



Airservices Australia
Mackay Post-PSI Targeted Sampling
Final Report
November 2019

Executive summary

This report outlines the findings of a post-Preliminary Site Investigation (PSI) targeted investigation completed by GHD Pty Ltd (GHD) on behalf of Airservices Australia (Airservices) from June-July 2019 at Mackay Airport, Mackay, Queensland ('the Site'). The purpose of the investigation was to provide a targeted assessment of per- and poly-fluorinated alkyl substances (PFAS) contamination at and in the vicinity of the Site, to assess the ecological and health risks to potential receptors:

- Recreational users of Shellgrit Creek and ecological risk to Shellgrit Creek;
- Recreational users of the Illawong Parkland east of the airport and ecological risk to Illawong Parkland; and
- Risk to beneficial users of extracted groundwater, to the east and south of the airport, potentially impacted with PFAS.

This investigation builds on the findings of the PSI (GHD 2019a) for the Site.

Scope

The scope of the targeted investigation included:

- Soil (onsite): Development of four boreholes and collection and analysis of soil samples along the eastern and southern boundary of the Site.
- Groundwater (onsite): Installation of four groundwater monitoring wells along the eastern and southern boundary of the Site. A groundwater monitoring event was completed including 10 wells (new and existing wells) targeting areas of historical AFFF usage identified in the PSI (GHD 2019).
- Sediment (onsite and offsite): Collection and analysis of sediment samples from six surface drain and creek bed locations.
- Surface water (onsite and offsite): Collection and analysis of surface water including samples from drainage channels and tidally influenced Shellgrit Creek.
- Biota (offsite): Collection and analysis of four fish species from upstream Shellgrit Creek (seven fish in total).
- Analysis of samples collected (groundwater, soil, surface water, sediment and biota) for PFAS concentrations.

Findings

Soil

Twenty six soil samples were collected during the installation of four groundwater monitoring wells. Nine soil samples were selected for analysis. All soil samples analysed reported concentrations less than the adopted human health (industrial/commercial and public open space (NEMP-FSANZ)) or interim ecological (NEMP in direct exposure) criteria for pre-TOPA with the exception of sample MW09_0.5 (sample collected at 0.5m bgl).

Groundwater

Samples from nine groundwater monitoring wells exceeded the ecological screening criteria for PFOS (0.00023 µg/L). Samples from three groundwater monitoring wells exceeded the adopted human health drinking water guideline (0.56 µg/L). Exceedances were also recorded for sum of

PFHxS and PFOS against the adopted human health drinking water (eight of 10 wells) and NHMRC (2 µg/L) and FSANZ (0.7 µg/L) recreational guidelines (five of the 10).

PFAS detected in groundwater at concentrations greater than human health and ecological criteria poses a potential risk to Shellgrit creek (groundwater and surface water interactions) and to the beneficial groundwater users to the east and south (including Illawong Parkland and possibly some agricultural properties). However, the water use survey did not indicate any known current extraction of groundwater on properties to the south and east of the Site, suggesting the risk to recreational uses of Illawong Parkland and users of extracted groundwater is low.

Sediment

PFAS was detected in all six sediment samples collected from onsite drainage lines and sediment from Shellgrit Creek, with the highest detection located at surface water location SW08 as mentioned above. However, PFAS concentrations detected in sediments were less than the ecological criteria and therefore unlikely to pose an immediate risk to sensitive sediment-hosted ecological receptors.

Surface water

All six surface water samples (collected from onsite drainage lines, offsite drainage lines and Shellgrit Creek) reported PFAS concentrations exceeding the drinking water and daily tolerable intake guideline values. One surface water sample (SW08, located next to the former training ground in the south of the Site) exceeded the prescribed human health recreational guidelines for sum of PFHxS and PFOS.

Biota

Four of the seven biota samples exceeded the FSANZ trigger point (fin fish – edible portions) for investigation (5.2 µg/kg) and the adopted ecological direct exposure criteria for mammals and wildlife (4.6 µg/kg and 8.2 µg/kg) for sum of PFHxS and PFOS. These results indicate a potential risk to ecological health, as well as human health for consumers of finned fish from Shellgrit Creek. These exceedances trigger the need for further investigation. No detections of PFOA were recorded in any of the biota samples analysed.

Gaps

The following data gaps remain with regard to assessment of risks to receptors targeted in this investigation:

- The vertical and lateral extent of residual PFAS contamination in soil on Site remains undefined in some areas, in particular within the former training area in the south of the Site.
- The off-site extent of PFAS in groundwater remains undefined.
- A Water Use Survey was conducted at the properties immediately surrounding the Site identifying no use of groundwater extraction at these properties. The survey focused on potential use of groundwater, however other beneficial uses of the land and surface water which may be impacted by PFAS adjacent to the Site remain undefined.
- The PFAS concentrations in biota at the mouth of Shellgrit creek remains a gap, as no capture and analysis of fish or shellfish was achieved at this location during the Post-PSI biota sampling timeframe.
- The PFAS concentrations of shellfish remains a data gap, as no capture and analysis of fish or shellfish in Shellgrit Creek was achieved during the Post-PSI biota sampling timeframe.

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List of abbreviations

Acronyms	
AFFF	Aqueous Film Forming Foam
AHD	Australian Height Datum
ALS	ALS Laboratory Group
ANZECC	Australia and New Zealand Environment Protection Council
ARMCANZ	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management
bgl	Below Ground Level
CoC	Chain of Custody
CoPC	Chemicals of Potential Concern
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of Environment
CSM	Conceptual Site Model
DBYD	Dial Before You Dig
DES	Department of Environment and Science
DI ASLP	Australian Standard Leaching Procedure with de-ionised water
DO	Dissolved Oxygen
DQI	Data Quality Indicators
DQO	Data Quality Objectives
EC	Electrical Conductivity
FTG	Fire Training Ground
IP	Interface probe
LOR	Limit of Reporting
MW	Monitoring Well
NATA	National Association of Testing Authorities
NDD	Non Destructive Digging
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
ORP	Oxidation Reduction Potential
PFAS	Per- and poly- fluoroalkyl Substances
PFAS NEMP	PFAS National Environmental Management Plan
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
pH	Potential of Hydrogen
PNEC	Predicted No Effect Concentrations
PSI	Preliminary Site Investigation
QA	Quality Assurance
QC	Quality Control
QLD	Queensland
SAQP	Sampling Analysis and Quality Plan
SOP	Standard Operating Procedure
SPR	Source Pathway Receptor
SRM	Standard reference material

