2%	0%	0%
PFUnDA	11	10.0%	1.4%	0%	0.2%
PFDoDA	12	0.1%	0%	0%	0%
PFTrDA	12	4.1%	0.1%	0%	0%

Note: The average composition has been calculated using all groundwater samples. Averages for soil have been calculated for samples where PFAS was detected

7.4.1 Soil Profiles

The PFAS present in soil samples ranged from short (four perfluorinated carbons) to long chain (12 perfluorinated carbons). The groundwater samples had a slightly smaller range of chain lengths, between four and eleven perfluorinated carbons. The smaller number of chain lengths 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. This indicates the longer chain compounds have lower mobility through the soil.

Table 21 shows the composition of PFAS in the soil samples from three depth intervals, 0.1 to 0.25 mbgl, 0.5 to 1.0 mbgl and 4.0 to 6.0 mbgl. Comparison of the compounds detected and averages indicates a larger range of compounds are detected in the shallower depth interval (0.1 to 1.0 mbgl) compared to the deeper interval (4.0 to 6.0 mbgl). PFAS composition in the deeper soil samples (>4.0 mbgl) consisted of three compounds (PFOS, PFHxS and PFHxA), suggesting that these compounds have relatively higher mobility. In particular, the ratio of PFHxS was noted to increase from 7.5% at 1.0 mbgl to 29.5% at the 4.0 to 5.8 mbgl depth interval.

7.4.2 Groundwater Profiles

The composition of PFAS in the groundwater samples is also shown in **Table 21**. The composition of PFAS in groundwater is dominated by PFOS (average of 33%) and PFHxS (average of 29%), with PFBS (9.6%), PFPeS (7.3%) and PFHxA (7.1%). Six other compounds are present above 1% (PFBA, PFPeA, PFHpS, PFHpA, PFOA and PFNA).

7.4.3 Summary

Based on **Table 21**, approximately 98% of the mass of PFAS in the soil (based on the sum of 28 PFAS analysed) is comprised of longer chain with more than six perfluorinated carbons. The mass of PFAS in the groundwater is mainly comprised of longer chain with more than six perfluorinated carbons (>82%).

7.5 Sediment Analytical Results

Three sediment samples (SED01, 02 and 03) were collected on site from concrete or earth lined drains on the southwestern, northwestern and northeastern boundary of the site (refer to **Figure 6**, **Appendix A**) with a fourth sediment sample (SED04) collected from the area of frequently pooled water. The results indicated PFAS was detected at in all samples with three of the locations recording concentrations relatively close to the limit of reporting (SED02, SED03 and SED04 had ∑(PFHxS+PFOS) in the range 0.0005 to 0.0094 mg/kg).

The fourth location, SED01 from an earth drain on southern boundary had a slightly higher concentration detected, 0.0376 mg/kg ∑(PFHxS+PFOS), which is noted to be a similar order of magnitude to the concentration of PFAS in soil at the nearest soil bore (AB_SS1 at 0.1 mbgl), which is located approximately 20 m north. These results suggest the potential for sediment PFAS impacts in the drain running along the southwestern boundary of the site, which may act as a preferential pathway for the migration of PFAS in surface water runoff and sediment transport.

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 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 a hazard. The risk to the receptor will be based on the consequence of the exposure. However, if one of these three is missing there is no risk.

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.

8.1 Contaminants of Potential Concern

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

8.2 Sources

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

8.2.1 Primary Sources

The following activities on the Fire Station 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 in the northeastern portion of the site and potentially the central southern grassed area to the east of the Engine Room.
- Leak and spills of AFFF containing PFAS from storage areas, during product transfer and vehicle maintenance.

- Buried landfill waste materials in the northern portion of the site.

8.2.2 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 stormwater perimeter drains

8.2.3 Off-Site

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

- Closed landfill from the rear (north) of the site and extending to the northeast and northwest
- Potential for use of AFFF at The Port of Airlie, approximately 600 m to the northwest of the site
- Potential for use of AFFF at the Whitsunday airport, approximately 3 km to the east of the site.

8.3 Migration Mechanisms

The mechanisms which may have contributed to the migration of PFAS across and from the Fire Station 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 AFFFs were historically used, particularly in unsealed areas
- 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 landfill materials and infiltration to groundwater
- Leaching of PFAS from soil and infiltration to groundwater in areas where AFFFs were historically used
- Leaching of PFAS from concrete structures and infiltration to groundwater
- Lateral and vertical migration of PFAS in groundwater under the influence of groundwater flow and PFAS dispersion
- Migration within backfill to underground services or landfilling areas which may act as preferential pathways for PFAS in the unsaturated zone.
- Use of groundwater off-site for irrigation of parks
- 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
- Transport of sediment along stormwater drains.

8.4 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 off-site for recreational activities and irrigation of parks
- Recreational users of nearby surface water bodies (Campbell Creek and Pioneer Bay)
- The terrestrial ecosystem (flora and fauna) on and off-site
- The aquatic ecosystems of nearby waterways (Campbell Creek and Pioneer Bay).

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 or using 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.

8.5 Assessment of Exposure Pathways

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

Table 22 Airlie Beach Fire Station PFAS CSM

Primary Source	Secondary Sources[10]	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 (including unlined drains)	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 landuse.
			Ecological: ingestion of plants and terrestrial biota by higher order ecological receptors	Terrestrial ecosystem	Possible	Considered possible due to exceedance of indirect ecological guideline value for commercial land use and accessibility of near surface soils due to the presence of large unsealed areas of the site.
		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 a commercial landuse.
	PFAS in concrete lined pits and drains	Leaching of PFAS within concrete structures to soil and groundwater	Human health - Incidental ingestion or contact with soil, groundwater or surface water.	Surface soil and groundwater	Possible	Considered possible as PFAS concentrations in soil and groundwater may be partly sourced from concrete impregnated with PFAS.
			Ecological – uptake and bioaccumulation.			

[10] The key PFAS compounds are those with national guideline values, as identified in Section 5.0: ∑(PFHxS+PFOS), PFOS and PFOA.

Primary Source	Secondary Sources[10]	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
	PFAS in groundwater	Groundwater transport in shallow 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	Unlikely	Considered unlikely as due to the proximity of the site to the coast and the presence of the closed landfill there is unlikely to be any groundwater extraction and use hydraulically down-gradient of the site.
			Uptake and bioaccumulation in terrestrial biota	Flora and fauna	Unlikely	
		Groundwater transport in shallow aquifer followed by extraction for stock watering	Livestock: direct ingestion or incidental ingestion or direct contact of groundwater (off-site)	Livestock	Unlikely	Considered unlikely as groundwater in the vicinity of the site is unlikely to be used for stock watering purposes.
		Groundwater transport in shallow aquifer followed by discharge to creeks and marine water bodies	Human health: direct or incidental ingestion or direct contact with off-site surface water (i.e. creeks and marine water). Direct ingestion of aquatic biota.	Recreational users	Possible	Considered possible. Due to the mobility and persistence of PFAS and as the local groundwater flow direction is inferred to be towards Pioneer Bay, groundwater in the shallow aquifer has the potential to discharge into the marine environment.
			Human health: direct ingestion of biota	Recreational users / off-site residents	Possible	
			Ecological: direct exposure as well as ingestion of biota by higher order ecological receptors.	Aquatic marine ecosystem	Possible	

Primary Source	Secondary Sources[10]	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
	PFAS in surface water	Surface water transport via overland flow into on- and off-site drains that discharge into ephemeral surface water bodies, creeks and marine waters	Human health: direct or incidental ingestion or direct contact with off-site surface water (i.e. surface water, drainage overland flow water, marine water). Direct ingestion of aquatic biota.	Recreational users	Possible	Considered possible. Runoff from the site will enter surrounding ephemeral stormwater channels which potentially drain into Campbell Creek and/or Pioneer Bay.
			Human health: direct ingestion of biota	Recreational users / off-site residents	Possible	
			Ecological: direct exposure as well as ingestion of biota by higher order ecological receptors.	Aquatic marine ecosystem	Possible	
	Accumulation of PFAS in creek sediment	Dispersion via surface water	Human health: incidental ingestion or direct contact of sediment (off-site). Direct ingestion of aquatic / marine biota	Recreational users	Unlikely	Considered unlikely due to the relatively low PFAS concentrations detected in sediment samples, the ephemeral nature of the drains and the distance of the site from the nearest creek (580 m to Campbell Creek) and Pioneer Bay (230 m).
			Ecological: direct exposure, as well as ingestion of biota by higher order ecological receptors	Aquatic / Marine ecosystem	Unlikely	

9.0 Conclusions

The key findings of the DSI are presented below.

- Soil conditions beneath the site indicate the site is generally underlain by clay fill to 2.4 mbgl underlain by superficial deposits (silty clay or clay) which overlie rock, which was present between 4.5 and 6.9 mbgl. Landfill materials intermixed within gravelly clay fill were intersected in the bore located along the northeastern boundary (AB_BH04) between 1.0 and 1.6 mbgl. Based on historical aerial photographs, information on the Council website and anecdotal information, it was understood that the site was built on the management area of a landfill (Airlie Beach landfill). The detection of landfill materials beneath the northeastern portion of the site indicates that the landfill extended beneath the fire station site.
- Groundwater elevations in August 2019 indicated a shallow aquifer is present beneath the site. Depth to groundwater was between 2.7 and 3.3 mbgl. Groundwater was inferred to locally flow to the northeast towards Pioneer Bay, which is approximately 300 m to the northeast.
- The primary PFAS compounds present in the soil samples were perfluorohexanesulfonic acid (PFHxS) and perfluorooctanesulfonic acid (PFOS). ∑(PFHxS+PFOS) and perfluorooctanoic acid (PFOA) concentrations in 22 soil samples collected from the nine soil bores did not exceed National Environmental Management Plan (NEMP) (HEPA, 2018) human health guidelines for commercial land use. PFOS concentrations exceeded the NEMP (HEPA, 2018) ecological guideline value for residential landuse in 14 samples of shallow fill collected from the upper 1.0 mbgl across the site. The concentration of PFOS in six soil samples exceeded the NEMP (HEPA, 2018) ecological PFOS guideline value for commercial landuse. The highest soil concentration (0.52 mg/kg PFOS at AB_SS5) was detected in a sample collected from fill material at 0.5 mbgl near the training tower within the grassed area historically used for foam training.
- PFAS concentrations in shallow fill (AB_SS3) from the central southern open grassed area to the southeast of the Engine Room (which had not been identified as a potential source area) were similar to PFAS concentrations in soil samples of shallow fill collected within the foam training area (e.g. soil samples from AB_BH03 and AB_BH04 at 1.0 mbgl). This suggests a historical source of PFAS close to sampling location AB_SS3. In the deeper soil bores, PFAS concentrations in the saturated zone soil were significantly lower (by two orders of magnitude) compared to concentrations in the 0.5 to 1.0 mbgl depth interval. This indicates attenuation of PFAS concentrations with increased depth.
- The primary PFAS compounds identified in groundwater samples from the four newly installed monitoring wells were PFHxS and PFOS, with overall compositions indicative of a PFOS-dominant AFFF product. ∑(PFHxS+PFOS) concentrations in groundwater exceeded the NEMP (HEPA 2018) human health (drinking and recreational water) quality guideline values in all four monitoring wells. The highest PFAS concentrations in groundwater (∑(PFHxS+PFOS)) were collected from the two monitoring wells (AB_MW03 (8.2 µg/L) and AB_MW04 (6.5 µg/L)) located in along the north eastern boundary of the site, down-hydraulic gradient of site source areas. AB_MW04 was advanced through landfill materials, which is a potential source of PFAS in groundwater. The two other monitoring wells (AB_MW01 and AB_MW02) were located adjacent to two other potential source areas, the area of the Case 4 Pit and the foam storage shed. ∑(PFHxS+PFOS) concentrations in these monitoring wells were approximately one order of magnitude lower compared to the concentration in the monitoring wells in the foam training area.
- As the groundwater PFAS concentration close to the northeastern down-hydraulic gradient boundary of the site are two orders of magnitude higher than the NEMP (HEPA, 2018) drinking water guideline value, it is likely that PFAS contaminants are migrating off-site at concentrations that exceed human health and ecological guideline values. The extent of PFAS in groundwater off-site is uncertain. Due to the proximity of Pioneer Bay located approximately 230 m to the northeast, and the shallow aquifer within the superficial deposits, groundwater locally flowing beneath the site has the potential to flow through the closed landfill and discharge into Pioneer Bay.

- The sediment analytical results indicated PFAS was detected at in all samples with three of the locations recording ∑(PFHxS+PFOS) concentrations relatively close to the limit of reporting (∑(PFHxS+PFOS) was in the range 0.0005 to 0.0023 mg/kg). The fourth location, AB_SED01 from an earth drain on the southern boundary had a slightly higher concentration detected, 0.0376 mg/kg ∑(PFHxS+PFOS). This suggests the potential for sediment PFAS impacts in the drain running along the southwestern boundary of the site, which may act as a preferential pathway for the migration of PFAS in surface water runoff and sediment transport. However, the risk to sediment in surface water is mitigated by the ephemeral nature of the drains and the distance of the site from the nearest creek (580 m to Campbell Creek) and Pioneer Bay (230 m).
- Total oxidisable precursor assay (TOPA) analysis was undertaken on one soil and one groundwater sample. The soil results did not identify the potential for PFAS precursors, while the groundwater results indicated a low potential for precursors. The results indicated a degraded PFAS product. Overall, it is considered unlikely that PFAS concentrations will significantly increase through biotransformation or oxidation processes.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered to be related to the historical firefighting practices at Airlie Beach Fire Station, spills from storage containers, product transfer, other maintenance activities or from landfill materials within the closed Airlie Beach landfill.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possible 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.

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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 8 November 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.

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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/ Creeks
- 1km Site Radius
- Site Boundary
- Cadastre

Queensland Fire and Emergency Services (QFES)

FIGURE 1
Site Location

PFAS Detailed Site Investigation at
Airlie Beach 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

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AECOM

N

0 5 10 15

Meters

Legend

- Montioring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Hydrant
- Drainage Line
- Comms Line
- Comms / Electrical Line
- Concrete Spoon Drain
- Electrical Line
- Hydrant Water Mains
- Sewer / Water
- Irrigation Trench
- Telstra / NBN Line
- Water Line
- Possible extent of landfill (based on 1985 aerial photography)
- Approximate Foam Training Area
- Site Boundary
- Cadastre

Queensland Fire and Emergency Services (QFES)

FIGURE 2
Site Layout and Sampling Locations

PFAS Detailed Site Investigation at
Airlie Beach Fire Station

Source: State of Queensland, 2019. AECOM 2019
Imagery: Nearmap 2017. ESRI Basemaps Online

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AECOM

N

0 5 10 15
Meters

Legend

- Montioring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Hydrant
- Inferred groundwater contours (mAHD)
- Drainage Line
- Comms Line
- Comms / Electrical Line
- Concrete Spoon Drain
- Electrical Line
- Hydrant Water Mains
- Sewer / Water
- Irrigation Trench
- Telstra / NBN Line
- Water
- Possible extent of landfill (based on 1985 aerial photography)
- Approximate Foam Training Area
- 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: 8 August 2019

PFAS Detailed Site Investigation at Airlie Beach Fire Station

Source: State of Queensland, 2019. AECOM 2019 Imagery: Nearmap 2017. ESRI Basemaps Online

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PCYC Building

Analyte	Unit	AB_SS4_190729	
		0.1 m	0.5 m
PFOS	mg/kg	0.0112	0.0266
PFHxS	mg/kg	0.0004	0.0008
PFOA	mg/kg	0.0011	0.0008

Analyte	Unit	AB_BH02_190730		
		0.2 m	0.5 m	4.0 m
PFOS	mg/kg	0.0036	0.0088	0.0006
PFHxS	mg/kg	<0.0002	0.0018	0.0008
PFOA	mg/kg	<0.0002	0.0005	<0.0002

Analyte	Unit	AB_SS3_190729	
		0.1 m	0.5 m
PFOS	mg/kg	0.202	0.152
PFHxS	mg/kg	0.0023	0.0029
PFOA	mg/kg	0.0011	0.0016
PFOA	mg/kg	0.0009	0.0003

Analyte	Unit	AB_BH01_190729		
		0.25 m	1.0 m	6.0 m
PFOS	mg/kg	0.0044	0.003	<0.0002
PFHxS	mg/kg	0.0022	<0.0002	<0.0002
PFOA	mg/kg	<0.0002	<0.0002	<0.0002

Area used for landfilling

Analyte	Unit	AB_BH04_190729		
		0.5 m	1.0 m	5.0 m
PFOS	mg/kg	0.0202	0.285	0.0041
PFHxS	mg/kg	0.0025	0.0027	0.0007
PFOA	mg/kg	0.0007	0.0005	<0.0002

Analyte	Unit	AB_SS5_190729	
		0.1 m	0.5 m
PFOS	mg/kg	0.312	0.523
PFHxS	mg/kg	0.0081	0.0058
PFOA	mg/kg	0.0021	0.0018

Analyte	Unit	AB_SS2_190729	
		0.1 m	0.5 m
PFOS	mg/kg	0.0228	0.0226
PFHxS	mg/kg	0.0017	0.0008
PFOA	mg/kg	0.0009	0.0003

Analyte	Unit	AB_BH03_190729		
		0.1 m	1.0 m	4.5 m
PFOS	mg/kg	0.0282	0.177	0.0016
PFHxS	mg/kg	0.0007	0.0009	0.0007
PFOA	mg/kg	0.0005	0.0003	<0.0002

Analyte	Unit	AB_SS1_190729	
		0.1 m	0.5 m
PFOS	mg/kg	0.017	0.0134
PFHxS	mg/kg	0.0015	0.0146
PFOA	mg/kg	0.0003	0.0004

AB_SS4
AB_SED02
105CP894264
Container (gas fired heat training)
AB_BH04/ MW04
AB_SED03
Workshop/Gym (Former Foam Store)
AB_SS2
Approximate foam use area
Storage Shed (inc. foam)
AB_BH02/ MW02
Area of frequently pooled water
BA Container
Containers (smoke rooms)
AB_SED04
Training Tower
AB_SS5
AB_BH03/ MW03
Training Rooms
BBQ area/Awning
276HR1926
AB_SS1
Offices/Admin
Engine Room
Turn-out gear room
AB_SED01
AB_SS3
349HR1904
Bowls Club
SHUTE HARBOUR ROAD
AB_BH01/ MW01
Case 4 Pit
111
114SP271832

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
- Montioring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Hydrant
- Drainage Line
- Comms Line
- Comms / Electrical Line
- Concrete Spoon Drain
- Electrical Line
- Hydrant Water Mains
- Sewer / Water
- Irrigation Trench
- Telstra / NBN Line
- Water Line
- Possible extent of landfill (based on 1985 aerial photography)
- Approximate Foam Training Area
- Site Boundary
- Cadastre

Queensland Fire and Emergency Services (QFES)

FIGURE 4
Soil PFAS Analytical Results

PFAS Detailed Site Investigation at
Airlie Beach Fire Station

Source: State of Queensland, 2019. AECOM 2019
Imagery: Nearmap 2017. ESRI Basemaps Online

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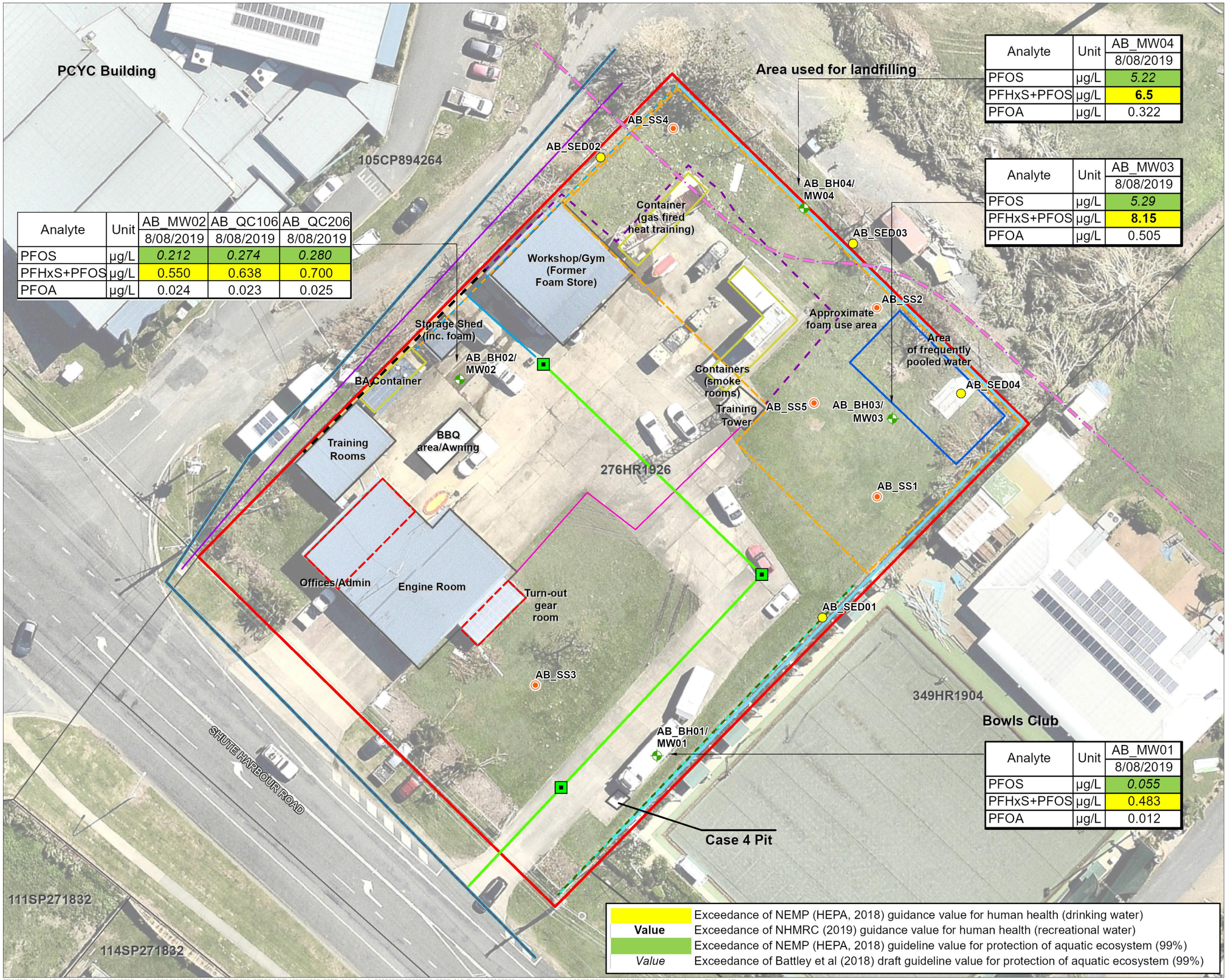

Analyte	Unit	AB_MW02	AB_QC106	AB_QC206
		8/08/2019	8/08/2019	8/08/2019
PFOS	µg/L	*0.212*	*0.274*	*0.280*
PFHxS+PFOS	µg/L	0.550	0.638	0.700
PFOA	µg/L	0.024	0.023	0.025

Analyte	Unit	AB_MW04
		8/08/2019
PFOS	µg/L	*5.22*
PFHxS+PFOS	µg/L	**6.5**
PFOA	µg/L	0.322

Analyte	Unit	AB_MW03
		8/08/2019
PFOS	µg/L	*5.29*
PFHxS+PFOS	µg/L	**8.15**
PFOA	µg/L	0.505

Analyte	Unit	AB_MW01
		8/08/2019
PFOS	µg/L	*0.055*
PFHxS+PFOS	µg/L	0.483
PFOA	µg/L	0.012

	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

- Montioring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Hydrant
- Drainage Line
- Comms Line
- Comms / Electrical Line
- Concrete Spoon Drain
- Electrical Line
- Hydrant Water Mains
- Sewer / Water
- Irrigation Trench
- Telstra / NBN Line
- Water Line
- Possible extent of landfill (based on 1985 aerial photography)
- Approximate Foam Training Area
- Site Boundary
- Cadastre

Queensland Fire and Emergency Services (QFES)

FIGURE 5
Groundwater PFAS Analytical Results

PFAS Detailed Site Investigation at Airlie Beach Fire Station

Source: State of Queensland, 2019. AECOM 2019 Imagery: Nearmap 2017. ESRI Basemaps Online

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Analyte	Unit	AB_SED02
		8/08/2019
PFOS	mg/kg	0.0023
PFHxS	mg/kg	<0.0002
PFOA	mg/kg	<0.0002

Analyte	Unit	AB_SED03
		8/08/2019
PFOS	mg/kg	0.0005
PFHxS	mg/kg	<0.0002
PFOA	mg/kg	<0.0002

Analyte	Unit	AB_SED04	AB_QC105	AB_QC205
		8/08/2019	8/08/2019	8/08/2019
PFOS	mg/kg	0.0013	0.0015	0.0094
PFHxS	mg/kg	<0.0002	<0.0002	<0.001
PFOA	mg/kg	<0.0002	<0.0002	<0.001

Analyte	Unit	AB_SED01
		8/08/2019
PFOS	mg/kg	0.0359
PFHxS	mg/kg	0.0017
PFOA	mg/kg	0.0006

AECOM

N

0 5 10 15
Meters

Legend

- Montioring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Hydrant
- Drainage Line
- Comms Line
- Comms / Electrical Line
- Concrete Spoon Drain
- Electrical Line
- Hydrant Water Mains
- Sewer / Water
- Irrigation Trench
- Telstra / NBN Line
- Water Line
- Possible extent of landfill (based on 1985 aerial photography)
- Approximate Foam Training Area
- Site Boundary
- Cadastre

Queensland Fire and Emergency Services (QFES)

FIGURE 6
Sediment PFAS Analytical Results

PFAS Detailed Site Investigation at
Airlie Beach Fire Station

Source: State of Queensland, 2019. AECOM 2019
Imagery: Nearmap 2017. ESRI Basemaps Online

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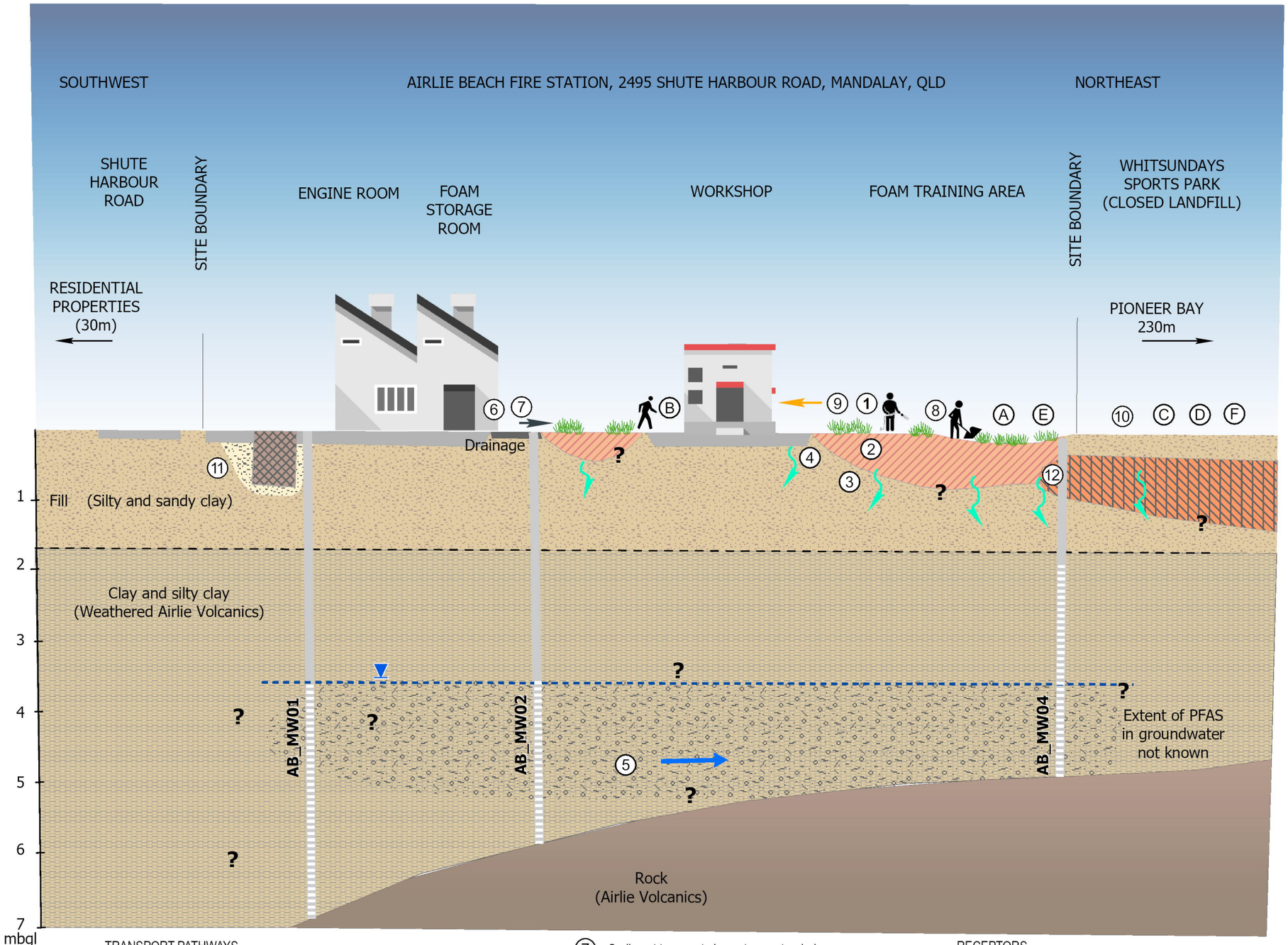

TRANSPORT PATHWAYS

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. Use of tap water on-site for domestic or irrigation purposes
12. Leaching of PFAS from landfill materials

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

AECOM

NOT TO SCALE

Legend

- PFAS in soil
- PFAS in groundwater
- Landfill materials
- Backfill
- Case 4 Pit
- Concrete
- Inferred groundwater flow direction
- Infiltration / Leaching
- Inferred groundwater depth
- Groundwater table

Queensland Fire and Emergency Services (QFES)

FIGURE 7
PFAS Conceptual Site Model

PFAS Detailed Site Investigation at Airlie Beach Fire Station

Source: AECOM 2019

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Appendix B

Tables

Appendix B Tables

Location ID	Date of Installation	Easting	Northing	Top of Casing Elevation (mAHD)	Cover	TOC Elevation (m AHD)	Drilled Depth (m)	Top of screen (mbgs)	Water Strike (mbgs)	Lithology of screened section
AB_BH01/MW01	29/07/2019	680435.6	7756783.3	4.423	Gatic	4.505	6.9	3.9	5.0	CLAY
AB_BH02/MW02	30/07/2019	680411.8	7756828.7	4.315	Gatic	4.386	5.8	3.8	2.4	Silty CLAY
AB_BH03/MW03	29/07/2019	680464.0	7756824.0	3.867	Gatic	3.967	4.5	1.5	3.0	Gravelly CLAY
AB_BH04/MW04	29/07/2019	680453.4	7756849.4	3.780	Gatic	3.88	5.0	2.0	3.6	CLAY to Silty CLAY

m' is metres
mAHD' is metres above Australian height datum
mbgs' is metres below ground surface

Well ID	Easting	Northing	Top of Casing Elevation (mAHD)	Gauging Date	Total Depth (mbtoc)	Depth to Water (mbtoc)	Corrected Groundwater Elevation (mAHD)
AB_MW01	680435.637	7756783.311	4.423	8/08/2019	5.5	1.168	3.255
AB_MW02	680411.800	7756828.723	4.315	8/08/2019	4.8	1.002	3.313
AB_MW03	680464.034	7756823.985	3.867	8/08/2019	4.4	0.861	3.006
AB_MW04	680453.363	7756849.423	3.780	8/08/2019	5.2	1.071	2.709

m' is metres
mAHD' is metres above Australian height datum
mbtoc' is metres below top of casing

Well ID	Date	pH	Temperature (°C)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)*
AB_MW01	8/08/2019	6.87	27.6	3875	2518.8	0.76	344.4
AB_MW02	8/08/2019	7.39	27.1	1380	897.0	0.42	203.3
AB_MW03	8/08/2019	7.23	25.6	2070	1345.5	0.20	313.2
AB_MW04	8/08/2019	7.63	25.9	1592	1034.8	3.57	264.2

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

		Sum (PFHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-Et-FOSA	N-Me-FOSA	N-Et-FOSE	N-MeFOSE	Sum of PFAS	Sum of TOP C4-C14 Carboxylates and C4-C8 Sulfonates
	LOR	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Units	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002
NEMP (HEPA 2018) 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																																	
AB_SS1_0.1_190729	29/07/2019	EB1919838	Normal	0.0185	0.017	0.0015	0.0008	0.0003	0.0005	0.0002	<0.0002	0.0003	<0.001	0.0005	0.0003	0.0008	0.0002	0.0418	0.0008	0.0282	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0932	-
AB_QC101_190729	29/07/2019	EB1919838	Duplicate	0.0215	0.0195	0.002	0.001	0.0003	0.0005	0.0002	<0.0002	0.0009	<0.001	0.0005	0.0003	0.0009	0.0002	0.0474	0.001	0.0274	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.102	-
AB_QC201_190729	29/07/2019	RN1242611	Triplicate	0.026	0.024	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.64	<0.002	<0.001	0.001	<0.001	0.075	<0.002	0.075	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.817	-
AB_SS1_0.5_190729	29/07/2019	EB1919838	Normal	0.028	0.0134	0.0146	0.001	0.0004	0.0013	0.0016	0.0008	<0.0002	<0.001	<0.0002	<0.0002	0.0011	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0342	-
AB_SS2_0.1_190729	29/07/2019	EB1919838	Normal	0.0245	0.0228	0.0017	0.0012	0.0009	<0.0002	<0.0002	0.0002	0.0041	<0.001	0.0012	0.0008	0.001	0.0003	0.001	<0.0002	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	0.0019	<0.0005	<0.0005	<0.0005	<0.0005	0.0375	-
AB_SS2_0.5_190729	29/07/2019	EB1919838	Normal	0.0234	0.0226	0.0008	0.0004	0.0003	<0.0002	<0.0002	<0.0002	0.0021	<0.001	0.0003	0.0002	0.0002	<0.0002	0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	0.0009	<0.0005	<0.0005	<0.0005	<0.0005	0.0283	-
AB_SS3_0.1_190729	19/07/2019	EB1919838	Normal	0.204	**0.202**	0.0023	0.0014	0.0011	<0.0002	<0.0002	0.0006	0.0009	<0.0002	0.0006	0.0003	0.0012	0.0007	0.0007	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.212	-
AB_SS3_0.5_190729	29/07/2019	EB1919838	Normal	0.155	**0.152**	0.0029	0.0013	0.0016	0.0003	0.0002	0.0009	<0.0002	0.0003	0.0005	0.0005	0.0011	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.161	-
AB_SS4_0.1_190729	29/07/2019	EB1919838	Normal	0.0116	0.0112	0.0004	0.0009	0.0011	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0011	0.0012	0.0017	0.0008	0.0031	<0.0002	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0219	-
AB_SS4_0.5_190729	29/07/2019	EB1919838	Normal	0.0274	0.0266	0.0008	0.0012	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0017	0.0011	0.0021	0.0005	0.0018	<0.0002	0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0368	-
AB_SS5_0.1_190729	29/07/2019	EB1919838	Normal	0.32	**0.312**	0.0081	0.0028	0.0021	0.0006	0.0007	0.0009	0.0049	0.002	0.0023	0.0024	0.0031	0.003	0.0045	0.0007	0.0011	<0.0005	<0.0005	0.0008	<0.0005	<0.0005	<0.0002	<0.0002	0.0012	<0.0005	<0.0005	<0.0005	<0.0005	0.353	-
AB_SS5_0.5_190729	29/07/2019	EB1919838	Normal	0.529	**0.523**	0.0058	0.0016	0.0018	0.0003	0.0003	0.0012	0.0014	<0.001	0.0013	0.001	0.0037	0.002	0.0012	<0.0002	0.0002	<0.0005	<0.0005	0.0011	<0.0005	<0.0005	<0.0002	<0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	0.548	-
AB_BH01_0.25_190729	29/07/2019	EB1919838	Normal	0.0066	0.0044	0.0022	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0066	-
AB_BH01_0.5_190729	29/07/2019	EB1919838	Normal	0.003	0.003	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.003	-
AB_QC103_190729	29/07/2019	EB1919838	Duplicate	0.0056	0.0056	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0056	-
AB_QC203_190729	29/07/2019	RN1242611	Triplicate	0.0078	0.0078	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.0078	-
AB_BH01_6.0_190729	29/07/2019	EB1919838	Normal	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	-
AB_BH02_0.2_190730	30/07/2019	EB1919838	Normal	0.0036	0.0036	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0036	-
AB_BH02_0.5_190730	30/07/2019	EB1919838	Normal	0.0106	0.0088	0.0018	0.0006	0.0005	<0.0002	<0.0002	0.0004	<0.0002	<0.001	0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0125	-
AB_BH02_4.0_190730	30/07/2019	EB1919838	Normal	0.0014	0.0006	0.0008	0.0003	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0017	-
AB_BH03_0.1_190729	29/07/2019	EB1919838	Normal	0.0158	0.0155	0.0003	0.0003	0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0005	0.0003	0.0003	<0.0002	0.0045	<0.0002	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0227	-
AB_QC100_190729	29/07/2019	EB1919838	Dupplicate	0.0289	0.0282	0.0007	0.0006	0.0005	<0.0002	<0.0002	<0.0002	0.002	<0.001	0.0007	0.0005	0.0006	0.0003	0.0072	<0.0002	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0423	-
AB_QC200_190729	29/07/2019	RN1242611	Triplicate	0.037	0.037	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0016	<0.002	<0.002	<0.001	<0.001	<0.001	0.0092	<0.002	0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.0498	-
AB_BH03_1.0_190729	29/07/2019	EB1919838	Normal	0.178	**0.177**	0.0009	0.0004	0.0003	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0004	0.0002	0.0014	<0.0002	0.0004	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.181	-
AB_BH03_4.5_190729	29/07/2019	EB1919838	Normal	0.0023	0.0016	0.0007	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0026	-
AB_BH04_0.1_190729	29/07/2019	EB1919838	Normal	0.0227	0.0202	0.0025	0.0008	0.0007	0.0002	0.0002	<0.0002	0.0009	<0.001	0.0007	0.0007	0.0008	0.0003	0.002	<0.0002	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.031	-
AB_BH04_1.0_190729	29/07/2019	EB1919838	Normal	0.288	**0.285**	0.0027	0.0006	0.0005	<0.0002	<0.0002	0.0004	<0.0002	<0.001	0.0008	0.0003	0.0007	0.0004	0.0164	<0.0002	0.0013	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	0.0006	0.0016	<0.0005	<0.0005	<0.0005	<0.0005	0.311	-
AB_BH04_5.0_190729	29/07/2019	EB1919838	Normal	0.0048	0.0041	0.0007	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0048	-
PFAS by TOPA																																	
AB_SS5_0.5_190729	29/07/2019	EB1921187-AB	TOPA	0.379	**0.374**	0.0049	0.0081	0.0067	0.0002	0.0002	0.001	<0.0002	0.05	0.011	0.0043	0.003	0.0018	0.0007	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.421	0.421