Acronyms	
SRN	Sample receipt notification
SWL	Standing Water Level
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Top of Casing
TOPA	Total Oxidisable Precursors Assay
WUS	Water Use Survey
Units	
bw	Body weight
d	Day
L	Litres
m	Metre
mbgl	Metres below ground level
mbTOC	Metres below Top of Casing
mg	Milligrams
mg/kg	Milligrams per kilogram
µg/kg	Micrograms per kilogram
mg/L	Milligrams per litre
ppm	Parts per Million
µS/cm	Micro-Siemens per centimetre
µg/L	Micrograms per litre

1. Introduction

Airservices Australia (Airservices) engaged GHD Pty Ltd (GHD) to undertake a post-Preliminary Site Investigation (PSI) targeted investigation at Mackay Airport, Mackay, Queensland (QLD) (the 'Site'). The targeted investigation focused on addressing gaps in the understanding of the potential off-site risks associated with contamination from per- and poly-fluorinated alkyl substances (PFAS). The Site locality and investigation area are shown in Figure 1, Appendix A. This investigation builds on the findings of the PSI (GHD 2019a) for the Site.

1.1 Purpose and objectives

The purpose of this post-PSI investigation was to assess PFAS contamination at and in the vicinity of the Site, to the extent necessary to assess the ecological and health risks to potential receptors:

- Recreational users of Shellgrit Creek and ecological risk to Shellgrit Creek;
- Recreational users of the Illawong Parkland east of the airport and ecological risk to Illawong Parkland; and
- Risk to beneficial users of extracted groundwater, to the east and south of the airport.

1.2 Background

1.2.1 PFAS

Aqueous film-forming foam (AFFF) has been used for fire-fighting purposes around Australia for decades. On airports, AFFF has been used at fuel depots, hangars and for operational and fire training purposes. Depending on the type of AFFF used, the principal PFAS constituents could have included perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) or fluorotelomers such as 6:2 fluorotelomer sulfonate (6:2FtS) and 8:2 fluorotelomer sulfonate (8:2FtS).

AFFF has not been used in the provision of aviation rescue and fire-fighting (ARFF) services by Airservices since 2010. Airservices has no knowledge of other leases based at Mackay Airport that may continue to store or use AFFF products, including the Mackay Airport. AFFF products historically used on airport sites contained PFAS.

1.2.2 PSI findings

Information reviewed as part of the PSI (GHD, 2019a) identified the following potential sources of PFAS at the Site, which include activities prior to Airservices commencing operations at Mackay Airport in 1995 (refer Figure 3).

- Fire training ground (FTG) – regular use of foam at the FTG locations since the fire station was constructed circa 1972 – 1974
- The fire station and surrounding locality – wash down of equipment and trucks, test foam releases and dispensing of excess foam
- Fire station workshop
- Historical fire training areas, including at the location of the current terminal building
- Fire extinguishers within hangars
- Fire Systems Queensland commercial outlet/depot (fire safety equipment suppliers)

- Surface water drainage channels

The sandy geology and shallow water table are conducive of conditions that would be expected to promote surface water and groundwater interactions, and the unconsolidated sandy environment is expected to be less conducive to the attenuation of PFAS. These factors mean that Mackay Airport is sensitively located with respect to the potential for contaminant migration via surface water and groundwater flow.

The PSI identified the following potentially sensitive receptors:

Onsite

- Site workers whose activities may result in exposure to impacted soils, surface water and groundwater

Offsite

- Nearby landowners abstracting potentially impacted groundwater for irrigation or other uses
- Consumers of potentially impacted seafood from the down gradient surface water receiving environment of the drainage channel, Shellgrit Creek and Coral Sea
- Recreational users of the potentially impacted drainage channel/creek and marine environment that may ingest contaminants or have dermal exposure to contaminants
- Flora and fauna in the possibly impacted hydraulically down-gradient marine surface water receiving environment

The PSI made the following conclusions:

- The primary source (use of AFFF containing PFAS) no longer exists on the Site. Secondary sources include residual soil and groundwater contamination.
- Onsite soil and sediment PFAS concentrations were reported either below the laboratory limit of reporting (LOR) or adopted human health and ecological guidelines (current at that time).
- PFHxS+PFOS (sum) concentrations in eight of the nine onsite groundwater samples analysed exceeded the drinking water guidelines and the PFOA concentrations in two groundwater samples (GMW6 and MW03) also exceeded the drinking water guidelines. PFOS concentrations in two groundwater samples analysed (GMW3 and GMW6) exceeded the adopted ecological screening criteria. These results indicate that groundwater may pose a potential risk to human health and ecological receptors.
- PFHxS+PFOS (sum) concentrations in two of the three surface water samples analysed for the Preliminary Sampling program reported concentrations exceeding the adopted criteria for consumption of fish from fresh and marine water. It should be noted that the PFOS criteria for the consumption of fish from fresh and marine waters were lower than the laboratory limit of reporting.

Gaps in the understanding of risks to the following sensitive receptors remained following the completion of the PSI. Further assessment of these gaps in understanding formed the basis of this post-PSI targeted sampling.

- Risk to recreational users of Shellgrit Creek and ecological risk to Shellgrit Creek
- Risk to recreational users of the Illawong Parkland east of the airport and ecological risk to Illawong Parkland
- Risk to beneficial users of extracted groundwater, to the east and south of the airport, potentially impacted with PFAS

1.3 Investigation boundaries

The investigation boundary of this post-PSI targeted investigation included the full extent of the Mackay Airport property as well as limited off-airport locations within the adjacent Shellgrit Creek. The Site locality and sampling locations for this post-PSI targeted investigation are shown in Figure 1 and Figure 2, Appendix A.

1.4 Technical framework

The sampling program was carried out in accordance with a Sampling, Analysis and Quality Plan (SAQP; GHD 2019b) and the National Environmental Protection Measure (NEPM, Assessment of Site Contamination), 1999 (2013 amendment). The SAQP was reviewed by Department of Environment and Science (DES), North Queensland Airports (NQA) and Queensland Health prior to implementation. It is noted that there were minor departures in the scope implemented from the SAQP, as detailed with justifications in Section 5.3.

The NEPM is the national guidance document for the assessment of site contamination in Australia; the purpose of this guidance is to establish a nationally consistent approach for the assessment of site contamination. The NEPM contains a number of schedules providing guidance on how to characterise site contamination, and assess the potential risks associated with this contamination.