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

		Sum (PHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-EtFOSA	N-MeFOSA	N-EtFOSE	N-MeFOSE	Sum of PFAS	Sum of TOP C4-C14 Carboxylates and C4-C8 Sulfonates
	Units	ug/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	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	0.0003	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0020	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	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0003	0.01
NEMP (HEPA, 2018) Human Health Drinking Water		0.07				0.56																										
NHMRC (2019) Human Health Recreational Water		**2.00**				**10.00**																										
NEMP (HEPA, 2018) Marine 99% Species Protection			0.00023			19.00																										
Battley et al (2018) 99% Species Protection			**0.051**																													
Location ID	**Date**	**Type**	**Lab Report**																														
PFAS by Standard Analysis																																	
AB_MW01_190808	8/08/2019	Normal	EB1921176	0.483	**0.055**	0.428	0.028	0.012	0.249	0.154	0.009	<0.002	0.02	0.008	0.007	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	0.97	
AB_MW02_190808	8/08/2019	Normal	EB1921176	0.55	**0.212**	0.338	0.104	0.024	0.059	0.071	0.01	<0.002	0.04	0.049	0.027	0.07	<0.002	0.008	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	1.01	
AB_QC106_190808	8/08/2019	Duplicate	EB1921176	0.638	**0.274**	0.364	0.102	0.023	0.064	0.065	0.01	<0.002	0.04	0.051	0.028	0.075	<0.002	0.008	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	1.1	
AB_QC206_190808	8/08/2019	Triplicate	RN1244319	0.70	**0.28**	0.42	0.11	0.025	0.064	0.07	0.008	<0.001	0.0099	0.055	0.03	0.093	0.0029	0.015	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.005	0.0099	
AB_MW03_190808	8/08/2019	Normal	EB1921176	**8.15**	**5.29**	2.86	1.11	0.505	0.597	0.503	0.282	<0.01	0.2	0.321	0.313	0.077	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	0.14	0.015	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	12.2	
AB_MW04_190808	8/08/2019	Normal	EB1921176	**6.5**	**5.22**	1.28	0.527	0.322	0.178	0.177	0.184	<0.01	0.1	0.178	0.172	0.167	<0.01	0.013	<0.01	<0.01	<0.025	<0.01	0.102	0.024	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	8.64	
PFAS by TOPA																																	
AB_MW03_190808	8/08/2019	Normal	EB1922105	**5.2**	**2.17**	3.03	3.5	0.53	0.59	0.55	0.26	<0.02	0.8	0.74	0.35	0.07	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	12.6	12.6

µg/L' micrograms per litre
'<' less than the limit of reporting
'-' not analysed

	Sum (PFHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-Et-FOSA	N-Me-FOSA	N-Et-FOSE	N-MeFOSE	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	mg/kg
LOR	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002
Sample ID	**Date**	**Lab Report**	**Type**																											
AB_SED01_190808	8/08/2019	EB1921176	Normal	0.0376	0.0359	0.0017	0.0008	0.0006	0.0004	0.0003	0.0003	<0.0002	<0.001	0.0004	0.0003	0.0005	<0.0002	0.0004	<0.0002	0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0418
AB_SED02_190808	8/08/2019	EB1921176	Normal	0.0023	0.0023	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0012	<0.0002	0.0002	<0.0005	<0.0005	<0.0005	0.0005	0.0006	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0048
AB_SED03_190808	8/08/2019	EB1921176	Normal	0.0005	0.0005	<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	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
AB_SED04_190808	8/08/2019	EB1921176	Normal	0.0013	0.0013	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0031
AB_QC105_190808	8/08/2019	EB1921176	Duplicate	0.0015	0.0015	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	0.0011	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0035
AB_QC205_190808	8/08/2019	RN1244319	Triplicate	0.0094	0.0094	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0032	<0.002	<0.002	<0.001	<0.001	<0.001	0.0025	<0.002	0.01	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.0345

Appendix C

Photographs

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
1	13/02/2019

Direction Photo Taken:
N/A

Description:
Class A and Class B Foams stored in storage shed midway along north-western site boundary.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
2	13/02/2019

Direction Photo Taken:
N/A

Description:
Storage of Class A and Class B Foam in foam storage shed midway along north-western site boundary.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
3	13/02/2019

Direction Photo Taken:
North-west

Description:
Stacked containers used for smoke training in foreground. A single container used for heat training in background.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
4	13/02/2019

Direction Photo Taken:
North

Description:
Training tower located in the centre of the site. The workshop is visible in the background.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
5	13/02/2019

Direction Photo Taken:
North

Description:
Surface depression location in the north-east corner of the Property.

Potential former landfill now used as a sports field is visible in the far right of the image.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
6	13/02/2019

Direction Photo Taken:
N/A

Description:
Case 4 Pit for drafting training located in the south-east corner of the site. Filled and sealed with concrete in 2018.

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
7	13/02/2019

Direction Photo Taken: South-west

Description: View along the driveway to the site with the grassed area in the background the primary area for foam training.

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
8	13/02/2019

Direction Photo Taken: North-west

Description: View along the driveway to the site with the grassed area in the background the primary area for foam training.

Potential former landfill is visible in the background of this image

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
9	29/07/2019

Direction Photo Taken: N/A

Description: Landfill type waste visible within BH04.

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
10	30/09/2019

Direction Photo Taken: North-east

Description: Removing solid stem augers from BH02 following water strike.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
11	08/08/2019

Direction Photo Taken:
North-east

Description:
SED01 – sediment collected in earthen stormwater drain

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Airlie Beach Fire Station	2495 Shute Harbour Road, Mandalay, Queensland	60609758

Plate No.	Date:
12	08/08/2019

Direction Photo Taken:
South-west

Description:
SED02 – sediment collected in concrete spoon drain

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
13	08/08/2019

Direction Photo Taken: North-west

Description: SED03 – sediment collected in earthen drain on northern fence line.

PHOTOGRAPHIC LOG

Site Name: Airlie Beach Fire Station	**Site Location:** 2495 Shute Harbour Road, Mandalay, Queensland	**Project No:** 60609758

Plate No.	**Date:**
14	08/08/2019

Direction Photo Taken: East

Description: SED04 – sediment collected from area of frequently pooled water in eastern corner of site.

Appendix D

Bore Logs

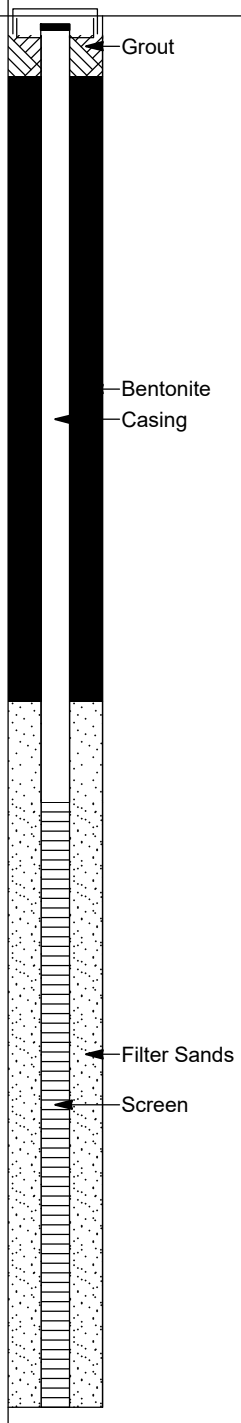
MONITORING WELL LOG AB_BH01 / AB_MW01

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

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
DRILLING METHOD Non-destructive Drilling, Hand Auger & SSAs
SAMPLING METHOD Grab
SURFACE ELEVATION 4.423 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 29/9/2019
BLANK 0.0 - 3.9 m bgl
SCREEN 3.9 - 6.9 m bgl
GRAVEL PACK 3.4 - 6.9 m bgl
SANITARY SEAL/BENTONITE 0.3 - 3.4 m bgl
NORTHING 7756783.3
EASTING 680435.6

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			AB_BH01_0.25_190729				CONCRETE	0.25
0.0			AB_BH01_0.5_190729				FILL: Sandy CLAY, brown, dry, firm, medium plasticity, with fine-medium angular gravels.	0.40
0.0			AB_BH01_1.0_190729		1.0		FILL: CLAY, pale grey/blue, dry, stiff, medium-high plasticity. Brown mottle @0.90m bgl.	
0.0			AB_BH01_1.5_190728				Trace of coarse sub-angular/sub-rounded gravels @ 1.40m bgl.	1.80
0.0			AB_BH01_2.0_190729		2.0		CLAY, brown, minor grey mottle, slightly moist, firm, medium plasticity, trace of coarse sand.	
0.0			AB_BH01_3.0_190729		3.0			
0.0			AB_BH01_4.0_190729		4.0		No mottle and no sand @ 4.40m bgl.	
0.0			AB_BH01_5.0_190729		5.0		Slightly moist @ 4.80m bgl. Wet @ 5.00m bgl.	
0.0			AB_BH01_6.0_190729		6.0			
0.0			AB_BH01_6.8_190729				Refusal @ 6.90m bgl on rock. Total Depth: 6.90 m	6.90



AB_BORELOGS_DRAFT.GPJ 16/12/19

MONITORING WELL LOG AB_BH02 / AB_MW02

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

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
DRILLING METHOD Non-destructive Drilling, Hand Auger & SSAs
SAMPLING METHOD Grab
SURFACE ELEVATION 4.315 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 30/9/2019
BLANK 0.0 - 3.8 m bgl
SCREEN 3.8 - 5.8 m bgl
GRAVEL PACK 3.3 - 3.8 m bgl
SANITARY SEAL/BENTONITE 0.8 - 3.3 m bgl
NORTHING 7756828.7
EASTING 680411.8

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							CONCRETE	0.15
0.0			AB_BH02_0.2_190730	*			FILL: Silty CLAY, pale grey/blue, brown mottle, dry, firm, medium plasticity, with coarse sand.	
0.0			AB_BH02_0.5_190730	*			Minor brown/orange mottle @ 0.40m bgl.	
0.0			AB_BH02_1.0_190730		1.0		Mottled pale grey/brown, low plasticity, trace of fine sub-angular gravels @ 0.80m bgl.	
								1.20
0.0			AB_BH02_1.5_190730				FILL: Sandy CLAY, mottled brown/orange/grey, dry, firm, no plasticity, with fine angular gravels.	
								1.80
0.0			AB_BH02_2.0_190730		2.0		DISTURBED NATURAL: Silty CLAY, brown, grey/orange mottle, slightly moist, very stiff, medium plasticity, with coarse sand.	
								2.40
0.0			AB_BH02_3.0_190730		3.0		Silty CLAY, brown, wet, firm, high plasticity, trace of fine sub-rounded gravels, with coarse sand.	
0.0			AB_BH02_4.0_190730	*	4.0		Trace of coarse sub-rounded gravels and isolated sub-rounded cobbles @ 3.80m bgl.	
					5.0			
0.0			AB_BH02_5.5_190730					
								5.80
							Refusal @ 5.80m bgl on rock. Total Depth: 5.80 m	

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

AB_BORELOGS_DRAFT.GPJ 16/12/19

MONITORING WELL LOG AB_BH03 / AB_MW03

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

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
DRILLING METHOD Non-destructive Drilling, Hand Auger & SSAs
SAMPLING METHOD Grab
SURFACE ELEVATION 3.867 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 29/9/2019
BLANK 0.0 - 1.5 m bgl
SCREEN 1.5 - 4.5 m bgl
GRAVEL PACK 1.0 - 4.5 m bgl
SANITARY SEAL/BENTONITE 0.3 - 1.0 m bgl
NORTHING 7756824
EASTING 680464

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			AB_BH03_0.1_190729				FILL: Silty CLAY loam, brown, dry, firm, no plastcity, trace of bitumen, with coarse angular gravels and cobbles.	
								0.40
0.0			AB_BH03_0.5_190729				FILL: Silty CLAY, brown, light brown mottle, dry, stiff, low plasticity, with fine-medium angular gravels.	
								0.90
0.0			AB_BH03_1.0_190729		1.0		FILL: Sandy CLAY, black, minor grey/yellow mottle, dry, firm, low plasticity, with coarse sand.	
								1.70
0.0			AB_BH03_2.0_190729		2.0		FILL/DISTURBED NATURAL: Gravelly CLAY, brown, slightly moist, stiff, medium-high plasticity, with fine-medium sub-angular gravels.	
							Moist @ 2.50m bgl.	
0.0			AB_BH03_3.0_190729		3.0			
					4.0			
								4.30
0.0			AB_BH03_4.5_190729				Silty CLAY, brown, wet, firm, medium-high plasticity, with fine sub-angular gravels (possibly fragments of bedrock).	4.50
							Refusal @ 4.50m bgl on rock. Total Depth: 4.50 m	

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

AB_BORELOGS_DRAFT.GPJ 16/12/19

MONITORING WELL LOG AB_BH04 / AB_MW04

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

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
DRILLING METHOD Non-destructive Drilling, Hand Auger & SSAs
SAMPLING METHOD Grab
SURFACE ELEVATION 3.780 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 29/9/2019
BLANK 0.0 - 2.0 m bgl
SCREEN 2.0 - 5.0 m bgl
GRAVEL PACK 1.5 - 5.0 m bgl
SANITARY SEAL/BENTONITE 0.3 - 5.0 m bgl.
NORTHING 7756849.4
EASTING 680453.4

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			AB_BH04_0.1_190729				FILL: Silty CLAY, dark brown, dry, firm, no-low plasticity, isolated angular cobbles.	
								0.40
0.0			AB_BH04_0.5_190729				FILL: Gravelly CLAY, brown, grey mottle, dry, stiff, low-medium plasticity, with fine-coarse angular gravels.	
0.0			AB_BH04_1.0_190729		1.0		Intermixed with LANDFILL returned as plastic bags, glass, concrete, brick, tile, rope, cloth and assorted plastic waste products.	
								1.60
0.0			AB_BH04_2.0_190729		2.0		FILL: CLAY, pale grey/blue, very slightly moist, stiff, medium-high plasticity, trace of sand, trace of fine sub-angular gravels. Slightly moist @ 2.10m bgl.	
								2.60
0.0			AB_BH04_3.0_190729		3.0		Silty CLAY, brown, minor grey/orange mottle, slightly moist, firm, medium plasticity, trace of coarse sand.	
0.0			AB_BH04_4.0_190729		4.0		Wet @ 3.60m bgl.	
0.0			AB_BH04_5.0_190729		5.0		End of hole at target depth. Total Depth: 5.00 m	5.00

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

AB_BORELOGS_DRAFT.GPJ 16/12/19

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

BOREHOLE LOG AB_SS1

PROJECT NUMBER 60609758 **DATE** 29/09/2019
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
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
0.1		AB_SS1_0.1_190729	✳			CL-ML	FILL: Silty CLAY loam, brown, dry, firm, no plasticity, with medium-coarse sub-angular/sub-rounded gravels. With sub-angular cobbles @ 0.20m blg.	0.30
0.0		AB_SS1_0.5_190729	✳			CLG	FILL: Gravelly CLAY, brown, dry, firm, no plasticity, coarse sub-rounded/sub-angular gravels and cobbles.	0.50
							End of hole at target depth. Total Depth: 0.50 m	

AB_BORELOGS_DRAFT.GPJ 16/12/19

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

BOREHOLE LOG AB_SS2

PROJECT NUMBER 60609758 **DATE** 29/09/2019
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
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
						CLG	FILL: Gravelly CLAY, brown, dry, firm, no plasticity, coarse sub-rounded/sub-angular gravels and cobbles.	
0.1		AB_SS2_0.1_190729	✳					
						CL-CH	FILL: CLAY, mottled brown/red/orange/grey, dry, stiff, no-low plasticity, with fine-medium angular gravels.	0.35
0.0		AB_SS2_0.5_190729	✳					
							End of hole at target depth. Total Depth: 0.50 m	0.50

AB_BORELOGS_DRAFT.GPJ 16/12/19

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

BOREHOLE LOG AB_SS3

PROJECT NUMBER 60609758 **DATE** 29/09/2019
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
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		AB_SS3_0.1_190729	✳			CL-ML	FILL: Silty CLAY loam, brown, slightly moist, firm, no plasticity.	
								0.25
						CL-CH	FILL: CLAY, brown, dry, stiff, medium plasticity.	
0.0		AB_SS3_0.5_190729	✳				Light brown @ 0.45m bgl.	
								0.50
							End of hole at target depth. Total Depth: 0.50 m	

AB_BORELOGS_DRAFT.GPJ 16/12/19

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

BOREHOLE LOG AB_SS4

PROJECT NUMBER 60609758 **DATE** 29/09/2019
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
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
						CLG	FILL: Gravelly CLAY, brown, dry, stiff, no plasticity, with fine-medium sub-angular gravels and isolated brick fragments.	
0.0		AB_SS4_0.1_190729	✳					
						CLS	FILL: Sandy CLAY, light brown, orange mottle, slightly moist, stiff, medium plasticity, trace of fine angular gravels.	0.35
0.0		AB_SS4_0.5_190729	✳					
							End of hole at target depth. Total Depth: 0.50 m	0.50

AB_BORELOGS_DRAFT.GPJ 16/12/19

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

BOREHOLE LOG AB_SS5

PROJECT NUMBER 60609758 **DATE** 29/09/2019
PROJECT NAME QFES PFAS DSI - Airlie Beach
LOCATION 2495 Shute Harbour Road, Mandalay, 4802
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
0.3		AB_SS5_0.1_190729	✳			CL-ML	FILL: Silty CLAY loam, brown, dry, firm, no plasticity, with medium-coarse sub-angular/sub-rounded gravels.	0.25
0.0		AB_SS5_0.5_190729	✳			CLG	FILL: Gravelly CLAY, brown, dry, firm, no plasticity, coarse sub-rounded/sub-angular gravels and cobbles.	0.50
							End of hole at target depth. Total Depth: 0.50 m	

AB_BORELOGS_DRAFT.GPJ 16/12/19

Appendix E

Fieldsheets and Calibration Certificates

Aus Groundwater Schooling Uni of Tech Sydney - conform 1 and module

ANZ

FQM - Groundwater Sampling and Purging Record

AECOM

Q4AN(EV)-405-FM1

Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Bore ID:**	MW01
Client:	QFES	**Project Location:**	Airlie Beach	**Fieldwork Staff:**	NK	**Sample Date:**	8/8/19

Well Development or Well Sampling Event? (circle)

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 8/8/19	Bore Radius (mm): 200mm	Chem Kit Serial No.:	☐ Decontaminated	☐ Low Flow Pump rate: 1/2	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 1.168	Screen Interval (m): Bott. 0.5m	Chem Kit Model:	☐ Dedicated	Intake depth: 5.00	Hydrasleeve Type:	
Bore Depth (m-pvc): 5.468	Casing Radius (mm): 50mm	**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
14:02	0	1.189	@ 1/2	–	–	–	–	–	Brown / High turbidity.
14:05	0.5	1.258	"	1.29	3829	6.86	140.9	27.8	"
14:08	1.0	1.278	"	0.94	3864	6.85	140.7	27.8	"
14:11	1.5	1.276	"	0.78	3870	6.86	140.0	27.7	Cleared up
14:14	2.0	"	"	0.77	3874	6.87	139.7	27.7	"
14:17	2.5	"	"	0.76	3875	6.87	139.4	27.6	
				✓	✓	✓	✓	✓	
				– Sampled @	2.5L	@ 1420			
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	

Field Commets

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

Approval and Distribution

Fieldwork Staff Signature — Date — Checker Name and Signature — Date

Project Manager Signature — Date — **Distribution:** Project Central File

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

TURN

Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Bore ID:**	MW02
Client:	QFES	**Project Location:**	Amie Beach	**Fieldwork Staff:**	NK	**Sample Date:**	8/8/19
						Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 8/8/19	Bore Radius (mm): 200	Chem Kit Serial No.: 19C101112	☑ Decontaminated	☑ Low Flow Pump rate: 1/2	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 1.002	Screen Interval (m): –	Chem Kit Model: YSI ProPlus.	☐ Dedicated	Intake depth: 4.25	Hydrasleeve Type:	
Bore Depth (m-pvc): 4.764	Casing Radius (mm): 50	**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
10:35	0	1.009	1/2	–	–	–	–	–	
10:38	0.5	"	"	1.73	1483	7.10	45.3	27.2	Orange/brown, high turb, very silty.
10:41	1.0	"	"	1.98	1480	7.06	37.3	27.2	"
10:44	1.5	"	"	1.74	1474	7.08	31.9	27.1	"
10:47	2.25	"	"	1.22	1454	7.15	23.1	27.0	"
10:50	2.75	"	"	0.89	1433	7.23	16.6	27.1	"
10:53	3.25	"	"	0.66	1413	7.30	10.0	27.1	"
10:56	4.00	"	"	0.48	1390	7.36	1.9	27.0	"
10:59	4.5	"	"	0.42	1387	7.38	-2.8	27.1	
11:02	5.0	"	"	0.42	1380	7.39	-1.7	27.1	
		—	Sampled	@ 1110	@	SL.			
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)	AB_QC106	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	AB_QC206	//

Approval and Distribution

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

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW03
Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Sample Date:**	
Client:	QFES	**Project Location:**	Airlie Beach	**Fieldwork Staff:**	NK	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 8/8/19	Bore Radius (mm): 200mm	Chem Kit Serial No.: 19C1011/2	☑ Decontaminated	☐ **Low Flow** Pump rate: 1/2	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 0.861	Screen Interval (m): Bottom 0.5	Chem Kit Model: YSI Pro Plus	☐ Dedicated	Intake depth: 4.0	Hydrasleeve Type:	
Bore Depth (m-pvc): 4.362	Casing Radius (mm): 50mm	**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
13:25	0	0.948	1/2	–	–	–	–	–	
13:28	0.75	"	"	0.24	2075	7.24	106.7	25.6	Med turbidity, Brown/orange.
13:31	1.25	"	"	0.24	2071	7.23	106.3	25.6	"
13:34	1.75	"	"	0.21	2068	7.23	106.9	25.5	"
13:37	2.0	"	"	0.20	2070	7.23	108.2	25.6	"Cleared up.
			Sampled @	13:40	@ 2L.				
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	1	x 250 mL Plastic	//	
									//

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

Turn

						Bore ID:	MW04
Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Sample Date:**	8/8/19
Client:	QFES	**Project Location:**	Airlie Beach	**Fieldwork Staff:**	NK	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 8/8/19	Bore Radius (mm): 200 ?	Chem Kit Serial No.:	☑ Decontaminated	☑ Low Flow Pump rate: 1/4	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 1.071	Screen Interval (m): Bottom 0.5	Chem Kit Model:	☐ Dedicated	Intake depth: 4.5	Hydrasleeve Type:	
Bore Depth (m-pvc): 5.154	Casing Radius (mm): 50	**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
10:25	1.0	1.244	1/4	0.41	1626	7.47	21.9	25.9	- Clear, pale yellow/brown
10:30	1.5	[illegible]	"	0.27	1630	7.48	0.9	26.1	"
11:31	1.75	1.557 1.625	"	0.26	1630	7.47	8.5	26.1	" Droping SWL - adjust to slowest speed.
11:36	2.25	1.735	"	0.23	1625	7.47	17.9	26.0	" @ slowest speed possible
11:41	2.50	1.810	"	0.22	1625	7.46	23.4	26.0	"
11:46	3.0	1.866	"	0.25	1625	7.46	26.2	26.0	
11:51	4.0	1.968	"	0.23	1622	7.45	29.9	26.0	
11:56	4.25	2.031	"	0.25	1623	7.44	30.7	25.9	
12:01	4.75	2.129	"	0.27	1622	7.44	30.2	25.9	Increase the speed to 1/3 turns, to find stable SWL
12:06	5.5	2.537	1/3	0.25	1622	7.43	23.3	25.9	
12:11	6.0	2.457	"	0.25	1623	7.44	18.3	25.9	slowed pump to 1/4 turn still dropping - leave @ 1/3
12:16	6.75	2.676	"	0.28	1623	7.43	15.8	25.9	
12:21	7.5	2.928	"	0.41	1626	7.43	15.4	25.9	
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	1	x 250 mL Plastic		//

Approval and Distribution

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

ANZ

FQM - Groundwater Sampling and Purging Record

Continued

Q4AN(EV)-405-FM1

~~Sun~~ QFES | 60609758 | James P.

Project Name:	~~Bowen Basin GME~~	**Project Number:**	~~60603041.2.2~~	**PM Name:**	Rob Bartlett / Josh Radford	**Bore ID:**	MW04
Client:	~~Arrow Energy~~ QFES	**Project Location:**	Airlie Beach	**Fieldwork Staff:**	NK	**Sample Date:**	8/8/19
						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: 4.5	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
12:26	8	3.118	1/3	0.62	1627	7.44	20.3	26.1	tested @ 1/4 turn, SWL still ↓
12:31	8.5	3.275	"	0.95	1627	7.46	27.7	26.0	Low flow, brown/orange.
12:36	9.25	3.526	"	1.36	1620	7.49	35.7	26.0	still ↓ @ 1/4 turn.
12:41	10	3.873	"	2.02	1614	7.53	47.3	26.1	
12:46	10.5	3.992	"	2.02	1619	7.52	53.4	26.2	
12:51	11.0	4.077	"	3.57	1592	7.62	59.2	26.2	
12:56	—	4.25	—						
			Left to recharge						
14:45		1.556	-	3.49	1548	7.83	163.9	25.9	
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		

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**

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: **15/07/2019**

Next calibration due: **11/01/2020**

AECOM

ANZ

FQM - Water Quality Meter Calibration Record

Q4AN(EV)-410-FM1

Project Name:	~~Bowen Basin GME~~ QFES Surat	**Project Number:**	~~60603041, 2.1~~ 60609758
Project Location:	Airlie Beach	**Client:**	~~Arrow Energy~~ QFES
PM Name:	~~Rob Bartlett / Josh Radford~~ James P	**Fieldwork Staff Name:**	

This calibration record is intended to prompt fieldwork staff to calibrate water quality meter (WQM) daily before the start of fieldworks.

INSTRUMENT DETAILS

Supplier:	Aimet
Make and Model:	YGI Pro plus.
Serial Number:	

CALIBRATION

CALIBRATE WITH CALIBRATION SOLUTIONS

Date and Time:	10:00 8/8/19				
Parameter	Acidity		Conductivity	Dissolved Oxygen	
Units	pH	pH	µS/cm	ppm	ppm
Calibration Standard Concentration:	4.0	7.0			
Calibration Reading:	4.0	7.01			
Calibration Temperature:	24.9	24.6			

ONGOING CHECKS

BUMP TEST WITH CALIBRATION SOLUTION

Date and Time:	10:00 8/8/19				
Parameter	Acidity		Conductivity	Dissolved Oxygen	ORP
Units	pH	pH	µS/cm	ppm	ppm
Calibration Standard Concentration:	4.0	7.0	2707	Zero	232.4
Bump Test Reading:	3.93	7.09	2693	0.03	232.3
Bump Test Temperature:	24.8	24.4	24.0	24.7	25°C

COMMENTS

Detail any equipment faults, minor maintenance performed, change of batteries or technical support provided.

Approval and Distribution

☐ Each individual instrument has been inspected and calibrated daily and bump tested as required by fieldwork staff.

Fieldwork Staff Signature **Date**

Distribution: Project Central File

Appendix F

Surveying Report

Our Ref: 400571
Surveyed - Veris
Date of Survey 8/8/19
Site Address: 2495 Shute Harbour Road, Jubilee Pocket

Origin of Coordinates

Projection	MGA Zone 55
Coordinate Datum	GDA94
Height Datum	AHD

Coordinate Origin PM 96448 E 680 421.603m, N 7 756 776.076m, Z 4.509m

Point ID	Easting (m)	Northing(m)	Elevation (m)
MW01 CASING	680435.637	7756783.311	4.423
MW01 Natural Surface Level	680435.561	7756783.219	4.505
MW02 CASING	680411.800	7756828.723	4.315
MW02 Natural Surface Level	680411.877	7756828.803	4.386
MW04 CASING	680453.363	7756849.423	3.780
MW04 Natural Surface Level	680453.525	7756849.577	3.880
MW03 CASING	680464.034	7756823.985	3.867
MW03 Natural Surface Level	680464.176	7756824.117	3.967

Appendix G

Analytical Data Validation

Appendix G - Analytical Data Validation

G1.0 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.

G1.1 Step 1 – State the Problem

A report prepared by QFES in November 2018 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.

G1.2 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.

G1.3 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 and February 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 for each of the six sites 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, groundwater and sediment analytical results collected between July and August 2019 as presented in this DSI report.

G1.4 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 beneath each site. This is considered to be less than 20 mbgl.

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

G1.5 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.

G1.5.1 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.

G1.5.2 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.

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).

G1.5.3 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.

G1.5.4 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.

G1.5.5 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 outlines 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.

G1.5.7 Step 7 – Optimise the Design for Obtaining Data

The methodology presented in this SAQP 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).

G2.0 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.

G3.0 Field QA/QC Data Assessment

G3.1 General

All 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 NATA accredited laboratories (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).

G3.2 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.

G3.3 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 a 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	22	3	14	3	14
Water samples	4	1	25	1	25
Sediment samples	4	1	25	1	25

G3.4 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 Soil and Sediment RPDs

An evaluation of the soil and sediment datasets are presented in **Table G1 and Table G2** respectively. The RPD non-conformances for PFAS compounds are summarised in the table below.

Summary of key PFAS RPD non-conformances for soil and sediment

Primary Sample ID	QC sample ID	PFOS	PFOA	PFDS	PFUnDA	PFTrDA	PFBA
AB_BH03_0.1_190729	AB_QC100_190729	58%	86%	148%	46%	-	-
	AB_QC200_190729	82%	137%	-	69%	120%	-
AB_BH01_0.5_190729	AB_QC103_190729	60%	-	-	-	-	-
	AB_QC203_190729	89%	-	-	-	-	-
AB_SS1_190729	AB_QC101_190729	100%	-	-	-	-	-
	AB_QC201_190729	34%	-	-	57%	91%	199%
AB_SED04_190808	AB_QC205_190808	151%	-	156%	123%	170%	-

The largest RPD was detected in the dataset for AB_SS01_0.1 where PFBA was reported at 0.64 mg/kg in the triplicate sample, and below the LOR (<0.0002 mg/kg) in the primary and duplicate sample. The reason for the difference is not known and 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.

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.

Groundwater RPDs

An evaluation of the groundwater dataset is presented in **Table G3**. There were no RPD non-conformances reported for groundwater samples.

G3.5 Rinsate Blank Samples

To assess the effectiveness of sampling procedures, four 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 the rinsate blank samples are presented in **Table G4**. All PFAS concentrations were below the LOR. This indicates that decontamination procedures were adequate and indicates that no cross contamination occurred during the fieldwork. The data are deemed acceptable for interpretative use and not considered to impact on data interpretation for this investigation.

G4.0 Laboratory QA/QC

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

ALS – EB1919838, EB1921176, EB1921187, EB1922105.

NMI – RN1242611, RN1244319.

G4.1 Extraction and Analysis Holding Time

All samples were received and analysed within the specified holding times with the exception of moisture content within AB_SS5_0.5 (TOPA). It should be noted that moisture content was analysed within the holding time for the standard analysis and that this exceedance was due to the rebatching of this sample for TOPA analysis.

G4.2 Laboratory QA/QC

The laboratories used in the investigation (ALS for primary and duplicate samples and NMI for triplicate samples) are 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 this investigation, 44 primary and field quality control samples were analysed across six laboratory batches. Two of the laboratory batches, EB1921187 and EB1922105, were samples rebatched for TOPA analysis.

G4.2.1 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. No method blank value outliers were identified in any of the batches.

G4.2.2 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 EB1919838 (MeFOSE) and five analytes (PFBA, MeFOSA, EtFOSA, MeFOSE, EtFOSE) in EB1921176. The non-conformances were for recovery less than the lower control limit. As advised by ALS, a batch is accepted if at least 80% of the analytes results have 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.

G4.2.3 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 is 1 in 10.

The RPDs for laboratory duplicate samples were within the limits for all analytes for all batches with the exception of the following non-conformances:

- EB1919838: The recovery of PFTrDA in an anonymous soil sample slightly exceeded the RPD limit.
- EB1921176: The recovery of PFOS in sediment sample AB_SED04_190808 slightly exceeded the RPD limit for PFOS.

The non-conformances are considered likely to be due to sample heterogeneity within the laboratory QC samples.

Batches EB1921187 and EB1921176 included samples collected from fire station sites other than Airlie Beach Fire Station. Some of these samples reported non-conformances for laboratory duplicates. As these samples are not relevant to Airlie Beach Fire Station, the results are not considered further.

G4.2.4 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.

Details of MS non-conformances within the dataset are presented in the table below.

Summary of Matrix Spike Recovery non-conformances

Batches		Comments
EB1919838 (SS3_0.5)	PFHxS, 10 FTS	Recovery was less than the lower data quality objective.
	PFOS	MS recovery not determined as background level was greater than or equal to 4x spike level.
EB1921176 Water-anonymous sample	EtFOSAA, 6:2 FTS	Recovery was less than the lower data quality objective.
	PFUnDA, 10:2 FTS	Recovery was less than the lower data quality objective.

The recovery of matrix spikes above and 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.

G4.2.5 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.

A summary of batches with surrogate spike recovery non-conformances are presented in the table below.

- EB1921176: Recovery was less than the lower data quality objective for 13C4-PFOS and 13C8-PFOA for samples AB_SED02, AB_SED03, AB_SED04 and AB_SQC105.
- EB1919838: Recovery was less than the lower data quality objective for 13C4-PFOS and 13C8-PFOA for sample AB_SS02_0.5.

Surrogate spike recovery non-conformance is potentially due to the matrix of the particular samples rather than the surrogate recovery and as such does not affect the quality of the data for interpretative use.

G4.2.6 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.

G5.0 Conclusions

While a small number of non-conformances with the laboratory QA/QC have been identified, which are considered to be related to sample heterogeneity, 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.

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		Lab Report Number	EB1919838	EB1919838		EB1919838	RN1242611		EB1919838	EB1919838		EB1919838	RN1242611		EB1919838	EB1919838		EB1919838	RN1242611	
		Field ID	AB_BH03_0.1 _190729	AB_QC100 _190729	RPD	AB_BH03_0.1 _190729	AB_QC200_190729	RPD	AB_BH01_0.5_190729	AB_QC103_190729	RPD	AB_BH01_0.5_190729	AB_QC203_190729	RPD	AB_SS1_0.1 _190729	AB_QC101_190729	RPD	AB_SS1_0.1 _190729	AB_QC201_190729	RPD
		Sampled Date	29/07/2019	29/07/2019		29/07/2019	29/07/2019		29/07/2019	29/07/2019		29/07/2019	29/07/2019		29/07/2019	29/07/2019		29/07/2019	29/07/2019	
	Units	LOR																		
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0005	0.0005	0	0.0005	<0.001	0
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0002	0.0002	0	0.0002	<0.001	0
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	0.0007	80	0.0003	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0015	0.002	29	0.0015	0.002	29
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	**0.0155**	**0.0282**	58	**0.0155**	**0.037**	82	**0.003**	**0.0056**	60	**0.003**	**0.0078**	89	0.017	0.0195	14	**0.017**	**0.024**	34
PFDS	mg/kg	0.0002	**0.0003**	**0.002**	148	**0.0003**	**0.0016**	137	<0.0002	<0.0002	0	<0.0002	<0.001	0	**0.0003**	**0.0009**	100	0.0003	<0.001	0
PFBA	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.002	0	<0.001	<0.001	0	<0.001	<0.002	0	<0.001	<0.001	0	<0.001	0.64	199
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	0.0005	0.0007	33	0.0005	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0005	0.0005	0	0.0005	<0.002	0
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	0.0006	67	0.0003	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0008	0.001	22	0.0008	<0.001	0
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	0.0005	50	0.0003	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0003	0.0003	0	0.0003	<0.001	0
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	**0.0002**	**0.0005**	86	0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0003	0.0003	0	0.0003	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	0.0006	67	0.0003	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0008	0.0009	12	0.0008	0.001	22
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	0.0003	40	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0002	0.0002	0	0.0002	<0.001	0
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	**0.0045**	**0.0072**	46	**0.0045**	**0.0092**	69	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0418	0.0474	13	**0.0418**	**0.075**	57
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0008	0.001	22	0.0008	<0.002	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0005	0.0008	46	**0.0005**	**0.002**	120	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0282	0.0274	3	**0.0282**	**0.075**	91
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0	<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	<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)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0002	<0.0002	0	<0.0002	<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)	<0.0002	<0.0002	0	<0.0002	<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)	<0.0002	0.0002	0	<0.0002	<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)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0005	<0.0005	0	<0.0005	<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)	<0.0005	<0.0005	0	<0.0005	<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 EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***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		EB1921176-AL	EB1921176-AL			EB1921176-AL	RN1244319	
Field ID		AB_SED04_190808	AB_QC105_190808	**RPD**		AB_SED04_190808	AB_QC205_190808	**RPD**
Sampled Date		8/08/2019	8/08/2019			8/08/2019	8/08/2019	
	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)	0.0013	0.0015	14	**0.0013**	**0.0094**	**151**
PFDS	mg/kg	0.0002	0.0004	0.0003	29	**0.0004**	**0.0032**	**156**
PFBA	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.002	0
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<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)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0006	0.0006	0	**0.0006**	**0.0025**	**123**
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0008	0.0011	32	**0.0008**	**0.01**	**170**
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
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)	<0.0005	<0.0005	0	<0.0005	<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 EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***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		EB1921176-AL	EB1921176-AL		EB1921176-AL	RN1244319	
Field ID		AB_MW02_190808	AB_QC106_190808	**RPD**	AB_MW02_190808	AB_QC206_190808	**RPD**
Sampled Date		8/08/2019	8/08/2019		8/08/2019	8/08/2019	
	Units	**LOR**						
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	0.059	0.064	8	0.059	0.064	8
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	0.071	0.065	9	0.071	0.07	1
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.338	0.364	7	0.338	0.42	22
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	0.01	0.01	0	0.01	0.008	22
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	0.212	0.274	26	0.212	0.28	28
PFDS	mg/kg	0.0002	<0.002	<0.002	0	<0.002	<0.001	0
PFBA	mg/kg	0.001	0.04	0.04	0	0.04	0.053	28
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	0.049	0.051	4	0.049	0.055	12
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	0.104	0.102	2	0.104	0.11	6
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	0.027	0.028	4	0.027	0.03	11
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	0.024	0.023	4	0.024	0.025	4
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	0.07	0.075	7	0.07	0.093	28
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	<0.002	<0.002	0	<0.002	0.0029	37
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	0.008	0.008	0	0.008	0.015	61
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.002	<0.002	0	<0.002	<0.001	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.002	<0.002	0	<0.002	<0.002	0
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.005	<0.005	0	<0.005	<0.002	0
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.005	<0.005	0	<0.005	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.005	<0.005	0	<0.005	<0.001	0
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.005	<0.005	0	<0.005	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	<0.005	<0.005	0	<0.005	<0.001	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.002	<0.002	0	<0.002	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.002	<0.002	0	<0.002	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.002	<0.002	0	<0.002	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.005	<0.005	0	<0.005	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.005	<0.005	0	<0.005	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.005	<0.005	0	<0.005	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.005	<0.005	0	<0.005	<0.005	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))

***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		EB1919838	EB1919838	EB1919838	EB1919838	EB1921176-AL
Field ID		AB_QC300_190729	AB_QC301 _190729	AB_QC303_190730	AB_QC302_190730	AB_QC304_190808
Sampled Date		29/07/2019	29/07/2019	30/07/2019	30/07/2019	8/08/2019
	Units	**LOR**				
PFBS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFPeS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHxS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHpS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFOS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFBA	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PFPeA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHxA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFHpA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFOA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFNA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFUnDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFDoDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFTrDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFTeDA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
6:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
10:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSAA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
EtFOSAA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
FOSA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
EtFOSA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
EtFOSE	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MeFOSE	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Appendix H