Key guidance documents considered in this investigation included:

- Heads of EPAs (HEPA) Australia and New Zealand and the Australian Government Department of the Environment and Energy (DoEE), *PFAS National Environmental Management Plan*, January 2018
- Heads of EPAs (HEPA) Australia and New Zealand and the Australian Government Department of the Environment and Energy (DoEE), *PFAS National Environmental Management Plan, Version 2.0 Consultation Draft*, February 2019
- NEPC 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*, National Environment Protection Council, May 2013 (NEPM 2013).
- Relevant GHD Standard Operating Procedures (SOPs)
- Australian Standard (AS4482.1-2005) *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds* (Australian Standard 2005)
- Australian Standard, (AS4482.2-1999) *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile substances*
- ANZECC & ARMCANZ 2000. *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October 2000, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

1.5 Limitations

This report has been prepared by GHD for Airservices Australia and may only be used and relied on by these parties for the purpose agreed between GHD and Airservices Australia as set out in this report.

Any person or entity other than Airservices Australia or regulatory agencies that proposes to rely on GHD's report may only do so, with GHD's prior approval and after a GHD Reliance Deed has been signed and returned. GHD otherwise disclaims responsibility to any person other than Airservices Australia arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Airservices Australia and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

These Limitations should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report

2. Site information

The following provides a summary of site information, as presented in the PSI (GHD, 2019a).

2.1 Surrounding land uses

Land uses immediately surrounding the airport comprise:

- **North** – Mixed residential and sports grounds
- **East** – Mixed residential properties to the east/north east and undeveloped land to the east/south east that includes a small landfill, beyond which is the Coral Sea
- **South** – Predominantly undeveloped land and some agricultural use (sugar cane and cattle)
- **West** – Mixed residential properties are located to the west/north west, mixed commercial properties to the west/south west, and agricultural use (sugar cane) on the south west boundary.

2.2 Topography

The Mackay Airport is located on a coastal plain with generally flat topography gently sloping towards the east in the direction of the ocean. The low elevation ranges between 3.5 to 5.2 m Australian Height Datum (mAHD)¹. The majority of the Site has been built up compared to the natural ground level to establish a relatively consistent, flat site.

2.3 Geology

2.3.1 Regional geology

The Queensland Government Mines online map (Map Sheet 11388, Mackay) indicates that the Site is underlain by two geological units. The western portion of the Site is classified as late Tertiary to Quaternary aged colluvium while the eastern portion of the Site is Quaternary aged unconsolidated sediments. The surface soil is characterised as colluvial and residual/estuarine deposit material including clay, silt, sand and gravel.

2.3.2 Soil profile

Bore logs from previous reports indicated surface soils at the Site are characterised as sandy silt, sandy clay and clayey material (GHD, 2008 and GHD, 2017). These observations are consistent with the published geological maps.

2.4 Hydrology

The nearest surface water bodies adjacent to the Site include the following:

- Tidally influenced drain/creek (Shellgrit Creek) to the immediate north east and east of the Site
- Wetlands (located approximately 0.3 km east from the Site)
- Bakers Creek (located approximately 2.2 km south from the Site)
- Pioneer River (located approximately 2.9 km north from the Site)
- Coral Sea (located approximately 1 km east from the Site)

¹ Elevation details were obtained from QLD Globe – Location (assessed on 30 July 2019)

There are several surface drains on-site, surrounding the northern, north-western and southern boundaries of the airport, and running between the apron and runway. Stormwater captured on the Site discharges into the adjacent Shellgrit Creek, including drains in the west of the Site which drain north and discharge into Shellgrit Creek.

2.5 Hydrogeology

A search of the Department of Natural Resources and Mines 2016, *Groundwater Database – Bore Reports*, Queensland State Government, identified 140 registered bores within 2 km of the Site (GHD, 2019). The search results are summarised below:

- Of the 140 registered bores, 80 were listed with facility roles information, this includes water resources investigation (7), metered bores (4), exploration (3), stratigraphic investigation (26), sub-artesian monitoring (12) and water supply (28).
- Based on the available casing structure information, most registered bores were screened through the shallow unconfined aquifer less than 20 mbgl.
- Standing water levels (SWLs) of the registered bores ranged from 1.5 to 8 mbgl.
- Water analysis information indicated a mixture of slightly acidic to alkaline and fresh to saline groundwater environments.
- Five of the 140 registered bores were located on the Mackay Airport site (20401, 20595, 46805, 46807 and 46809). The available information suggested SWLs on the Site range from 2.1 mbgl to 2.7 mbgl and sit within a sandy aquifer.

It is important to note that unregistered and private bores may also exist, particularly as signage is not required for wells installed to depths less than 5 m in the Mackay area. Previous groundwater investigations undertaken at the Mackay Airport have identified groundwater at around 2.16 mbgl. The extent of saltwater intrusion and tidal influence is largely not understood.

2.6 Summary of site history

The airport has been operational since prior to 1953. The current fire station was built in the early 1970s and the former fire station was situated at the location of the former terminal. The current terminal was built in 1991 and is located at the site of the original fire training ground.

Fire training was historically conducted at a number of different locations on the Mackay Airport and in the immediate surrounding locality. It remains unclear if fire training has always occurred (or occurred consistently and regularly) at Mackay Airport or if training has been conducted at other airports, particularly in the period between 1990 and 2004. However, on airport, three confirmed locations have been used for fire training (Figure 3):

- The original FTG (now the site of the current terminal) used until circa 1990
- An interim (now former) FTG located immediately off-site to the south east of the airport (EW01 located in this area) which was used between circa 1990 and 2004
- The current FTG which has been in use since 2004.

AFFF has historically been stored in the vicinity of the current fire station, near the FTG and within a bunded area since 2002.

It is also noted that Airport Emergency Planning (AEP) exercises used water for training, with the exception of one AEP off-site training exercise where foam was used (based on unconfirmed anecdotal information) at a site to the east of the Airport, near Shellgrit Creek. It is unclear what year this training exercise may have occurred, or the exact location.

Reportable concentrations of PFAS have been detected in previous investigations, in locations of known fire training by Airservices (at the current and interim FTGs where investigations have been undertaken). Figure 3, Appendix A illustrates the identified areas of AFFF use and/or storage on site since the airport's inception in 1953.

3. Data quality objectives

The Data Quality Objectives (DQO) process is a seven-step systematic planning approach used to prepare plans for environmental data collection activities. The DQO process is specified in the NEPM 1999, (2013 amendment) and provides a systematic approach for defining the criteria that a data collection design should satisfy, including; when, where and how to collect samples or measurements; determination of tolerable decision error rates; and the number of samples or measurements that should be collected.