Analytical Laboratory Reports

ALSCompass
SAMPLING *Intelligence*

Environmental Division
Brisbane
Work Order Reference
EB1919838

Telephone : + 61-7-3243 7222

Custody Document for Submissions via ALS Compass App

Project: 606909758 20 - AB **Client:** AECOM Pty Ltd **Project Manager:** James Peachey
Phone: (0425 206 362

ALS Compass COC Reference: 2652 **# Samples:** **Sampler:** Camden McCosker
Phone: (0499 990 214

Turnaround Requirements: Standard 5 Day Urgent

Special Instructions:

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
Camden	K Schafer	K Schafer	M. Birch
Date / Time:	**Date / Time:** 31-7-19 09:45	**Date / Time:** 31-7-19 1600	**Date / Time:** 1/8/19 9:40

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1919838**

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_AB	Page	: 1 of 4
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: 2652	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CAMDEN McCOSKER		

Dates

Date Samples Received	: 01-Aug-2019 09:40	Issue Date	: 07-Aug-2019
Client Requested Due Date	: 08-Aug-2019	Scheduled Reporting Date	: **08-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 3	Temperature	: 1.4°C; 1.6°C; -0.7°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 50 / 29

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
- ***SRN Reissued 7/8/19: As per the email from Camden McCosker 7/8/19, the sample ID's for ALS #38-39 have been changed to "BH02".***
- ***01/08/2019*: SRN has been resent to acknowledge samples have been fowarded to NMI as requested on the Chain of Custody. This will incur a freight fowarding fee. For any further information regarding these adjustments 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.**
- 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)
EB1919838-001	19-Jul-2019 15:17	AB_SS3_0.1_190729		✓	✓
EB1919838-002	29-Jul-2019 11:24	AB_SS3_0.5 _190729		✓	✓
EB1919838-003	29-Jul-2019 11:26	AB_BH03_0.1 _190729		✓	✓
EB1919838-004	29-Jul-2019 11:27	AB_BH03_0.5 _190729	✓		
EB1919838-005	29-Jul-2019 11:27	AB_BH03_1.0 _190729		✓	✓
EB1919838-006	29-Jul-2019 11:28	AB_BH03_2.0_190729	✓		
EB1919838-007	29-Jul-2019 11:29	AB_BH03_3.0 _190729	✓		
EB1919838-008	29-Jul-2019 11:30	AB_BH03_ 4.5_190729		✓	✓
EB1919838-009	29-Jul-2019 12:31	AB_SS4_0.1 _190729		✓	✓
EB1919838-010	29-Jul-2019 12:32	AB_SS4_0.5 _190729		✓	✓
EB1919838-011	29-Jul-2019 12:32	AB_SS2_0.1 _190729		✓	✓
EB1919838-012	29-Jul-2019 12:33	AB_SS2_0.5 _190729		✓	✓
EB1919838-013	29-Jul-2019 12:33	AB_SS1_0.1 _190729		✓	✓
EB1919838-014	29-Jul-2019 12:34	AB_SS1_0.5 _190729		✓	✓
EB1919838-015	29-Jul-2019 12:34	AB_SS5_0.1 _190729		✓	✓
EB1919838-016	29-Jul-2019 12:35	AB_SS5_0.5 _190729		✓	✓
EB1919838-017	29-Jul-2019 14:16	AB_BH04_0.1 _190729		✓	✓
EB1919838-018	29-Jul-2019 14:16	AB_BH04_0.5 _190729	✓		
EB1919838-019	29-Jul-2019 14:19	AB_BH04_1.0 _190729		✓	✓
EB1919838-020	29-Jul-2019 14:19	AB_BH04_2.0 _190729	✓		
EB1919838-021	29-Jul-2019 14:19	AB_BH04_3.0 _190729	✓		
EB1919838-022	29-Jul-2019 14:20	AB_BH04_4.0 _190729	✓		
EB1919838-023	29-Jul-2019 14:20	AB_BH04_5.0 _190729		✓	✓
EB1919838-024	29-Jul-2019 16:24	AB_BH01_0.25_190729		✓	✓
EB1919838-025	29-Jul-2019 16:24	AB_BH01_0.5_190729		✓	✓
EB1919838-026	29-Jul-2019 16:25	AB_BH01_1.0_190729	✓		
EB1919838-027	29-Jul-2019 17:00	AB_BH01_1.5_190729	✓		
EB1919838-028	29-Jul-2019 17:01	AB_BH01_2.0_190729	✓		
EB1919838-029	29-Jul-2019 17:01	AB_BH01_3.0_190729	✓		
EB1919838-030	29-Jul-2019 17:04	AB_BH01_4.0 _190729	✓		
EB1919838-031	29-Jul-2019 17:04	AB_BH01_5.0 _190729	✓		
EB1919838-032	29-Jul-2019 17:05	AB_BH01_6.0 _190729		✓	✓
EB1919838-033	29-Jul-2019 17:05	AB_BH01_6.8_190729	✓		
EB1919838-034	30-Jul-2019 08:34	AB_BH02_0.2 _190730		✓	✓
EB1919838-035	30-Jul-2019 08:34	AB_BH02_0.5 _190730		✓	✓

			(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1919838-036	30-Jul-2019 08:35	AB_BH02_1.0 _190730	✓		
EB1919838-037	30-Jul-2019 08:36	AB_BH02_1.5 _190730	✓		
EB1919838-038	30-Jul-2019 09:11	AB_BH02_2.0_190730	✓		
EB1919838-039	30-Jul-2019 09:11	AB_BH02_3.0_190730	✓		
EB1919838-040	30-Jul-2019 09:12	AB_BH02_4.0_190730		✓	✓
EB1919838-041	30-Jul-2019 09:12	AB_BH02_5.5_190730	✓		
EB1919838-044	29-Jul-2019 11:26	AB_QC100 _190729		✓	✓
EB1919838-046	29-Jul-2019 16:23	AB_QC103_190729		✓	✓
EB1919838-048	29-Jul-2019 12:31	AB_QC101_190729		✓	✓
EB1919838-050	30-Jul-2019 08:33	AB_QC104_190730	✓		

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)
EB1919838-042	29-Jul-2019 09:00	AB_QC300_190729		✓
EB1919838-043	29-Jul-2019 11:25	AB_QC301 _190729		✓
EB1919838-045	29-Jul-2019 14:16	AB_QC102_190729	✓	
EB1919838-047	30-Jul-2019 07:05	AB_QC303_190730		✓
EB1919838-049	30-Jul-2019 07:04	AB_QC302_190730		✓

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
- EDI Format - XTab (XTAB)	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
- EDI Format - XTab (XTAB)	Email	james.peachey@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1919838**	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_AB	Date Samples Received	: 01-Aug-2019 09:40
Order number	: 60609758 2.0	Date Analysis Commenced	: 01-Aug-2019
C-O-C number	: 2652	Issue Date	: 08-Aug-2019 11:13
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 50		
No. of samples analysed	: 29		

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*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Minh Wills	2IC Organic Chemist	Brisbane Organics, 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 'AB_SS2_0.5 _190729' shows poor surrogate recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Matrix spike shows results out of control limit due to primary sample matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Sample shows poor duplicate results due to sample heterogeneity. Confirmed by re-extraction and re-analysis.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	AB_SS3_0.1_190729	AB_SS3_0.5 _190729	AB_BH03_0.1 _190729	AB_BH03_1.0 _190729	AB_BH03_ 4.5_190729
			Client sampling date / time	19-Jul-2019 15:17	29-Jul-2019 11:24	29-Jul-2019 11:26	29-Jul-2019 11:27	29-Jul-2019 11:30
Compound	CAS Number	LOR	Unit	EB1919838-001	EB1919838-002	EB1919838-003	EB1919838-005	EB1919838-008
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**17.0**	**20.4**	**8.0**	**18.1**	**22.2**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	**0.0003**	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	**0.0002**	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0023**	**0.0029**	**0.0003**	**0.0009**	**0.0007**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	**0.0006**	**0.0009**	<0.0002	**0.0003**	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.202**	**0.152**	**0.0155**	**0.177**	**0.0016**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	**0.0009**	<0.0002	**0.0003**	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0006**	**0.0005**	**0.0005**	**0.0004**	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0014**	**0.0013**	**0.0003**	**0.0004**	**0.0003**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0003**	**0.0005**	**0.0003**	**0.0002**	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0011**	**0.0016**	**0.0002**	**0.0003**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0012**	**0.0011**	**0.0003**	**0.0014**	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0007**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	**0.0007**	<0.0002	**0.0045**	**0.0004**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	**0.0005**	<0.0002	<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	AB_SS3_0.1_190729	AB_SS3_0.5 _190729	AB_BH03_0.1 _190729	AB_BH03_1.0 _190729	AB_BH03_ 4.5_190729
				Client sampling date / time	19-Jul-2019 15:17	29-Jul-2019 11:24	29-Jul-2019 11:26	29-Jul-2019 11:27	29-Jul-2019 11:30
Compound	CAS Number	LOR	Unit		EB1919838-001	EB1919838-002	EB1919838-003	EB1919838-005	EB1919838-008
					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	<0.0005
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		**0.212**	**0.161**	**0.0227**	**0.181**	**0.0026**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.204**	**0.155**	**0.0158**	**0.178**	**0.0023**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.208**	**0.159**	**0.0171**	**0.179**	**0.0026**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**84.5**	**71.0**	**74.5**	**94.0**	**86.0**
13C8-PFOA	----	0.0002	%		**84.0**	**82.0**	**80.0**	**82.5**	**88.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	AB_SS4_0.1 _190729	AB_SS4_0.5 _190729	AB_SS2_0.1 _190729	AB_SS2_0.5 _190729	AB_SS1_0.1 _190729
				Client sampling date / time	29-Jul-2019 12:31	29-Jul-2019 12:32	29-Jul-2019 12:32	29-Jul-2019 12:33	29-Jul-2019 12:33
Compound	CAS Number	LOR	Unit		EB1919838-009	EB1919838-010	EB1919838-011	EB1919838-012	EB1919838-013
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**16.1**	**16.9**	**14.1**	**12.9**	**11.1**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0005**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0002**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0004**	**0.0008**	**0.0017**	**0.0008**	**0.0015**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	**0.0002**	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0112**	**0.0266**	**0.0228**	**0.0226**	**0.0170**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	**0.0041**	**0.0021**	**0.0003**
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0011**	**0.0017**	**0.0012**	**0.0003**	**0.0005**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0009**	**0.0012**	**0.0012**	**0.0004**	**0.0008**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0012**	**0.0011**	**0.0008**	**0.0002**	**0.0003**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0011**	**0.0008**	**0.0009**	**0.0003**	**0.0003**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0017**	**0.0021**	**0.0010**	**0.0002**	**0.0008**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0008**	**0.0005**	**0.0003**	<0.0002	**0.0002**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0031**	**0.0018**	**0.0010**	**0.0005**	**0.0418**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0008**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		**0.0004**	**0.0002**	**0.0004**	<0.0002	**0.0282**
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	**0.0019**	**0.0009**	<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	AB_SS4_0.1 _190729	AB_SS4_0.5 _190729	AB_SS2_0.1 _190729	AB_SS2_0.5 _190729	AB_SS1_0.1 _190729
				Client sampling date / time	29-Jul-2019 12:31	29-Jul-2019 12:32	29-Jul-2019 12:32	29-Jul-2019 12:33	29-Jul-2019 12:33
Compound	CAS Number	LOR	Unit		EB1919838-009	EB1919838-010	EB1919838-011	EB1919838-012	EB1919838-013
					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	<0.0005
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		**0.0219**	**0.0368**	**0.0375**	**0.0283**	**0.0932**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0116**	**0.0274**	**0.0245**	**0.0234**	**0.0185**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0159**	**0.0322**	**0.0286**	**0.0246**	**0.0209**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**75.0**	**70.0**	**90.0**	**52.5**	**91.5**
13C8-PFOA	----	0.0002	%		**87.5**	**84.5**	**83.5**	**51.5**	**85.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	AB_SS1_0.5 _190729	AB_SS5_0.1 _190729	AB_SS5_0.5 _190729	AB_BH04_0.1 _190729	AB_BH04_1.0 _190729
			Client sampling date / time	29-Jul-2019 12:34	29-Jul-2019 12:34	29-Jul-2019 12:35	29-Jul-2019 14:16	29-Jul-2019 14:19
Compound	CAS Number	LOR	Unit	EB1919838-014	EB1919838-015	EB1919838-016	EB1919838-017	EB1919838-019
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**14.8**	**17.4**	**16.1**	**15.5**	**23.2**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	**0.0013**	**0.0006**	**0.0003**	**0.0002**	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	**0.0016**	**0.0007**	**0.0003**	**0.0002**	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0146**	**0.0081**	**0.0058**	**0.0025**	**0.0027**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	**0.0008**	**0.0009**	**0.0012**	<0.0002	**0.0004**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0134**	**0.312**	**0.523**	**0.0202**	**0.285**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	**0.0049**	**0.0014**	**0.0009**	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	**0.002**	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	**0.0023**	**0.0013**	**0.0007**	**0.0008**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0010**	**0.0028**	**0.0016**	**0.0008**	**0.0006**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	**0.0024**	**0.0010**	**0.0007**	**0.0003**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0004**	**0.0021**	**0.0018**	**0.0007**	**0.0005**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0011**	**0.0031**	**0.0037**	**0.0008**	**0.0007**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	**0.0030**	**0.0020**	**0.0003**	**0.0004**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	**0.0045**	**0.0012**	**0.0020**	**0.0164**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	**0.0007**	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	**0.0011**	**0.0002**	**0.0005**	**0.0013**
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	**0.0012**	**0.0020**	**0.0005**	**0.0016**
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	AB_SS1_0.5 _190729	AB_SS5_0.1 _190729	AB_SS5_0.5 _190729	AB_BH04_0.1 _190729	AB_BH04_1.0 _190729
				Client sampling date / time	29-Jul-2019 12:34	29-Jul-2019 12:34	29-Jul-2019 12:35	29-Jul-2019 14:16	29-Jul-2019 14:19
Compound	CAS Number	LOR	Unit		EB1919838-014	EB1919838-015	EB1919838-016	EB1919838-017	EB1919838-019
					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	**0.0006**
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	**0.0008**	**0.0011**	<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		**0.0342**	**0.353**	**0.548**	**0.0310**	**0.311**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0280**	**0.320**	**0.529**	**0.0227**	**0.288**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0307**	**0.333**	**0.536**	**0.0258**	**0.290**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**85.0**	**77.0**	**89.5**	**83.5**	**92.0**
13C8-PFOA	----	0.0002	%		**82.0**	**89.0**	**86.0**	**85.5**	**90.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	AB_BH04_5.0_190729	AB_BH01_0.25_190729	AB_BH01_0.5_190729	AB_BH01_6.0_190729	AB_BH02_0.2_190730
			Client sampling date / time	29-Jul-2019 14:20	29-Jul-2019 16:24	29-Jul-2019 16:24	29-Jul-2019 17:05	30-Jul-2019 08:34
Compound	CAS Number	LOR	Unit	EB1919838-023	EB1919838-024	EB1919838-025	EB1919838-032	EB1919838-034
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**20.1**	**23.8**	**19.6**	**19.6**	**22.0**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0007**	**0.0022**	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0041**	**0.0044**	**0.0030**	<0.0002	**0.0036**
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	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<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	AB_BH04_5.0_190729	AB_BH01_0.25_190729	AB_BH01_0.5_190729	AB_BH01_6.0_190729	AB_BH02_0.2_190730
				Client sampling date / time	29-Jul-2019 14:20	29-Jul-2019 16:24	29-Jul-2019 16:24	29-Jul-2019 17:05	30-Jul-2019 08:34
Compound	CAS Number	LOR	Unit		EB1919838-023	EB1919838-024	EB1919838-025	EB1919838-032	EB1919838-034
					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	<0.0005
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		**0.0048**	**0.0066**	**0.0030**	<0.0002	**0.0036**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0048**	**0.0066**	**0.0030**	<0.0002	**0.0036**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0048**	**0.0066**	**0.0030**	<0.0002	**0.0036**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**85.0**	**76.0**	**77.5**	**88.5**	**86.0**
13C8-PFOA	----	0.0002	%		**84.5**	**86.5**	**85.0**	**78.5**	**86.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	AB_BH02_0.5 _190730	AB_BH02_4.0_190730	AB_QC100 _190729	AB_QC103_190729	AB_QC101_190729
			Client sampling date / time	30-Jul-2019 08:34	30-Jul-2019 09:12	29-Jul-2019 11:26	29-Jul-2019 16:23	29-Jul-2019 12:31
Compound	CAS Number	LOR	Unit	EB1919838-035	EB1919838-040	EB1919838-044	EB1919838-046	EB1919838-048
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**19.9**	**22.0**	**8.2**	**20.0**	**9.0**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	**0.0005**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	**0.0002**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0018**	**0.0008**	**0.0007**	<0.0002	**0.0020**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	**0.0004**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0088**	**0.0006**	**0.0282**	**0.0056**	**0.0195**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	**0.0020**	<0.0002	**0.0009**
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0002**	<0.0002	**0.0007**	<0.0002	**0.0005**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0006**	**0.0003**	**0.0006**	<0.0002	**0.0010**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0002**	<0.0002	**0.0005**	<0.0002	**0.0003**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0005**	<0.0002	**0.0005**	<0.0002	**0.0003**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	**0.0006**	<0.0002	**0.0009**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	**0.0003**	<0.0002	**0.0002**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	**0.0072**	<0.0002	**0.0474**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	**0.0010**
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	**0.0008**	<0.0002	**0.0274**
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	AB_BH02_0.5 _190730	AB_BH02_4.0_190730	AB_QC100 _190729	AB_QC103_190729	AB_QC101_190729
				Client sampling date / time	30-Jul-2019 08:34	30-Jul-2019 09:12	29-Jul-2019 11:26	29-Jul-2019 16:23	29-Jul-2019 12:31
Compound	CAS Number	LOR	Unit		EB1919838-035	EB1919838-040	EB1919838-044	EB1919838-046	EB1919838-048
					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	<0.0005
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		**0.0125**	**0.0017**	**0.0423**	**0.0056**	**0.102**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0106**	**0.0014**	**0.0289**	**0.0056**	**0.0215**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0121**	**0.0017**	**0.0312**	**0.0056**	**0.0241**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**99.5**	**88.0**	**78.5**	**86.0**	**75.0**
13C8-PFOA	----	0.0002	%		**106**	**97.5**	**92.5**	**88.5**	**94.5**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_QC300_190729	AB_QC301 _190729	AB_QC303_190730	AB_QC302_190730	----
				Client sampling date / time	29-Jul-2019 09:00	29-Jul-2019 11:25	30-Jul-2019 07:05	30-Jul-2019 07:04	----
Compound	CAS Number	LOR	Unit		EB1919838-042	EB1919838-043	EB1919838-047	EB1919838-049	--------
					Result	Result	Result	Result	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
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	0.01	µg/L		<0.01	<0.01	<0.01	<0.01	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
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	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
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	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_QC300_190729	AB_QC301 _190729	AB_QC303_190730	AB_QC302_190730	----
				Client sampling date / time	29-Jul-2019 09:00	29-Jul-2019 11:25	30-Jul-2019 07:05	30-Jul-2019 07:04	----
Compound	CAS Number	LOR	Unit		EB1919838-042	EB1919838-043	EB1919838-047	EB1919838-049	--------
					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	0.005	µg/L		<0.005	<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	<0.002	----
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	0.005	µg/L		<0.005	<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	<0.005	----
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	0.005	µg/L		<0.005	<0.005	<0.005	<0.005	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		<0.002	<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	<0.002	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**87.7**	**77.8**	**90.0**	**90.0**	----
13C8-PFOA	----	0.002	%		**98.1**	**95.1**	**110**	**106**	----

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

QUALITY CONTROL REPORT

Work Order	: **EB1919838**	Page	: 1 of 16
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_AB	Date Samples Received	: 01-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 01-Aug-2019
C-O-C number	: 2652	Issue Date	: 08-Aug-2019
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 50		
No. of samples analysed	: 29		

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*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Minh Wills	2IC Organic Chemist	Brisbane Organics, 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: 2501985)									
EB1919838-001	AB_SS3_0.1_190729	EA055: Moisture Content	----	0.1	%	17.0	17.4	2.14	0% - 20%
EB1919838-014	AB_SS1_0.5 _190729	EA055: Moisture Content	----	0.1	%	14.8	15.5	4.72	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2501986)									
EB1919838-035	AB_BH02_0.5 _190730	EA055: Moisture Content	----	0.1	%	19.9	19.7	1.02	0% - 20%
EB1919842-013	Anonymous	EA055: Moisture Content	----	0.1	%	16.3	15.9	2.39	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501991)									
EB1919838-001	AB_SS3_0.1_190729	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	0.0023	0.0022	4.43	0% - 50%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0006	0.0006	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.202	0.186	8.36	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0009	0.0010	15.4	No Limit
EB1919838-014	AB_SS1_0.5 _190729	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0013	0.0012	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0016	0.0015	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0146	0.0146	0.00	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0008	0.0008	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0134	0.0138	3.23	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: 2501992)									
EB1919838-035	AB_BH02_0.5 _190730	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	0.0018	0.0017	9.52	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0088	0.0078	11.5	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: 2501992) - continued									
EB1919838-035	AB_BH02_0.5 _190730	EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1919839-014	Anonymous	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	0.0009	0.0009	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	0.0108	0.0098	10.3	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0008	0.0007	15.2	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2501991)									
EB1919838-001	AB_SS3_0.1_190729	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0006	0.0006	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	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0011	0.0011	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0012	0.0011	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0007	0.0007	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0007	0.0006	0.00	No Limit
		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
EB1919838-014	AB_SS1_0.5 _190729	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	0.0010	0.0011	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	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0011	0.0012	12.4	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	<0.0002	<0.0002	0.00	No Limit
		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: 2501992)									
EB1919838-035	AB_BH02_0.5 _190730	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	0.0006	0.0006	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	0.0005	0.0004	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	<0.0002	<0.0002	0.00	No Limit
		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

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: 2501992) - continued									
EB1919838-035	AB_BH02_0.5 _190730	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
EB1919839-014	Anonymous	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	0.0003	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	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0004	0.0005	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	0.0126	0.0110	14.4	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0079	# 0.0062	23.9	0% - 20%
		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: 2501991)									
EB1919838-001	AB_SS3_0.1_190729	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
EB1919838-014	AB_SS1_0.5 _190729	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: 2501992)									

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 (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501992) - continued									
EB1919838-035	AB_BH02_0.5 _190730	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
EB1919839-014	Anonymous	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: 2501991)									
EB1919838-001	AB_SS3_0.1_190729	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
EB1919838-014	AB_SS1_0.5 _190729	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: 2501991) - continued									
EB1919838-014	AB_SS1_0.5 _190729	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: 2501992)									
EB1919838-035	AB_BH02_0.5 _190730	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
EB1919839-014	Anonymous	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: 2501826)									
EB1919838-042	AB_QC300_190729	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
EB1919842-038	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

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: 2501826) - continued									
EB1919842-038	Anonymous	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: 2501826)									
EB1919838-042	AB_QC300_190729	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
		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
EB1919842-038	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
		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: 2501826)									
EB1919838-042	AB_QC300_190729	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

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: 2501826) - continued									
EB1919838-042	AB_QC300_190729	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
EB1919842-038	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: 2501826)									
EB1919838-042	AB_QC300_190729	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
EB1919842-038	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: 2501826)									
EB1919838-042	AB_QC300_190729	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
EB1919842-038	Anonymous	EP231X-LL: Sum of PFAS	----	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 (%)*
EP231P: PFAS Sums (QC Lot: 2501826) - continued									
EB1919842-038	Anonymous	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: 2501991)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	84.5	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	81.2	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	77.1	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	77.7	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	74.6	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	72.5	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501992)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	95.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	86.3	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	95.3	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	95.4	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	90.5	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	92.9	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501991)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	75.8	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.0	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.2	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.0	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.0	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.6	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.6	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	59.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	78.7	59	129
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501992)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	68.6	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.8	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.6	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.4	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: 2501992) - continued								
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.8	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	80.1	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501991)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.8	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	90.5	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.0	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	96.0	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	63.1	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	71.6	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.6	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501992)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.8	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	88.0	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	83.5	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 60.7	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	85.2	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501991)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	84.0	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	83.0	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	74.4	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	76.2	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501992)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	95.7	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	87.3	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	88.6	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	129	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: 2501826)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	91.2	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	79.7	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	82.9	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	82.1	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	58.2	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	61.8	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501826)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	76.3	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	81.0	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	84.6	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	82.2	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	74.6	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	70.0	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	60.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	60.6	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	68.4	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	74.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	76.2	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	68.6	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	61.5	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	51.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	62.4	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	62.6	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	57.0	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501826)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	91.6	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	85.2	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	72.2	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	54.1	50	130
EP231P: PFAS Sums (QCLot: 2501826)								
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: 2501826) - 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: 2501991)							
EB1919838-002	AB_SS3_0.5 _190729	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	80.4	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	81.2	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	# 32.8	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	78.4	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	82.0	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501992)							
EB1919838-040	AB_BH02_4.0_190730	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	81.2	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	77.6	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	84.4	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	88.4	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	74.4	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	93.6	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501991)							
EB1919838-002	AB_SS3_0.5 _190729	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	65.4	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	85.2	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	78.0	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	78.4	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	68.8	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	70.4	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	93.2	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	92.8	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	87.2	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	78.8	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	79.2	59	129

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: 2501992)							
EB1919838-040	AB_BH02_4.0_190730	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	60.0	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	81.6	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	92.4	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	82.4	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	90.4	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	82.0	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	86.8	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	84.0	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	80.0	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	74.4	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	82.7	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501991)							
EB1919838-002	AB_SS3_0.5 _190729	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	100	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	87.7	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	88.0	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	65.4	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	75.5	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	105	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	94.0	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501992)							
EB1919838-040	AB_BH02_4.0_190730	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	95.2	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	82.7	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	81.9	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	68.4	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	86.8	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	86.8	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	82.4	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501991)							
EB1919838-002	AB_SS3_0.5 _190729	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	86.8	54	130

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
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501991) - continued							
EB1919838-002	AB_SS3_0.5 _190729	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	90.4	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	90.4	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	# 54.8	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501992)							
EB1919838-040	AB_BH02_4.0_190730	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	86.4	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	79.6	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	84.0	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	124	60	130

Sub-Matrix: **WATER**

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: 2501826)							
EB1919838-043	AB_QC301 _190729	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	73.8	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	73.0	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	76.4	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	75.0	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	68.6	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	57.6	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501826)							
EB1919838-043	AB_QC301 _190729	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	71.8	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	75.4	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	81.6	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	79.8	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	78.2	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	71.0	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	66.4	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	53.6	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	55.0	40	130
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	74.8	40	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	61.8	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826)							
EB1919838-043	AB_QC301 _190729	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	63.6	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	59.9	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	52.2	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	51.0	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*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826) - continued							
EB1919838-043	AB_QC301 _190729	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	57.1	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	52.8	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	51.0	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501826)							
EB1919838-043	AB_QC301 _190729	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	81.4	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	78.0	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	69.0	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	52.4	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1919838**	Page	: 1 of 8
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Telephone	: +61 7 3552 8616
Project	: 60609758_AB	Date Samples Received	: 01-Aug-2019
Site	: ----	Issue Date	: 08-Aug-2019
Sampler	: CAMDEN McCOSKER	No. of samples received	: 50
Order number	: 60609758 2.0	No. of samples analysed	: 29

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.**
- **Duplicate outliers exist - please see following pages for full details.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

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
Duplicate (DUP) RPDs							
EP231B: Perfluoroalkyl Carboxylic Acids	EB1919839--014	Anonymous	**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	23.9 %	0% - 20%	**RPD exceeds LOR based limits**
Laboratory Control Spike (LCS) Recoveries							
EP231C: Perfluoroalkyl Sulfonamides	QC-2501992-002	----	**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	60.7 %	63-124%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1919838--002	AB_SS3_0.5 _190729	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	32.8 %	52-126%	**Recovery less than lower data quality objective**
EP231A: Perfluoroalkyl Sulfonic Acids	EB1919838--002	AB_SS3_0.5 _190729	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1919838--002	AB_SS3_0.5 _190729	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	54.8 %	60-130%	**Recovery less than lower data quality objective**

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP231S: PFAS Surrogate	EB1919838-012	AB_SS2_0.5 _190729	**13C4-PFOS**	----	52.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1919838-012	AB_SS2_0.5 _190729	**13C8-PFOA**	----	51.5 %	70-130 %	**Recovery less than lower data quality objective**

Analysis Holding Time Compliance

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

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

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

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

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)							
AB_SS3_0.1_190729	**19-Jul-2019**	**----**	----	----	**01-Aug-2019**	02-Aug-2019	✓
HDPE Soil Jar (EA055)							
AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729, AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**----**	----	----	**01-Aug-2019**	12-Aug-2019	✓
HDPE Soil Jar (EA055)							
AB_BH02_0.2 _190730, AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**----**	----	----	**01-Aug-2019**	13-Aug-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
AB_SS3_0.1_190729	**19-Jul-2019**	**02-Aug-2019**	15-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X)							
AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X)							
AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X)							
AB_BH02_0.2 _190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X)							
AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**05-Aug-2019**	11-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) AB_SS3_0.1_190729	**19-Jul-2019**	**02-Aug-2019**	15-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.2 _190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) AB_SS3_0.1_190729	**19-Jul-2019**	**02-Aug-2019**	15-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.2 _190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**05-Aug-2019**	11-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) AB_SS3_0.1_190729	**19-Jul-2019**	**02-Aug-2019**	15-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.2 _190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) AB_SS3_0.1_190729	**19-Jul-2019**	**02-Aug-2019**	15-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SS3_0.5 _190729, AB_BH03_0.1 _190729, AB_BH03_1.0 _190729, AB_BH03_ 4.5_190729, AB_SS4_0.1 _190729, AB_SS4_0.5 _190729, AB_SS2_0.1 _190729, AB_SS2_0.5 _190729, AB_SS1_0.1 _190729, AB_SS1_0.5 _190729, AB_SS5_0.1 _190729, AB_SS5_0.5 _190729, AB_BH04_0.1 _190729, AB_BH04_1.0 _190729, AB_BH04_5.0 _190729, AB_BH01_0.25_190729, AB_BH01_0.5_190729, AB_BH01_6.0 _190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_QC100 _190729, AB_QC103_190729, AB_QC101_190729	**29-Jul-2019**	**02-Aug-2019**	25-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.2 _190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**02-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_BH02_0.5 _190730, AB_BH02_4.0_190730	**30-Jul-2019**	**02-Aug-2019**	26-Jan-2020	✓	**05-Aug-2019**	11-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)								
AB_QC300_190729,	AB_QC301 _190729	**29-Jul-2019**	**01-Aug-2019**	25-Jan-2020	✓	**01-Aug-2019**	25-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)								
AB_QC303_190730,	AB_QC302_190730	**30-Jul-2019**	**01-Aug-2019**	26-Jan-2020	✓	**01-Aug-2019**	26-Jan-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-LL)								
AB_QC300_190729,	AB_QC301 _190729	**29-Jul-2019**	**01-Aug-2019**	25-Jan-2020	✓	**01-Aug-2019**	25-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)								
AB_QC303_190730,	AB_QC302_190730	**30-Jul-2019**	**01-Aug-2019**	26-Jan-2020	✓	**01-Aug-2019**	26-Jan-2020	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-LL)								
AB_QC300_190729,	AB_QC301 _190729	**29-Jul-2019**	**01-Aug-2019**	25-Jan-2020	✓	**01-Aug-2019**	25-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)								
AB_QC303_190730,	AB_QC302_190730	**30-Jul-2019**	**01-Aug-2019**	26-Jan-2020	✓	**01-Aug-2019**	26-Jan-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL)								
AB_QC300_190729,	AB_QC301 _190729	**29-Jul-2019**	**01-Aug-2019**	25-Jan-2020	✓	**01-Aug-2019**	25-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)								
AB_QC303_190730,	AB_QC302_190730	**30-Jul-2019**	**01-Aug-2019**	26-Jan-2020	✓	**01-Aug-2019**	26-Jan-2020	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-LL)								
AB_QC300_190729,	AB_QC301 _190729	**29-Jul-2019**	**01-Aug-2019**	25-Jan-2020	✓	**01-Aug-2019**	25-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)								
AB_QC303_190730,	AB_QC302_190730	**30-Jul-2019**	**01-Aug-2019**	26-Jan-2020	✓	**01-Aug-2019**	26-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	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**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

AECO06/190802/3
Due: 9/8/19 AO

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 (List due date): 5 Day	FOR LABORATORY USE ONLY (Circle)
OFFICE: Brisbane	(Standard TAT may be longer for some tests e.g.. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/
PROJECT: 60609758 2.0	ALS QUOTE NO.: BN/112/19	Free ice / frozen ice bricks present upon receipt? Yes No N/
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) 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	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Camden			
DATE/TIME: 31/7/19 0946	DATE/TIME:	DATE/TIME: 1/8/19	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please Forward to NM1 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.
	AB_QC200-190729	29/7/19	S	1P	1					N19/019417			Forward to NM1
	AB_QC201-190729	"	"	"	1					N19/019418			"
	AB_QC202-190729	29/7/19	"	"	1					N19/019419			"
	AB_QC203-190729	"	"	"	1					N19/019420			"
	AB_QC204-190730	30/7/19	"	"	1					N19/019421			"
				TOTAL									

RECEIVED
02 AUG 2019
BY: Am 13:28

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: **AECO06/190802/3**

Total No. of Samples: **5**

LRNs	Customer Sample ID	Lab Sample Description
N19/019417	AB_QC200_190729	SOIL 29/7/19
N19/019418	AB_QC201_190729	SOIL 29/7/19
N19/019419	AB_QC202_190729	SOIL 29/7/19
N19/019420	AB_QC203_190729	SOIL 29/7/19
N19/019421	AB_QC204_190730	SOIL 30/7/19

SAMPLE RECEIVED CONDITION

Date samples received:	2-AUG-2019
Sample received in good order:	Yes
NMI Quotation no. provided:	
Client purchase order number:	60609758_2_0
Temperature of samples:	Chilled
Comments:	ALL OK
Estimated report date:	9-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. RN1242611

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190802/3
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609758_2_0
		Date Received	: 02-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
N19/019417	AB_QC200_190729	SOIL 29/7/19
N19/019418	AB_QC201_190729	SOIL 29/7/19
N19/019420	AB_QC203_190729	SOIL 29/7/19

Lab Reg No.		N19/019417	N19/019418	N19/019420		
Date Sampled		29-JUL-2019	29-JUL-2019	29-JUL-2019		
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
PFBA (375-22-4)	mg/kg	<0.002	0.64	<0.002		NR70
PFPeA (2706-90-3)	mg/kg	<0.002	<0.002	<0.002		NR70
PFHxA (307-24-4)	mg/kg	<0.001	<0.001	<0.001		NR70
PFHpA (375-85-9)	mg/kg	<0.001	<0.001	<0.001		NR70
PFOA (335-67-1)	mg/kg	<0.001	<0.001	<0.001		NR70
PFNA (375-95-1)	mg/kg	<0.001	0.0010	<0.001		NR70
PFDA (335-76-2)	mg/kg	<0.001	<0.001	<0.001		NR70
PFUdA (2058-94-8)	mg/kg	0.0092	0.075	<0.002		NR70
PFDoA (307-55-1)	mg/kg	<0.002	<0.002	<0.002		NR70
PFTrDA (72629-94-8)	mg/kg	0.0020	0.075	<0.002		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	<0.001	<0.001	<0.001		NR70
PFPeS (2706-91-4)	mg/kg	<0.001	<0.001	<0.001		NR70
PFHxS (355-46-4)	mg/kg	<0.001	0.0020	<0.001		NR70
PFHpS (375-92-8)	mg/kg	<0.001	<0.001	<0.001		NR70
PFOS (1763-23-1)	mg/kg	0.037	0.024	0.0078		NR70
PFNS (68259-12-1)	mg/kg	0.0012	<0.001	<0.001		NR70
PFDS (335-77-3)	mg/kg	0.0016	<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.		N19/019417	N19/019418	N19/019420		
Date Sampled		29-JUL-2019	29-JUL-2019	29-JUL-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	<0.001	<0.001	<0.001		NR70
8:2 FTS (39108-34-4)	mg/kg	<0.001	<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)	%	110	117	120		NR70
PFPeA (Surrogate Recovery)	%	113	118	111		NR70
PFHxA (Surrogate Recovery)	%	111	119	107		NR70
PFHpA (Surrogate Recovery)	%	118	122	115		NR70
PFOA (Surrogate Recovery)	%	122	126	121		NR70
PFNA (Surrogate Recovery)	%	104	125	121		NR70
PFDA (Surrogate Recovery)	%	122	130	126		NR70
PFUdA (Surrogate Recovery)	%	138	118	134		NR70
PFDoA (Surrogate Recovery)	%	115	135	129		NR70
PFTeDA (Surrogate Recovery)	%	119	143	143		NR70
PFHxDA (Surrogate Recovery)	%	146	158	145		NR70
FOUEA (Surrogate Recovery)	%	33	41	47		NR70
PFBS (Surrogate Recovery)	%	113	116	114		NR70
PFHxS (Surrogate Recovery)	%	109	114	113		NR70
PFOS (Surrogate Recovery)	%	113	124	115		NR70
PFOSA (Surrogate Recovery)	%	112	119	119		NR70
N-MeFOSA (Surrogate Recovery)	%	141	102	127		NR70
N-EtFOSA (Surrogate Recovery)	%	127	125	126		NR70
N-MeFOSAA (Surrogate Recovery)	%	117	111	95		NR70
N-EtFOSAA (Surrogate Recovery)	%	105	117	112		NR70
N-MeFOSE (Surrogate Recovery)	%	120	125	108		NR70
N-EtFOSE (Surrogate Recovery)	%	90	127	132		NR70
4:2 FTS (Surrogate Recovery)	%	85	86	86		NR70
6:2 FTS (Surrogate Recovery)	%	75	79	83		NR70
8:2 FTS (Surrogate Recovery)	%	75	96	99		NR70
8:2 diPAP (Surrogate Recovery)	%	55	73	42		NR70
Dates						
Date extracted		6-AUG-2019	6-AUG-2019	6-AUG-2019		
Date analysed		12-AUG-2019	12-AUG-2019	12-AUG-2019		

N19/019417
To N19/019420

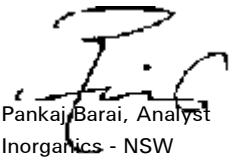
REPORT OF ANALYSIS

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

13-AUG-2019

Lab Reg No.		**N19/019417**	**N19/019418**	**N19/019420**		
Date Sampled		**29-JUL-2019**	**29-JUL-2019**	**29-JUL-2019**		
	Units					**Method**
Trace Elements						
Total Solids	%	89.1	90.5	76.8		NT2_49



Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

13-AUG-2019

All results are expressed on a dry weight basis.

REPORT OF ANALYSIS

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.