The DQO process that has been adopted for the investigation is described in detail in the sections below.

Table 3-1 Data quality objectives

Step		Description
1	State the problem to be resolved	The objectives of the investigation were to conduct a targeted water use survey and targeted sampling to support Airservices' risk and evidence based approach to managing PFAS contamination associated with Airservices legacy use of AFFF. Specifically, this investigation seeks to resolve the following problems: • What is the risk associated with PFAS contamination sourced from legacy use of AFFF by Airservices to recreational users of Shellgrit Creek? • What is the risk associated with PFAS contamination sourced from legacy use of AFFF by Airservices to recreational users of the Illawong Parkland east of the airport? • What is the risk associated with PFAS contamination sourced from legacy use of AFFF by Airservices to users of groundwater both south and east of the airport?
2	Identify the decision/s to be made	To address the problems set out in Step 1, the following decisions are required to achieve the task objective and to identify data gaps and additional information that may be required: • What is the likelihood that PFAS contamination has migrated off-site via groundwater or surface water? • Do the results of the groundwater, surface water and soil sampling and analysis at the boundary of the Site (on-site) indicate there is a potential for PFAS contamination off-site which has originated from the Mackay Airport? • Do the concentrations of PFAS in surface water, sediment and biota samples collected off-site exceed adopted guideline criteria? • What are the beneficial water uses of properties located down hydraulic gradient of the Site?
3	Identify the inputs to the decision	To inform the decisions and identify key data gaps and needs, the following information was considered necessary: • The location of potential PFAS contamination sources. • The location of existing groundwater monitoring wells with respect to potential PFAS contamination sources. • Installation of additional groundwater monitoring wells where gaps in understanding exist. • Groundwater and surface water flow pathways. • The results of the laboratory analysis of groundwater, surface water, soil, sediment and biota samples. • The capacity of the aquifer to attenuate migration. • Results of water use survey to understand the beneficial uses of groundwater down hydraulic gradient of the Site.

Step	Description
4	Define the boundaries of the study The study boundary comprises: - On-site groundwater within the shallow (unconfined) aquifer - On-site surface water and sediment within drainage lines in the vicinity of the identified potential PFAS sources - Off-site surface water, sediment and biota from Shellgrit Creek - A preliminary Water Use Survey (WUS) was conducted on selected properties to the south and east of the Site (down hydraulic gradient).
5	Develop a decision rule The key decision rules are: Is PFAS present at concentrations above laboratory LOR in boundary wells and in surface water? - If NO – there is less potential for PFAS contamination to migrate off-site and the priority for conducting off-site groundwater investigations may be reduced. - If YES – there is potential for PFAS contamination to migrate off-site and the priority for conducting off-site groundwater investigations is increased. AND: Do the concentrations of PFAS in on-site samples exceed the adopted guideline criteria? - If YES – groundwater and surface water off-site is more likely to be contaminated and the priority for conducting off-site groundwater investigations is increased. - If NO – groundwater and surface water <i>off-site</i> is less likely to be contaminated and the priority for conducting off-site groundwater investigations may be reduced. Do the concentrations of PFAS in off-site samples of surface water, sediment or biota exceed the adopted guideline criteria? - If YES – surface water, sediment or biota off-site may have been impacted by PFAS sourced from the Site. - If NO – surface water, sediment or biota off-site is less likely to be contaminated and the priority for conducting off-site investigations may be reduced.
6	Specify the tolerable limits on decision errors A detailed assessment of potential for sampling and measurement errors will be undertaken based on investigation scope, methodology and results. Data quality will be assessed as detailed in Schedules B2 and B3 of the ASC NEPM. Implications for data quality with respect to the task objective will be identified and discussed. Due to the margin of error associated with analytical methods, any results close to the threshold (within the margin of error either over or under) are more likely to be incorrectly considered either “contaminated” or “uncontaminated”. As targeted samples are to be collected as part of a judgemental approach, greater confidence in results will be achieved through knowledge of the Site and the likely location of PFAS sources. As such, the following tolerable limits on decision making are proposed for targeted sampling locations:

Step	Description
	- For results <i>within</i> the margin of error (either above or below the threshold) the initial classification would be considered valid (unless for a chemical not considered to be a contaminant of potential concern). - Any results <i>above</i> the threshold would require further investigation and delineation to determine the size of the impact identified.
7	Optimise the design for obtaining the data The sample design will be optimised through: - Identification of potential PFAS sources from the PSI (GHD 2019). - A review of the likely hydraulic characteristics of the shallow (unconfined) aquifer to estimate the groundwater flow directions at various locations of the Site. - A review of the surface water pathways across and leaving the Site. - Selection of existing groundwater monitoring wells. - Installation of targeted groundwater monitoring wells. - Collection of on-site groundwater, surface water, soil and sediment samples. - Collection of off-site surface water, sediment or biota samples. - Appropriate laboratory analysis methodologies. - Evaluation and interpretation of results with respect to relevant guidelines.

4. Assessment criteria

The guidelines have been derived based on, or using, existing nationally agreed long standing Australian processes. Where appropriate Australian derived guidelines are not available, internationally derived guideline values have been provided. The *PFAS National Environmental Management Plan*² (PFAS NEMP) (HEPA, 2018) was released in January 2018 and is a nationally agreed upon plan to manage and investigate PFAS contamination. An updated version (Version 2.0) of PFAS NEMP was released as a consultation draft on 28 February 2019. As Version 2.0 represents the most up to date understanding of PFAS risks. Guidelines provided in the PFAS NEMP Version 2.0 for human health (water and soil) and ecological/ecosystem protection (water and soil) will be utilised as screening criteria for further investigations and are summarised in the following sections.

Updated recreational guidelines on PFAS in recreational waters from the National Health and Medical Research Council (NHMRC)³ have also been utilised for screening surface water and groundwater PFAS results. This guideline has been adopted in addition to the Department of Health (DOH) recreational guidelines for PFAS. The recreational screening value for sum of PFHxS and PFOS (2 µg/L) and PFOA (10 µg/L) is to be applied to swimming and boating activities on/in natural waters and water bodies such as rivers and lakes (appropriate for recreational users of Shellgrit Creek. This guideline does not apply to any other recreational use or non-natural water bodies such as pools. For the latter, the DOH recreational guideline values for PFHxS and PFOS (0.7 µg/L) and PFOA (5.6 µg/L) must be used.

In Australia, there are currently no guidelines or screening criteria for PFAS toxicity in sediments. In absence of the Australian guidelines, the following Norwegian guidance have been adopted:

- Bakke, T, Kallqvist, T, Ruus, A, Breedveld, GD & Hylland, K 2010, *Development of sediment quality criteria in Norway*, Journal of Soil and Sediments, 10, 172– 178.