This Report supersedes reports: *RN1242287* *RN1242600*

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: AECO06/190802/3 **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	114	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	103	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	103	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	115	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFUdA (2058-94-8)	NR70	0.002	<0.002	NA	NA	NA	108	NA
PFDoA (307-55-1)	NR70	0.002	<0.002	NA	NA	NA	104	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	118	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	91	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	104	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	95	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	102	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	110	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	107	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	106	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	106	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	96	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	98	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	100	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	101	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	89	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	128	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	103	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	101	NA
10:2 FTS (120226-60-0)	NR70	0.002	<0.002	NA	NA	NA	89	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	107	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: **13/08/2019**

ANZ

FQM - Generic Chain of Custody Form

Environmental Division
Brisbane
Work Order Reference
EB1921176

Telephone : + 61-7-3243 7222

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	
PROJECT MANAGER (PM): James Peachey	SITE: QFES Home Hill	MOBILE: 0499089474	PHONE:
PROJECT NUMBER & TASK CODE: 60609758	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passler@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract su	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
Hold onto samples for further TOPA Selection

SAMPLE INFORMATION (note: S = Soil, W=Water)				CONTAINER INFORMATION		EP231X-LL: PFAS Low Level	P231X-LL (TOPA): PFAS TOPA Low Level		EP231X-ST: PFAS Full Suite Super Trace		EP231X: PFAS Full Suite						HLD	

RELINQUISHED BY		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name:	Date: 9/8/19	Name: N.SUTTON	Date: 9/8/19	Name:	Date: 13/8/19	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of: ALS BRIS	Time: 9:30	Transport Co:

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. **Soil Container Codes:** Jar = Unpreserved glass jar

COC Page of

AECOM

ANZ

FQM - Generic Chain of Custody Form

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): James Peachey	SITE: QFES Ayr	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: 60609758	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY

COOLER SEAL (circle appropriate)

Intact: Yes No N/A

SAMPLE TEMPERATURE

CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Hold onto samples for further TOPA Selection

SAMPLE INFORMATION (note: S = Soil, W=Water)	CONTAINER INFORMATION	231X-LL: PFAS Low Level	231X-LL (TOPA): PFAS TOPA Low Level	231X-ST: PFAS Full Suite Super Trace	P231X: PFAS Full Suite						Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Kuo	Date: 9/8/19	Name: N. SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

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. **Soil Container Codes**: Jar = Unpreserved glass jar

COC Page of

ANZ

FQM - Generic Chain of Custody Form

AECOM

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): **James Peachey**	SITE: **QFES Airlie Beach**	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: **60609758**	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
Hold onto samples for further TOPA Selection

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	EP231X-LL: PFAS Low Level	EP231X-LL (TOPA): PFAS TOPA Low Level	EP231X-ST: PFAS Full Suite Super Trace	EP231X: PFAS Full Suite	HOLD	Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.
23	AB_MW01_190808	W	8/08/19	1420	P	1	X					
24	AB_MW02_190808	W	8/08/19	1110	P	1	X					
25	AB_MW03_190808	W	8/08/19	1340	P	1	X					
26	AB_MW04_190808	W	8/08/19	1445	P	1	X					
27	AB_SED01_190808	S	8/08/19	0930	J	1				X		
28	AB_SED02_190808	S	8/08/19	0940	J	1				X		
29	AB_SED03_190808	S	8/08/19	0900	J	1				X		
30	AB_SED04_190808	S	8/08/19	0920	J	1				X		
31	AB_QC106_190808	W	8/08/19		P	1						
32	AB_QC105_190808	S	8/08/19		J	1				X		
	AB_QC206_190808	W	8/08/19		P	1						Forward to NMI
	AB_QC205_190808	S	8/08/19		J	1				X		Forward to NMI
33	AB_QC303_190808	W	8/08/19		P	1	X			✓		

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Kuo	Date: 9/8/19	Name: N. SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

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.
Soil Container Codes: Jar = Unpreserved glass jar

COC Page of

AECOM

ANZ

FQM - Generic Chain of Custody Form

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): **James Peachey**	SITE: **QFES Proserpine**	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: **60609758**	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY

COOLER SEAL (circle appropriate)

Intact: Yes No N/A

SAMPLE TEMPERATURE

CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Hold onto samples for further TOPA Selection

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		1X-LL: PFAS Low Level	IX-LL (TOPA): PFAS TOPA Low Level	1X-ST: PFAS Full Suite Super Trace	2X: PFAS Full Suite							

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Vann	Date: 9/8/19	Name: N.SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 15:00	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

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.

Soil Container Codes: Jar = Unpreserved glass jar

COC Page of

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1921176**

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
E-mail	: james.peachey@aecom.com	E-mail	: carsten.emrich@alsglobal.com
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Facsimile	: +61 07 3553 2050	Facsimile	: +61-7-3243 7218
Project	: 60609758	Page	: 1 of 4
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: QFES		
Sampler	: NK		

Dates

Date Samples Received	: 13-Aug-2019 09:30	Issue Date	: 13-Aug-2019
Client Requested Due Date	: 22-Aug-2019	Scheduled Reporting Date	: **22-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 1.4, 1.2°C - Ice present
Receipt Detail	: MEDIUM ESKIES	No. of samples received / analysed	: 39 / 37

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 samples " "AB_QC206_190808", "AB_QC205_190808" and " will be forwarded to NMI for analysis. Please note that this will incur a freight forwarding fee.**
-
- **Please be advised that for sample "AB_QC303_190808"(ALS ID#33), the container is labelled as "AB_QC304_190808". All samples will be reported as per the Chain of Custody unless ALS is otherwise advised.**
-
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Super Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- 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).
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- 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	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1921176-027	08-Aug-2019 09:30	AB_SED01_190808	✓	✓
EB1921176-028	08-Aug-2019 09:40	AB_SED02_190808	✓	✓
EB1921176-029	08-Aug-2019 09:00	AB_SED03_190808	✓	✓
EB1921176-030	08-Aug-2019 09:20	AB_SED04_190808	✓	✓
EB1921176-032	08-Aug-2019 00:00	AB_QC105_190808	✓	✓

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)	WATER - EP231X-ST PFAS - Super Trace Waters Long Suite (28
E					

			(On Hold) WATER No analysis requested	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)	WATER - EP231X-ST PFAS - Super Trace Waters Long Suite (28
EB1921176-023	08-Aug-2019 14:20	AB_MW01_190808		✓	
EB1921176-024	08-Aug-2019 11:10	AB_MW02_190808		✓	
EB1921176-025	08-Aug-2019 13:40	AB_MW03_190808		✓	
EB1921176-026	08-Aug-2019 14:45	AB_MW04_190808		✓	
EB1921176-031	08-Aug-2019 00:00	AB_QC106_190808	✓		
EB1921176-033	08-Aug-2019 00:00	AB_QC303_190808		✓	

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

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

JANELLE PASSIER

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

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1921176-AL**	Page	: 1 of 9
Amendment	: **3**		
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	Date Samples Received	: 13-Aug-2019 09:30
Order number	: 60609758 2.0	Date Analysis Commenced	: 15-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019 13:58
Sampler	: NK		
Site	: QFES		
Quote number	: BN/112/19		
No. of samples received	: 11		
No. of samples analysed	: 11		

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-LL: Samples were diluted due to matrix interference. LOR adjusted accordingly.
- **Super Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Amendment (04/09/2019): This report has been amended and re-released to allow the reporting of additional analytical data.
- Amendment (29/8/19): This report has been amended to allow the splitting of the work order into 5 separate reports. All analysis results are as per the previous report.
- Amendment (30/8/19): This report has been amended to allow the the work order to be split into 4 separate reports. All analysis results are as per the previous report.
- EP231X-ST: Sample EB1921176_015 required dilution prior to extraction due to matrix interferences (high sediment content). LOR values have been adjusted accordingly.
- EP231X-LL & EP231X: Matrix spike shows results out of control limit due to primary sample matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Particular samples show poor surrogate recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Duplicate shows results out of control limit due to sample heterogeneity. Confirmed by re-extraction and re-analysis.

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	AB_SED01_190808	AB_SED02_190808	AB_SED03_190808	AB_SED04_190808	AB_QC105_190808
				Client sampling date / time	08-Aug-2019 09:30	08-Aug-2019 09:40	08-Aug-2019 09:00	08-Aug-2019 09:20	08-Aug-2019 00:00
					EB1921176-027	EB1921176-028	EB1921176-029	EB1921176-030	EB1921176-032
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**22.2**	**39.1**	**15.7**	**16.8**	**16.3**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		**0.0004**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0017**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0359**	**0.0023**	**0.0005**	**0.0013**	**0.0015**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0004**	**0.0003**
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0004**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0008**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0006**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0005**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0004**	**0.0012**	<0.0002	**0.0006**	**0.0006**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		**0.0002**	**0.0002**	<0.0002	**0.0008**	**0.0011**
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	AB_SED01_190808	AB_SED02_190808	AB_SED03_190808	AB_SED04_190808	AB_QC105_190808
				Client sampling date / time	08-Aug-2019 09:30	08-Aug-2019 09:40	08-Aug-2019 09:00	08-Aug-2019 09:20	08-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		EB1921176-027	EB1921176-028	EB1921176-029	EB1921176-030	EB1921176-032
					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	<0.0005
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	**0.0006**	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0418**	**0.0048**	**0.0005**	**0.0031**	**0.0035**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0376**	**0.0023**	**0.0005**	**0.0013**	**0.0015**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0401**	**0.0028**	**0.0005**	**0.0013**	**0.0015**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**83.0**	**21.5**	**12.5**	**30.5**	**40.5**
13C8-PFOA	----	0.0002	%		**80.5**	**21.5**	**14.0**	**35.5**	**49.0**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	AB_MW01_190808	AB_MW02_190808	AB_MW03_190808	AB_MW04_190808	AB_QC106_190808
				Client sampling date / time	08-Aug-2019 14:20	08-Aug-2019 11:10	08-Aug-2019 13:40	08-Aug-2019 14:45	08-Aug-2019 00:00
					EB1921176-023	EB1921176-024	EB1921176-025	EB1921176-026	EB1921176-031
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		**0.249**	**0.059**	**0.597**	**0.178**	**0.064**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		**0.154**	**0.071**	**0.503**	**0.177**	**0.065**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		**0.428**	**0.338**	**2.86**	**1.28**	**0.364**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		**0.009**	**0.010**	**0.282**	**0.184**	**0.010**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		**0.055**	**0.212**	**5.29**	**5.22**	**0.274**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		**0.02**	**0.04**	**0.20**	**0.10**	**0.04**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		**0.008**	**0.049**	**0.321**	**0.178**	**0.051**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		**0.028**	**0.104**	**1.11**	**0.527**	**0.102**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		**0.007**	**0.027**	**0.313**	**0.172**	**0.028**
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		**0.012**	**0.024**	**0.505**	**0.322**	**0.023**
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	**0.070**	**0.077**	**0.167**	**0.075**
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	**0.008**	<0.010	**0.013**	**0.008**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	<0.005	<0.025	<0.025	<0.005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	<0.005	<0.025	<0.025	<0.005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	<0.005	<0.025	<0.025	<0.005

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_MW01_190808	AB_MW02_190808	AB_MW03_190808	AB_MW04_190808	AB_QC106_190808
				Client sampling date / time	08-Aug-2019 14:20	08-Aug-2019 11:10	08-Aug-2019 13:40	08-Aug-2019 14:45	08-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		EB1921176-023	EB1921176-024	EB1921176-025	EB1921176-026	EB1921176-031
					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	<0.025	<0.025	<0.005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	<0.005	<0.025	<0.025	<0.005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<0.002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	<0.002	<0.010	<0.010	<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	<0.010	<0.010	<0.005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	<0.005	**0.140**	**0.102**	<0.005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	**0.015**	**0.024**	<0.005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	<0.010	<0.010	<0.005
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		**0.970**	**1.01**	**12.2**	**8.64**	**1.10**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		**0.483**	**0.550**	**8.15**	**6.50**	**0.638**
Sum of PFAS (WA DER List)	----	0.002	µg/L		**0.807**	**0.853**	**11.4**	**8.10**	**0.946**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**83.4**	**85.1**	**127**	**109**	**129**
13C8-PFOA	----	0.002	%		**95.6**	**97.4**	**125**	**127**	**130**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_QC304_190808	----	----	----	----
				Client sampling date / time	08-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921176-033	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		<0.002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_QC304_190808	----	----	----	----
				Client sampling date / time	08-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921176-033	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<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	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		<0.002	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		<0.002	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		<0.002	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**75.6**	----	----	----	----
13C8-PFOA	----	0.002	%		**94.9**	----	----	----	----

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	: **EB1921176-AL**	Page	: 1 of 14
Amendment	: **3**		
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	Date Samples Received	: 13-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 15-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019
Sampler	: NK		
Site	: QFES		
Quote number	: BN/112/19		
No. of samples received	: 11		
No. of samples analysed	: 11		

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: 2524697)									
EB1921176-005	Anonymous	EA055: Moisture Content	----	0.1	%	8.5	8.3	2.98	0% - 20%
EB1921176-030	AB_SED04_190808	EA055: Moisture Content	----	0.1	%	16.8	16.9	0.695	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2524688)									
EB1921176-005	Anonymous	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	0.0021	0.0015	35.7	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1921176-030	AB_SED04_190808	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	0.0013	# 0.0022	54.0	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0004	0.0007	46.9	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2524688)									
EB1921176-005	Anonymous	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	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	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 (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2524688) - continued									
EB1921176-005	Anonymous	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
EB1921176-030	AB_SED04_190808	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	0.0006	0.0009	45.5	No Limit
		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	0.0008	0.0015	53.7	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: 2524688)									
EB1921176-005	Anonymous	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
EB1921176-030	AB_SED04_190808	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

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: 2524688)									
EB1921176-005	Anonymous	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
EB1921176-030	AB_SED04_190808	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: 2524698)									
EB1921176-001	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.010	0.010	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.090	0.083	8.09	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.056	0.031	57.5	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.010	<0.010	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	4.22	4.05	4.11	0% - 20%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.250	0.300	18.2	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	59.9	# 47.1	23.9	0% - 20%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.100	<0.100	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 (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2557723)									
EB1921176-031	AB_QC106_190808	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.064	0.071	10.8	0% - 20%
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.065	0.076	16.1	0% - 20%
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.364	0.408	11.5	0% - 20%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.010	0.013	23.7	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.274	0.283	3.30	0% - 20%
		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: 2524698)									
EB1921176-001	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		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	<0.010	<0.010	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	<0.05	<0.05	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.260	0.260	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.380	0.340	11.1	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.610	0.550	10.3	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.930	0.880	5.52	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.110	0.130	16.7	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.50	<0.50	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2557723)									
EB1921176-031	AB_QC106_190808	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.051	0.057	11.0	0% - 20%
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.102	0.111	9.03	0% - 20%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.028	0.031	7.11	0% - 50%

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 (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2557723) - continued									
EB1921176-031	AB_QC106_190808	EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.023	0.026	8.98	0% - 50%
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.075	0.079	4.68	0% - 20%
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	0.008	0.009	18.2	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	0.04	0.05	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2524698)									
EB1921176-001	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		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
EB1921176-020	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.250	<0.250	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2557723)									
EB1921176-031	AB_QC106_190808	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

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: 2557723) - continued									
EB1921176-031	AB_QC106_190808	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: 2524698)									
EB1921176-001	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		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
EB1921176-020	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	1.35	1.37	1.47	0% - 50%
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.100	<0.100	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2557723)									
EB1921176-031	AB_QC106_190808	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: 2524698)									
EB1921176-001	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	0.146	0.124	16.3	0% - 50%
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	0.146	0.114	24.6	0% - 50%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	0.146	0.114	24.6	0% - 50%

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 (%)*
EP231P: PFAS Sums (QC Lot: 2524698) - continued									
EB1921176-020	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	68.0	# 55.0	21.2	0% - 20%
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	64.1	# 51.2	22.5	0% - 20%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	67.6	# 54.6	21.4	0% - 20%
EP231P: PFAS Sums (QC Lot: 2557723)									
EB1921176-031	AB_QC106_190808	EP231X-LL: Sum of PFAS	----	0.002	µg/L	1.10	1.22	9.66	0% - 20%
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	0.638	0.691	7.98	0% - 20%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	0.946	1.04	9.18	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: 2524688)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	93.2	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	92.7	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	78.0	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	92.8	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	77.6	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	90.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524688)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	# 37.5	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.6	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.6	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	58.4	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	60.0	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	59.3	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524688)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.4	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 54.5	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 45.4	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 35.2	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 48.1	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.6	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	62.4	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524688)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	79.3	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	74.2	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	85.3	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: 2524688) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	100	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
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2524698)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	93.7	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	99.1	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	85.2	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	93.5	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	77.6	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	64.1	40	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2557723)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	95.0	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	91.9	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	87.7	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	92.0	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	94.8	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	74.5	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524698)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	85.6	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	91.2	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	90.6	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	88.0	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	75.6	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	64.4	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	69.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	67.8	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	61.8	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	79.3	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2557723)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	83.8	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	86.8	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	86.6	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	88.6	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	86.4	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	78.8	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	71.4	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: 2557723) - continued								
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	67.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	77.2	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	93.6	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	96.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524698)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	81.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	88.2	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	57.3	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	57.3	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	60.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	53.4	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	51.2	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2557723)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	73.0	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	78.8	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	75.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	78.9	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	75.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	71.2	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	64.6	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524698)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	89.9	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	96.0	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	72.0	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	56.6	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2557723)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	104	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	120	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	87.3	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: 2557723) - continued								
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.0482 µg/L	73.8	50	130
EP231P: PFAS Sums (QCLot: 2524698)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----
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	----	----	----	----
EP231P: PFAS Sums (QCLot: 2557723)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----
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: 2524688)							
EB1921176-006	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	66.8	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	70.0	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	54.4	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	70.0	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# 37.3	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	54.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524688)							
EB1921176-006	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	# 26.1	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	57.3	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	74.5	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	60.9	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	64.5	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	# 62.2	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	# 37.0	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	# 51.8	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# 51.3	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	# 41.6	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	# 49.2	59	129

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: 2524688)							
EB1921176-006	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	65.6	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	# 49.2	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	# 48.6	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	# 33.0	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	# 39.7	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	61.6	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	# 51.2	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524688)							
EB1921176-006	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	63.2	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# 57.6	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	65.2	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	# 46.8	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: 2524698)							
EB1921176-002	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	114	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	108	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	82.4	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	123	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	107	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524698)							
EB1921176-002	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	103	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	110	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	107	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	108	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	106	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	103	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	87.0	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	125	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	110	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: 2524698) - continued							
EB1921176-002	Anonymous	EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	97.8	40	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	106	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524698)							
EB1921176-002	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	123	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	129	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	112	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	96.1	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	114	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	112	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	81.4	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524698)							
EB1921176-002	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	117	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	116	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	119	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	114	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1921176**	Page	: 1 of 13
Amendment	: **3**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 13-Aug-2019
Site	: QFES	Issue Date	: 04-Sep-2019
Sampler	: NK	No. of samples received	: 39
Order number	: 60609758 2.0	No. of samples analysed	: 39

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.**
- **Duplicate outliers exist - please see following pages for full details.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

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
Duplicate (DUP) RPDs							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1921176--030	AB_SED04_190808	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	54.0 %	0% - 50%	**RPD exceeds LOR based limits**
Laboratory Control Spike (LCS) Recoveries							
EP231B: Perfluoroalkyl Carboxylic Acids	QC-2524688-002	----	**Perfluorobutanoic acid (PFBA)**	375-22-4	37.5 %	52-128%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Methyl perfluorooctane sulfonamide (MeFOSA)**	31506-32-8	54.5 %	65-126%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Ethyl perfluorooctane sulfonamide (EtFOSA)**	4151-50-2	45.4 %	64-126%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	35.2 %	63-124%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)**	1691-99-2	48.1 %	58-125%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids			**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	37.3 %	55-127%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorobutanoic acid (PFBA)**	375-22-4	26.1 %	52-128%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorononanoic acid (PFNA)**	375-95-1	62.2 %	63-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorodecanoic acid (PFDA)**	335-76-2	37.0 %	55-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	51.8 %	62-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorododecanoic acid (PFDoDA)**	307-55-1	51.3 %	53-134%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	41.6 %	49-129%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids			**Perfluorotetradecanoic acid (PFTeDA)**	376-06-7	49.2 %	59-129%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides			**N-Methyl perfluorooctane sulfonamide (MeFOSA)**	31506-32-8	49.2 %	65-126%	**Recovery less than lower data quality objective**