The Norwegian guidance was derived to provide environmental and health-driven risk assessment of marine sediments, to be used primarily as a supportive tool in the decision process on remediation of polluted harbour sediment. It must be noted that Bakke *et al.* (2010) does not provide supporting data for the values published. CSIRO is proposing to determine appropriate sediment quality guidelines to be applied in Australia, however, these may take up to two to three years to be validated and published.

4.1 Human health based guidelines

4.1.1 Water

Human health based drinking water and recreational water guideline values to be utilised for further investigations are provided in Table 4-1.

² Heads of EPAs (HEPA) Australia and New Zealand and the Australian Government Department of the Environment and Energy (DoEE), *PFAS National Environmental Management Plan*, January 2018

³ NHMRC, NHMRC (2019) Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Waters. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

Table 4-1 Human health based guidance values for water

Exposure scenario	Sum of PFOS + PFHxS	PFOA	Description	Source
Health-based guidance values	0.02 µg/kg _{bw} /d	0.16 µg/kg _{bw} /d	Tolerable daily intake	Foods Standards Australia New Zealand (FSANZ) 2017
	0.07 µg/L	0.56 µg/L	Drinking water	Australian Government Department of Health 2017
	0.7 µg/L	5.6 µg/L	Recreational water (other recreational use or non-natural water bodies such as pools)	National Health and Medical Research Council (NHMRC), 2019
	2 µg/L	10 µg/L	Recreational water (swimming and boating activities on/in natural waters and water bodies such as rivers and lakes)	NHMRC 2019

Notes: bw = body weight, µg = micrograms. Where the guideline values refer to the sum of PFOS + PFHxS, this includes PFOS only, PFHxS only, and the sum of the two.

4.1.2 Soil

Human health based soil criteria guideline values to be utilised for further investigations are provided in Table 4-2.

Table 4-2 Human health based guidance values for soil

Exposure scenario	Sum of PFOS + PFHxS	PFOA	Land use	Comments and source
Soil – Human health screening values	1 mg/kg	10 mg/kg	Public open space	National Environmental Management Plan (NEMP). Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. NEPM (Assessment of Site Contamination) Health Investigation Level C assumptions for public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools (except where soil used for agriculture studies) and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate.

Exposure scenario	Sum of PFOS + PFHxS	PFOA	Land use	Comments and source
	20 mg/kg	50 mg/kg	Industrial/commercial	National Environmental Management Plan (NEMP). Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. NEPM (Assessment of Site Contamination) Health Investigation Level-D assumptions including 8 hrs spent indoors and 1 hr spent outdoors at a site such as a shop, office, factory or industrial site. Note: the industrial commercial – Ecological Direct Exposure for PFOA has been set at 50 mg/kg in anticipation of the Stockholm Convention low content limit of 50 mg/kg.

Note: Where the guideline values refer to the sum of PFOS + PFHxS, this includes PFOS only, PFHxS only, and the sum of the two.

4.1.3 Biota

Human health based fish and seafood consumption trigger values to be utilised for further investigations are provided in Table 4-3, based on values provided in Food Standards Australia New Zealand (FSANZ, 2017) *Assessment of potential dietary exposure to perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) occurring in foods sampled from contaminated sites*. We note that these trigger values are protective of frequent seafood consumption and are likely to be conservative values for the average recreational fisherman.

Table 4-3 Human Health: Fish and Seafood Consumption; Proposed trigger points for investigation

Food classification	PFOS PFOS + PFHxS (µg/kg)	PFOA (µg/kg)	Derivation
Crustaceans	65	520	Children 2-6 years, median consumption
Finfish (all)	5.2	41	Children 2-6 years, P90 consumption
Fish liver	280	2,240	Population 2+ years, median consumption assumed to be 5 g (weight of one liver)

Note: P90 is defined as 90% of estimates exceed the P90 estimate (and by definition 10% of estimates are less than the P90 estimate).

4.2 Ecological and ecosystem guidelines

ANZECC default guideline values are applied to flowing natural waterways at the edge of a mixing zone. However, to obtain screening criteria for a preliminary assessment, these default guideline values can be selected to obtain a high level estimation of risk and to identify whether further investigation is required.

The Shellgrit Creek flow path has been re-engineered and modified, and the creek accepts surface water runoff from commercial, industrial and residential areas of Mackay. As such, the creek is considered a slightly-to-moderately disturbed ecological system. Australian and New Zealand Guidelines for Fresh and Marine Water Quality – technical draft default guideline values for PFOS and PFOA (WQGs) advise that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife.

It must be noted that the application of the freshwater default guidelines to marine systems provide an additional level of conservatism as PFOS is less bioavailable in saline water and can be expected to preferentially bind to marine sediments.

4.2.1 Water

Aquatic ecosystem water guideline values to be utilised are provided in Table 4-4.

Table 4-4 Aquatic ecosystem guideline values

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection – high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality – technical draft default guideline values for PFOS and PFOA. The 99% species protection level for PFOS is close to the level of detection, and therefore a 'detect' threshold may be used rather than a quantified measurement. The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms. The WQGs advise that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection – high conservation value systems	As above Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.

4.2.2 Soil

Ecological soil guideline values to be utilised are provided in Table 4-5.

Table 4-5 Ecological guideline values for soil

Exposure scenario	PFOS	PFOA	Land use	Comments and source
Interim soil - ecological direct exposure	1 mg/kg	10 mg/kg	Public open space	Future work is recommended to review available soil – ecological direct exposure criteria proposed by Australian research and industry organisations. ** As an interim, it is proposed that the human health screening value for public open space be used (see Table 4-2).

Exposure scenario	PFOS	PFOA	Land use	Comments and source
Interim soil – ecological indirect exposure	0.01 mg/kg		All land uses	Criterion is based on dietary exposure of a secondary consumer as the most sensitive exposure pathway assessed. This value may not be protective of specific animals, including predatory animals such as quolls.

** For example, CRC CARE 2017, *Assessment, management and remediation guidance for perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA) – Part 3: ecological screening levels*, CRC CARE Technical Report no. 38, Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.

4.2.3 Sediment

The Norwegian guidance provides a system for classification of the environmental quality of contaminated marine sediments based on the toxicity of the contaminants, which covers 43 compounds. The system has five quality classes (Classes I to IV), each with its own range of contaminant concentrations (see Table 4-6).

Class I represents background concentrations. The upper limits for Class II and Class III are the Predicted No Effect Concentrations (PNEC) for chronic acute (intermittent) exposure from the compound. The upper limit of Class IV is 2-5 × PNEC, which is intermittent depending on the compound, and Class V is everything above this. The border between Class II and Class III is the most significant as it separates no-effects sediments from those for which sediment remediation may be needed (Bakke *et al.* 2010).

Table 4-6 Norwegian environmental quality classification system

I	II	III	IV	V
Background	Good	Moderate	Bad	Very Bad
Background levels	No toxic effects	Toxic effects following chronic exposure	Toxic effects following short term exposure	Severe acute toxic effects

The Norwegian PNEC for PFOS of 0.22 mg/kg (Class II) has been selected as an initial screening criterion for this assessment, as it represents the concentration which has no toxic effects and where no remediation may be needed.

4.2.4 Biota

There are two factors to consider for ecological receptors: (1) the effects to the lower trophic level organisms themselves and (2) the risks to higher order species consuming the sampled organisms.

The PFAS NEMP Version 2.0 provides screening criteria to evaluate risks to higher order organisms consuming aquatic biota.

Table 4-7 Ecological guideline values for biota

Exposure scenario	Sum of PFOS + PFHxS	PFOA	Description	Comments and source
Ecological direct exposure for wildlife diet	4.6 µg/kg	-	Mammalian diet – consumption of aquatic biota ww food	Canadian Federal Environment Quality Guidelines (ECCC 2018) The avian diet value may not be protective of migratory wading birds that have a high food intake due to the need to gain weight rapidly.
	8.2 µg/kg	-	Avian diet – consumption of aquatic biota ww food	

The values provided in Table 4-7 are applicable to whole tissue samples (rather than edible portions).

It is noted that the Canadian Government has published a fish tissue guideline for the protection of fish health (8100 µg/kg) but these guidelines have not been endorsed by Australian Regulators and will not be applied to this investigation.

5. Sampling and analytical program

This section outlines the sampling design, analytical requirements and the methodology for the collection of environmental data.

The sampling program was developed and documented in a Sampling, Analysis and Quality Plan (SAQP; GHD 2019b). The SAQP was reviewed by Department of Environment and Science (DES), North Queensland Airports (NQA) and Queensland Health prior to implementation. It is noted that there were minor departures in the scope implemented from the SAQP, as detailed with justifications in Section 5.3.

5.1 Sampling program

The selection of sampling locations and sampling densities was developed in accordance with NEPM 1999 (amendment 2013), *Schedule B2 Guideline of Site Contamination* and relevant Australian Standards (AS). A judgmental based sampling design was chosen to address data gaps and potential source pathway linkages associated with potential:

- Risk to recreational users of Shellgrit Creek and ecological risk to Shellgrit Creek
- Risk to recreational users of the Illawong Parkland east of the airport and ecological risk to Illawong Parkland
- Risk to beneficial users of extracted groundwater, to the east and south of the airport, potentially impacted with PFAS

Sampling locations are presented in Figure 1, Appendix A.

5.2 Sampling location justification

Justification for the proposed sample locations is included in Table 5-1. The sample locations are presented in Figure 2, Appendix A.

Table 5-1 Sample location justification

Environmental Aspect	Sample ID	Justification
Groundwater (on-site)	GMW6	Provides coverage of southern boundary of the Site. Concentrations of PFOS in groundwater from GMW6 exceeded the adopted criteria during the 2017 sampling event (GHD 2019).
	EW01	Located east of GMW6, within the area of Airservices former fire training ground, this location provides coverage of the southern boundary of the Site
	MW02	Located in the south west corner of the Site, this location provides coverage of the southern boundary of the Site.
	MW03	Adjacent to known ARFF drill ground area, ad hoc training, and area used for storage of and training with AFFF since fire station was built in 1972.
	GMW3	Provides coverage of eastern boundary of the Site.
	GMW2	Provides coverage of eastern boundary of the Site.

Environmental Aspect	Sample ID	Justification
Groundwater and soil (on-site)	MW06 (new well)	Groundwater well location to assess potential for PFAS in groundwater due to 'Ad hoc use up to stopping AFFF use' at this location. Also, this location provides additional assessment of potential for exceedances in GMW6 and EW01 migrating off-site
	MW07 (new well)	Groundwater well location to assess potential for PFAS in groundwater due to 'Ad hoc use up to stopping AFFF use' at this location. Also, this location provides additional assessment of potential for exceedances in MW03 and GMW6 migrating off-site.
	MW08 (new well)	Groundwater well location to assess potential for exceedances in MW03 migrating off-site.
	MW09 (new well)	Groundwater well location to assess extent of exceedance in GWM3.
Surface water and sediment	SW01 – SW02 / SS01 – SS02	Resample the existing surface water and sediment locations, as per 2017 (GHD, 2019)
	SW04 / SS04	Additional surface water and sediment sample location targeting drainage near GWM3.
	SW05 / SS05	Additional surface water and sediment samples representative of up gradient (background) conditions
	SW06 / SS06	Additional surface water and sediment sample location to fill data gap associated with risk to recreational use of creek (samples to be collected near public foot bridge, possible fishing area)
	SW07 / SS07	Additional surface water and sediment sample location to fill data gap associated with risk to recreational use of creek
	SW08 / SS08	Additional surface water and sediment sample location targeting potential groundwater discharge near GWM6 (highest PFOS result in GHD 2019) and EW01
Biota	Biota01	Biota sample location to fill data gap associated with risk to recreational use of creek (biota were captured in the upper estuary of Shellgrit Creek at sampling location Biota01.)
	Biota02	Biota sample location to fill data gap associated with risk to recreational use of creek (Attempts at capturing biota at proposed sampling location Biota02 downstream in Shellgrit Creek near the break wall of the mouth failed)

A list of analytes included for each location are included in Table 5-3 and Table 5-3. .

Table 5-2 Sampling analysis

Sample media	Groundwater	Surface water	Soil	Sediment	Fish
Sample ID	GMW5, EW01, MW02, MW03, GMW3, GMW2, MW06, MW07, MW08, MW09	SW01, SW04-SW08	MW06, MW07, MW08, MW09	SS01, SS02, SS05-SS08	Biota 1 (Fish)
Number of primary samples collected	10	6	32	6	7
Number of primary samples analysed	10	6	8	6	7
QA/QC (Dup)	1	-	1	-	-
QA/QC (Split)	1	-	1	-	-
Analysis					
pH	10	-	-	-	-
TDS	10	7	-	-	-
Particle Size Distribution*	-	-	4	-	-
PFAS – Low level full suite (28 analytes) including linear/branched speciation	12	6	18	6	7
PFAS – Low level Total Oxidisable Precursors Assay (TOPA), which provides the reporting of Sum of C4-C14 as Total Organic Fluorine (TOF)**	2	2	2	-	-
PFAS – low level full suite (28 analytes) TCLP analysis	-	-	1	-	-
Major anions and cations & Alkalinity	10	6	-	-	-
Total Organic Carbon (TOC)	10	5	7	6	-

Notes:

* Particle size distribution analysis was assigned for one soil sample per borehole, to inform groundwater modelling if required.