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP231C: Perfluoroalkyl Sulfonamides			**N-Ethyl perfluorooctane sulfonamide (EtFOSA)**	4151-50-2	48.6 %	64-126%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides			**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	33.0 %	63-124%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides			**N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)**	1691-99-2	39.7 %	58-125%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides			**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	51.2 %	55-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids			**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	57.6 %	61-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids			**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	46.8 %	60-130%	**Recovery less than lower data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP231A: Perfluoroalkyl Sulfonic Acids			**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	23.9 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFAS**	----	21.2 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFHxS and PFOS**	355-46-4/1763-23-1	22.5 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFAS (WA DER List)**	----	21.4 %	0% - 20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids			**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	EB1921138--003	Anonymous	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	156 %	40-130%	**Recovery greater than upper data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921138--003	Anonymous	**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	35.2 %	40-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921138--003	Anonymous	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	135 %	50-130%	**Recovery greater than upper data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921138--003	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	136 %	50-130%	**Recovery greater than upper data quality objective**

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP231S: PFAS Surrogate			**13C4-PFOS**	----	67.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	69.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-028	AB_SED02_190808	**13C4-PFOS**	----	21.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-029	AB_SED03_190808	**13C4-PFOS**	----	12.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-030	AB_SED04_190808	**13C4-PFOS**	----	30.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-032	AB_QC105_190808	**13C4-PFOS**	----	40.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-028	AB_SED02_190808	**13C8-PFOA**	----	21.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-029	AB_SED03_190808	**13C8-PFOA**	----	14.0 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-030	AB_SED04_190808	**13C8-PFOA**	----	35.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate	EB1921176-032	AB_QC105_190808	**13C8-PFOA**	----	49.0 %	70-130 %	**Recovery less than lower data quality objective**

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP231S: PFAS Surrogate			**13C4-PFOS**	----	35.9 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	45.5 %	70-130 %	**Recovery less than lower data quality objective**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)	**06-Aug-2019**	**----**	----	----	**15-Aug-2019**	20-Aug-2019	✓
HDPE Soil Jar (EA055) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**----**	----	----	**15-Aug-2019**	22-Aug-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-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
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X) AB_SED01_190808, AB_SED02_190808, AB_SED03_190808, AB_SED04_190808, AB_QC105_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-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)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_QC106_190808	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_MW01_190808, AB_MW02_190808, AB_MW03_190808, AB_MW04_190808, AB_QC304_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-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
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_QC106_190808	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_MW01_190808, AB_MW02_190808, AB_MW03_190808, AB_MW04_190808, AB_QC304_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-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
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_QC106_190808	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_MW01_190808, AB_MW02_190808, AB_MW03_190808, AB_MW04_190808, AB_QC304_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_QC106_190808	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_MW01_190808, AB_MW02_190808, AB_MW03_190808, AB_MW04_190808, AB_QC304_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-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)	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) AY_SW02_190806, AY_Tap01_190806	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST) AY_SW03_190806	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_QC106_190808	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL) AB_MW01_190808, AB_MW02_190808, AB_MW03_190808, AB_MW04_190808, AB_QC304_190808	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-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	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	5	**20.00**	**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
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

REPORT OF ANALYSIS

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/3
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609759_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
N19/020822	AB_QC205_190808	SOIL 8/08/19

Lab Reg No.				N19/020822		
Date Sampled				08-AUG-2019		
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
PFBA (375-22-4)	mg/kg	<0.002	<0.002	<0.002		NR70
PFPeA (2706-90-3)	mg/kg	<0.002	<0.002	<0.002		NR70
PFHxA (307-24-4)	mg/kg	<0.001	<0.001	<0.001		NR70
PFHpA (375-85-9)	mg/kg	<0.001	<0.001	<0.001		NR70
PFOA (335-67-1)	mg/kg	<0.001	<0.001	<0.001		NR70
PFNA (375-95-1)	mg/kg	<0.001	<0.001	<0.001		NR70
PFDA (335-76-2)	mg/kg	<0.001	<0.001	<0.001		NR70
PFUdA (2058-94-8)	mg/kg	<0.002	<0.002	0.0025		NR70
PFDoA (307-55-1)	mg/kg	<0.002	<0.002	<0.002		NR70
PFTrDA (72629-94-8)	mg/kg	<0.002	<0.002	0.010		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	<0.01	<0.001		NR70
PFBS (375-73-5)	mg/kg	<0.001	<0.001	<0.001		NR70
PFPeS (2706-91-4)	mg/kg	<0.001	<0.001	<0.001		NR70
PFHxS (355-46-4)	mg/kg	<0.001	<0.001	<0.001		NR70
PFHpS (375-92-8)	mg/kg	<0.001	<0.001	<0.001		NR70
PFOS (1763-23-1)	mg/kg	0.0026	<0.002	0.0094		NR70
PFNS (68259-12-1)	mg/kg	<0.001	<0.001	<0.001		NR70
PFDS (335-77-3)	mg/kg	<0.001	<0.001	0.0032		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.				N19/020822		
Date Sampled				08-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	<0.001	<0.001	<0.001		NR70
8:2 FTS (39108-34-4)	mg/kg	<0.001	<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)	%	124	105	110		NR70
PFPeA (Surrogate Recovery)	%	120	112	112		NR70
PFHxA (Surrogate Recovery)	%	116	114	109		NR70
PFHpA (Surrogate Recovery)	%	122	103	117		NR70
PFOA (Surrogate Recovery)	%	123	112	117		NR70
PFNA (Surrogate Recovery)	%	123	107	109		NR70
PFDA (Surrogate Recovery)	%	127	106	117		NR70
PFUdA (Surrogate Recovery)	%	130	99	129		NR70
PFDoA (Surrogate Recovery)	%	126	108	114		NR70
PFTeDA (Surrogate Recovery)	%	127	100	114		NR70
PFHxDA (Surrogate Recovery)	%	131	120	115		NR70
FOUEA (Surrogate Recovery)	%	78	0	39		NR70
PFBS (Surrogate Recovery)	%	116	103	105		NR70
PFHxS (Surrogate Recovery)	%	120	114	109		NR70
PFOS (Surrogate Recovery)	%	124	112	116		NR70
PFOSA (Surrogate Recovery)	%	122	103	108		NR70
N-MeFOSA (Surrogate Recovery)	%	105	110	93		NR70
N-EtFOSA (Surrogate Recovery)	%	113	117	93		NR70
N-MeFOSAA (Surrogate Recovery)	%	119	69	107		NR70
N-EtFOSAA (Surrogate Recovery)	%	136	91	119		NR70
N-MeFOSE (Surrogate Recovery)	%	107	113	107		NR70
N-EtFOSE (Surrogate Recovery)	%	136	114	98		NR70
4:2 FTS (Surrogate Recovery)	%	88	68	79		NR70
6:2 FTS (Surrogate Recovery)	%	103	78	83		NR70
8:2 FTS (Surrogate Recovery)	%	101	76	92		NR70
8:2 diPAP (Surrogate Recovery)	%	59	43	57		NR70
Dates						
Date extracted		19-AUG-2019	19-AUG-2019	19-AUG-2019		
Date analysed		21-AUG-2019	21-AUG-2019	21-AUG-2019		

N19/020818
to

REPORT OF ANALYSIS

N19/020822:

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.
FOUEA Surrogate Recovery was not reported.
LORs raised for selected analytes due to low surrogate recoveries.

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

28-AUG-2019

Lab Reg No.				**N19/020822**		
Date Sampled				**08-AUG-2019**		
	Units					**Method**
Trace Elements						
Total Solids	%	92.5	76.7	85.1		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

Report No. RN1244319

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/3
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609759_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
N19/020821	AB_QC206_190808	WATER 8/08/19

Lab Reg No.					N19/020821		
Date Sampled					08-AUG-2019		
		Units					Method
PFAS (per-and poly-fluoroalkyl substances)							
PFBA (375-22-4)		ug/L	0.0099	0.11	0.053	0.15	NR70
PFPeA (2706-90-3)		ug/L	0.019	0.30	0.055	0.23	NR70
PFHxA (307-24-4)		ug/L	0.032	0.36	0.11	0.92	NR70
PFHpA (375-85-9)		ug/L	0.019	0.44	0.030	0.22	NR70
PFOA (335-67-1)		ug/L	0.0075	0.63	0.025	0.34	NR70
PFNA (375-95-1)		ug/L	<0.001	0.10	0.093	0.30	NR70
PFDA (335-76-2)		ug/L	<0.001	0.010	0.0029	0.027	NR70
PFUdA (2058-94-8)		ug/L	<0.001	0.0083	0.015	0.12	NR70
PFDoA (307-55-1)		ug/L	<0.001	<0.001	<0.001	<0.001	NR70
PFTrDA (72629-94-8)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
PFTeDA (376-06-7)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
PFHxDA (67905-19-5)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
PFODA (16517-11-6)		ug/L	<0.005	<0.005	<0.005	<0.005	NR70
FOUEA (70887-84-2)		ug/L	<0.001	<0.001	<0.001	<0.001	NR70
PFBS (375-73-5)		ug/L	0.041	0.036	0.064	0.50	NR70
PFPeS (2706-91-4)		ug/L	0.024	0.084	0.070	0.68	NR70
PFHxS (355-46-4)		ug/L	0.18	4.0	0.42	9.8	NR70
PFHpS (375-92-8)		ug/L	0.0062	0.32	0.0080	0.36	NR70
PFOS (1763-23-1)		ug/L	3.5	45	0.28	25	NR70
PFNS (68259-12-1)		ug/L	<0.001	0.0032	<0.001	0.010	NR70
PFDS (335-77-3)		ug/L	<0.001	<0.001	<0.001	<0.001	NR70
PFOSA (754-91-6)		ug/L	<0.001	0.0087	<0.001	0.0016	NR70
N-MeFOSA (31506-32-8)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
N-EtFOSA (4151-50-2)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
N-MeFOSAA (2355-31-9)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
N-EtFOSAA(2991-50-6)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70

REPORT OF ANALYSIS

Lab Reg No.					N19/020821		
Date Sampled					08-AUG-2019		
		Units					Method
PFAS (per-and poly-fluoroalkyl substances)							
N-MeFOSE (24448-09-7)		ug/L	<0.005	<0.005	<0.005	<0.005	NR70
N-EtFOSE (1691-99-2)		ug/L	<0.005	<0.005	<0.005	<0.005	NR70
4:2 FTS (757124-72-4)		ug/L	<0.001	<0.001	<0.001	<0.001	NR70
6:2 FTS (27619-97-2)		ug/L	1.5	0.81	<0.001	0.034	NR70
8:2 FTS (39108-34-4)		ug/L	<0.001	0.0069	<0.001	0.028	NR70
10:2 FTS (120226-60-0)		ug/L	<0.001	<0.001	<0.001	<0.001	NR70
8:2 diPAP (678-41-1)		ug/L	<0.002	<0.002	<0.002	<0.002	NR70
PFBA (Surrogate Recovery)		%	116	107	102	104	NR70
PFPeA (Surrogate Recovery)		%	107	118	128	128	NR70
PFHxA (Surrogate Recovery)		%	104	122	125	102	NR70
PFHpA (Surrogate Recovery)		%	108	115	115	106	NR70
PFOA (Surrogate Recovery)		%	106	103	121	102	NR70
PFNA (Surrogate Recovery)		%	71	43	91	42	NR70
PFDA (Surrogate Recovery)		%	106	109	80	92	NR70
PFUdA (Surrogate Recovery)		%	87	99	78	94	NR70
PFDoA (Surrogate Recovery)		%	74	95	93	98	NR70
PFTeDA (Surrogate Recovery)		%	90	104	84	89	NR70
PFHxDA (Surrogate Recovery)		%	132	156	141	161	NR70
FOUEA (Surrogate Recovery)		%	71	61	95	58	NR70
PFBS (Surrogate Recovery)		%	104	129	120	126	NR70
PFHxS (Surrogate Recovery)		%	102	85	119	71	NR70
PFOS (Surrogate Recovery)		%	97	188	92	129	NR70
PFOSA (Surrogate Recovery)		%	90	93	77	79	NR70
N-MeFOSA (Surrogate Recovery)		%	75	83	74	84	NR70
N-EtFOSA (Surrogate Recovery)		%	56	107	73	97	NR70
N-MeFOSAA (Surrogate Recovery)		%	72	86	66	74	NR70
N-EtFOSAA (Surrogate Recovery)		%	93	88	77	85	NR70
N-MeFOSE (Surrogate Recovery)		%	133	157	135	113	NR70
N-EtFOSE (Surrogate Recovery)		%	65	117	96	127	NR70
4:2 FTS (Surrogate Recovery)		%	68	78	87	74	NR70
6:2 FTS (Surrogate Recovery)		%	81	282	92	89	NR70
8:2 FTS (Surrogate Recovery)		%	86	92	71	68	NR70
8:2 diPAP (Surrogate Recovery)		%	66	81	83	102	NR70
Dates							
Date extracted			23-AUG-2019	23-AUG-2019	23-AUG-2019	23-AUG-2019	
Date analysed			23-AUG-2019	23-AUG-2019	23-AUG-2019	23-AUG-2019	

REPORT OF ANALYSIS

Lab Reg No.					**N19/020821**		
Date Sampled					**08-AUG-2019**		
		Units					**Method**

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

28-AUG-2019

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TECHNICAL
COMPETENCE

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This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1244317*

Measurement Uncertainty is available upon request.

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190813/3 **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: **26/08/2019**

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190816/3 **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: **28/08/2019**

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):

EB1919838-016 AB_SS5_0.5_190729

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

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1921187-AB**	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 _AB	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 13:02
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.

- E
- 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	AB_SS5_0.5_190729	----	----	----	----
				Client sampling date / time	29-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-002	--------	--------	--------	--------
					Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**16.2**	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		**0.0002**	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0002**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0049**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0010**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.374**	----	----	----	----
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		**0.005**	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0110**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0081**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0043**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0067**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0030**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0018**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0007**	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	----	----	----	----
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	AB_SS5_0.5_190729	----	----	----	----
				Client sampling date / time	29-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-002	--------	--------	--------	--------
					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		**0.421**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.379**	----	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.0002	mg/kg		**0.421**	----	----	----	----
Sum of TOP C4 - C14 as Fluorine	----	0.0002	mg/kg		**0.272**	----	----	----	----
EP231_TOP_S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**82.5**	----	----	----	----
13C8-PFOA	----	0.0002	%		**83.5**	----	----	----	----

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-AB**	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 _AB	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		

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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	Anonymous	EA055: Moisture Content	----	0.1	%	14.6	14.5	0.706	0% - 20%
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2527289)									
EB1921187-001	Anonymous	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	Anonymous	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	Anonymous	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	Anonymous	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	Anonymous	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	Anonymous	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 _AB,	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						
HDPE Soil Jar						
HDPE Soil Jar						
HDPE Soil Jar						
AB_SS5_0.5_190729	----	----	----	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)							
HDPE Soil Jar (EA055)							
HDPE Soil Jar (EA055)							
HDPE Soil Jar (EA055)							
AB_SS5_0.5_190729	**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))	**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)) AB_SS5_0.5_190729	**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))	**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)) AB_SS5_0.5_190729	**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))	**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)) AB_SS5_0.5_190729	**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))	**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)) AB_SS5_0.5_190729	**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))	**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)) AB_SS5_0.5_190729	**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

From: Peachey, James <james.peachey@aecom.com>
Sent: Friday, 23 August 2019 5:47 AM
To: Carsten Emrich <Carsten.Emrich@alsglobal.com>
Cc: ALSEnviro Brisbane <ALSEnviro.Brisbane@alsglobal.com>
Subject: [EXTERNAL] - Rebatch EB1921176 and ES1925572

Hi Carsten

Please could you rebatch the following samples for TOPA (EP231X-TOP):

EB1921176

3 -025 (AB_MW03_190808)

Regards

James Peachey
Associate Director - Environment
D +61 7 3553 3909 M +61 426 206 362
james.peachey@aecom.com

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Environmental Division
Brisbane
Work Order Reference
EB1922105

Telephone : +61-7-3243 7222

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1922105**	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	Date Samples Received	: 23-Aug-2019 05:47
Order number	: 60609758 2.0	Date Analysis Commenced	: 27-Aug-2019
C-O-C number	: ----	Issue Date	: 12-Sep-2019 17:46
Sampler	: NK		
Site	: QFES		
Quote number	: BN/112/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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

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.

- Amendment (12/9/19): This report has been amended as a result of misinterpretation of sample identification numbers (IDs). All analysis results are as per the previous report

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	AB_MW03_190808	----
				Client sampling date / time	08-Aug-2019 00:00	----
					EB1922105-003	--------
					Result	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids						
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.59**	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.55**	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**3.03**	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		**0.26**	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**2.17**	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids						
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.8**	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**0.74**	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**3.50**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.35**	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.53**	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.07**	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides						
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	AB_MW03_190808	----
				Client sampling date / time	08-Aug-2019 00:00	----
Compound	CAS Number	LOR	Unit		EB1922105-003	--------
					Result	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued						
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids						
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----
EP231_TOP_P: PFAS Sums						
Sum of PFAS	----	0.01	µg/L		**12.6**	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**5.20**	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L		**12.6**	----
^ **Sum of TOP C4 - C14 as Fluorine**	----	0.01	µg/L		**8.06**	----
EP231_TOP_S: PFAS Surrogate						
13C4-PFOS	----	0.02	%		**105**	----
13C8-PFOA	----	0.02	%		**128**	----

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	: **EB1922105**	Page	: 1 of 6
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	Date Samples Received	: 23-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 27-Aug-2019
C-O-C number	: ----	Issue Date	: 12-Sep-2019
Sampler	: NK		
Site	: QFES		
Quote number	: BN/112/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. 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

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: 2544054)									
EB1922105-001		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.75	0.75	0.00	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.05	0.04	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.08	0.07	15.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.81	0.76	7.14	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.03	0.03	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2544054)									
EB1922105-001		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.06	0.05	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.17	0.10	53.7	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.54	0.47	13.5	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.08	0.05	36.2	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	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_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2544054) - continued									
EB1922179-007	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2544054)									
EB1922105-001		EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	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_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2544054) - continued									
EB1922105-001		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EB1922179-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2544054)									
EB1922105-001		EP231X: Sum of PFAS	----	0.01	µg/L	2.57	2.32	10.2	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	1.56	1.51	3.26	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	2.57	2.32	10.2	0% - 20%
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	1.64	1.48	10.3	0% - 20%
EB1922179-007	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	<0.01	<0.01	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: **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: 2544054)								
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	0.946 µg/L	87.4	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	0.928 µg/L	64.1	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2544054)								
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	99.7	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: 2544054)								
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: 2544054)								
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	0.0948 µg/L	-1.05	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: 2544054) - 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: 2544054)								
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	----	----	----	----
EP231X: Sum of TOP C4 - C14 as Fluorine	----	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	: **EB1922105**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 23-Aug-2019
Site	: QFES	Issue Date	: 12-Sep-2019
Sampler	: NK	No. of samples received	: 4
Order number	: 60609758 2.0	No. of samples analysed	: 4

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **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))	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP)) AB_MW03_190808	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X (TOP))	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP)) AB_MW03_190808	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X (TOP))	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP)) AB_MW03_190808	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP))	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP)) AB_MW03_190808	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-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
EP231_TOP_P: PFAS Sums							
HDPE (no PTFE) (EP231X (TOP))	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP)) AB_MW03_190808	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-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)	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	18	**5.56**	**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.