** It is generally expected that TOPA be included in PFAS analysis by the PFAS Technical Working Group (comprising representatives from DES and Queensland Health).

Table 5-3 PFAS analysed within the PFAS suite

Perfluoroalkyl Sulfonic Acids	Abbreviation
Perfluorobutane sulfonic acid	PFBS
Perfluoropentane sulfonic acid	PFPeS
Perfluorohexane sulfonic acid	PFHxS
Perfluoroheptane sulfonic acid	PFHpS
Perfluorooctane sulfonic acid	PFOS
Perfluorodecane sulfonic acid	PFDS
Perfluoroalkyl Carboxylic Acids	
Perfluorobutanoic acid	PFBA
Perfluoropentanoic acid	PFPeA
Perfluorohexanoic acid	PFHxA
Perfluoroheptanoic acid	PFHpA
Perfluorooctanoic acid	PFOA
Perfluorononanoic acid	PFNA
Perfluorodecanoic acid	PFDA
Perfluoroundecanoic acid	PFUnDA
Perfluorododecanoic acid	PFDODA
Perfluorotridecanoic acid	PFTTrDA
Perfluorotetradecanoic acid	PFTeDA
Perfluoroalkyl Sulfonamides	
Perfluorooctane sulfonamide	FOSA
N-Methyl perfluorooctane sulfonamide	MeFOSA
N-Ethyl perfluorooctane sulfonamide	EtFOSA
N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE
N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE
N-Methyl perfluorooctane sulfonamidoacetic acid	MeFOSAA
N-Ethyl perfluorooctane sulfonamidoacetic acid	EtFOSAA
Fluorotelomer Sulfonic Acids	
4:2 Fluorotelomer sulfonic acid	4:2 FTS
6:2 Fluorotelomer sulfonic acid	6:2 FTS
8:2 Fluorotelomer sulfonic acid	8:2 FTS
10:2 Fluorotelomer sulfonic acid	10:2 FTS

5.3 Deviations from SAQP

The following samples could not be collected during the post-PSI targeted sampling program:

- No biota could be collected from proposed downstream location Biota02 (proposed in GHD SAQP 2019, Figure 1) during the sampling program after numerous attempts using a number of different methods and time spent in an attempt to collect one of the target species as illustrated in Table 5-4.

- Proposed surface water location SW02 was dry and no sample could be collected.
- Proposed sediment location SS04 was unable to be sampled due to the presence of extensive organic matter and roots. Sufficient sediment could not be recovered for analysis from this location at the time of sampling.
- Allowance was made for PFAS super trace analysis to be carried out for water samples that recorded below LOR for sum of PFAS low level analysis (LOR 0.01-0.002 µg/L). This analysis was not required due to detections recorded in all water samples above PFAS low level LOR's for sum of PFAS.

5.4 Target species

The marine and estuarine taxa targeted for biological sampling (stated in SAQP, GHD 2019b) were selected based on a desk-top review of potential biota targeted by recreational and indigenous fishers in the region. These species were confirmed as appropriate target species by Queensland Health.

Table 5-4 indicates target species collected during the biota sampling in Shellgrit Creek. The target species caught during the post-PSI sampling were located upstream of Shellgrit Creek (Biota01, Figure 2, Appendix A). Sampling and analysis of larger fish (included four barramundi caught) required filleting and removal of tissue from specimens to be tested in a laboratory.

Table 5-4 Identified target species

Scientific name	Common name	Photo	Habitat and diet	Catch and sampling technique
<i>Acanthopagrus australis</i>	Yellowfin Bream		- Bream inhabit estuaries in salt- or brackish water up to the fresh water limit, and inshore rocky reef habitats near ocean beaches and rocky headlands. - Carnivorous, the yellowfin bream preys on small fishes and bottom-dwelling invertebrates such as crabs, shellfish, polychaete worms and ascidians.	Seine net
<i>Nematalosa erebi</i>	Boney bream		Bony bream are a freshwater and estuarine species which inhabit shallow or slow flowing rivers, streams and lakes, particularly in turbid conditions. The bony bream feeds on benthic algae and detritus, as well as on small invertebrates.	Seine net

Scientific name	Common name	Photo	Habitat and diet	Catch and sampling technique
Lates calcarifer	Barramundi		• Rockhampton and further north • Coastal marine • Estuarine and freshwater habitats • Adults mainly in estuaries (mangroves and river mouths) • Juveniles extend up rivers into fresh water • Often stocked in impoundments	Seine net
Mugil cephalus	Mullet		• All Queensland coastal waters • Marine waters, estuaries, lagoons and rivers	Seine net

6. Field investigations

6.1 Preparations

6.1.1 Safety

GHD prepared a project-specific Health Safety & Environment Plan (HSEP) plan for the Site works in accordance with work, health and safety (WHS) legislation and associated Codes of Practice. The HSEP plan consisted of a summary of relevant site activities and specific job-related tasks; a hazard register that identified foreseeable hazards; risk ranking and risk management measures for each identified hazard; and procedures for monitoring and / or implementing remedial actions to manage project-based risks.

6.2 Fieldwork program

The following intrusive site investigation based on the SAQP (GHD, 2019b) was undertaken 25 June to 3 July 2019. The fieldwork program is summarised in Table 6-1 and field documentation provided in Appendix D and Appendix E.

Table 6-1 Field work schedule

Date	Activity
25 - 26 June 2019	Biota Sampling in Shellgrit Creek
27 - 28 June 2019	Underground services location and NDD to maximum depth of 1.2 m of newly installed groundwater monitoring wells (MW06 to MW09). Drilling (drill rig from 1.2 m to final depth) and development of newly installed groundwater monitoring wells (MW06 to MW09). Collection of surface water samples and sediment samples
01 - 03 July 2019	Surveying of the four newly installed monitoring wells (MW06 to MW09). Gauging and sampling of 10 nominated groundwater monitoring wells (GMW2, GMW3, GMW6, MW02, MW03, MW06, MW07, MW08, MW09, EW01).

6.3 Monitoring well installation

The methodology for soil sampling and groundwater well installation is provided in Table 6-2 below and detailed procedures in the GHD standard operating procedures (SOPs) provided in the SAQP (GHD, 2019b).

Table 6-2 Groundwater MW installation

Task	Method / Approach
Site inspection and preparation	The site inspection included a site walk over to identify suitable access and locations for groundwater monitoring wells to be installed. Specifically, the site inspection included the following tasks: • Document site facilities and key site features (including drainage features) and identify suitable offsite surface water locations in Shellgrit Creek and appropriate locations along eastern boundary to establish new monitoring wells. • Identify evidence of potential contamination including discolouration or oil staining on the ground surface, disturbed or affected vegetation or notable odours

Task	Method / Approach
	- Identify surface water on or adjacent to the Site (if any) and potential discharge points for surface water runoff - Identify land uses of the immediate surrounds and access to off-site surface water and biota sampling locations. - Confirm drilling / sampling locations for the intrusive investigations and potential constraints to sampling in particular areas - Undertake Dial Before You Dig (DBYD) searches - Obtain necessary PERCOW Permits and airside escort arrangements.
Intrusive soil investigation	- Clearance of all sample locations by a Services Locator - NDD of the top 1.2 m using hydro excavation unit (as appropriate and in accordance with the SOP) of each sample location for clearance of underground services. A hand auger was used to retrieve sample from hole. The hand auger was decontaminated before and between the collection of each sample interval using deionised water and Liquinox in accordance with the GHD SOP provided in the SAQP (GHD, 2019). - Drilling soil bores to depths detailed in Bore Logs (Appendix B) using solid flight augers. Samples from the solid flight auger were collected with gloved hands (nitrile) and/or a small spade. A new set of disposable gloves were used to sample each sample interval. Where wet or saturated sands close to the final well installation depth were encountered, samples were collected via gloved hand off the hollow flight auger. - Where hole collapses occurred due to saturated marine silts/sands, drilling using solid flight auger was reattempted to achieve target depth. Where this method was ineffective a gravity valve sand pump inside a larger diameter casing (to avoid re-collapse) was used to reach target depth and install well screen and casing. - Decontamination of the solid flight auger, and spade (used for sampling) was undertaken between each sample location in accordance with the decontamination methodology outlined in the SAQP. - Logging of the soil profile was completed by an environmental scientist to assess the underlying geology, and occurrence of groundwater - Soil samples were collected from each of the soil boreholes generally at the surface, 0.2 mbgl, 0.5 mbgl and 1 mbgl, and then at approximately 1 m intervals to a maximum depth of 4.1-5.7 m or where changes in lithology or potential contamination were observed, unless soil samples were too saturated to be recovered from the drilling. - Laboratory analysis of primary and secondary soil samples at ALS (primary laboratory) and Eurofins (secondary laboratory) for analytes as specified in Table 5-2. Two soil samples per soil bore (near surface and vadose zone) were analysed. - Collection of QA/QC samples including duplicate, split samples - Drill cuttings were collected in drums and stored at the western end of the Site for waste classification and disposal options.
Well construction	- Installation of groundwater monitoring wells (MW06 to MW09) to a maximum depth of approximately 5.7 mbgl (or less depending on depth to groundwater) to assess groundwater flow and groundwater quality. - Groundwater wells were constructed as per <i>Minimum Construction Requirements for Water Bores in Australia</i> (3rd edition, 2012), National Uniform Drillers Licensing Committee. - Wells were constructed using 50 mm ID uPVC, Class 18, acid washed threaded standpipe with machine slotted (0.4 mm) screened section. Graded and washed filter sand was installed 0.5 m above the screened interval, then a bentonite seal and grout to the surface. - Screened and installation depths varied according to strata, identified conductive horizons, areas of potential contamination and the need to minimise the risk of cross contamination between soil horizons / units. - Wells were completed at the surface with flush mounted gatic covers concreted below the ground surface. Well construction details are presented in the borehole logs in Appendix B.

Task	Method / Approach
Well development	- All wells were developed after construction using bailer to remove borehole smear and formation fines present in the filter pack surrounding the screen. Approximately 60 to 100 litres of groundwater was removed when developing each well. - GHD considers that the development procedure undertaken was adequate to allow collection of representative groundwater samples. - Purged water from the well development was purged to ground as per SAQP. - Calibration records for groundwater equipment and field sheets in Appendix D.
Well survey	- The top of the well casings were surveyed to Australian Height Datum (AHD) by a licenced surveyor. In cases where the top of casing was not evenly cut, the highest point of the top of casing was surveyed. - The survey data (top of collar) is presented in Appendix C.

6.4 Groundwater monitoring

The methodology for groundwater well monitoring is provided in Table 6-3 below and detailed procedures provided in SOPs in the SAQP (GHD, 2019b).

Table 6-3 Groundwater monitoring

Activity	Method / Approach
Well gauging	- Groundwater standing water levels (SWL) were gauged using an interface probe from the top of the well casing. - Gauging data from this round is provided in Appendix D.
Groundwater sampling	- Groundwater sampling was undertaken approximately three days after installation and development of the new wells to allow for water levels and groundwater chemistry to stabilise. - All existing and newly installed wells were purged and sampled using a low-flow peristaltic pump. Purging continued until field quality parameters stabilised. - Groundwater samples were collected directly from tubing dedicated to each specific well, and decanted in laboratory provided sampling containers suitable for the analysis to be performed and filled to minimise headspace. All samples were labelled with an indelible pen (non-permanent markers) on water resistant labels attached to the sample bottles. - A multi-probe water quality meter, including temperature, DO, pH, ORP and EC was used to collect water quality readings during the purging and sampling process. Groundwater gauging and sampling records are provided in Appendix D. - Laboratory analysis of groundwater samples was as specified in Appendix H.
Decontamination	- Decontamination of the interface probe was undertaken through a three stage approach. The first stage involved cleaning the equipment using a 5% mixture of pH phosphate free detergent (Liquinox) in water, followed by a 1% mixture and then deionised water as a final rinse. - Dedicated single-use tubing was used for sample collection to minimise potential for cross contamination.
QA/QC	Two Quality Control samples were collected including one intra-laboratory ("blind") sample and one inter-laboratory ("split") sample.

6.5 Surface water sampling

The methodology summary for surface water sampling is provided in Table 6-4 below and detailed procedures provided in the SAQP (GHD, 2019b).

Table 6-4 Surface water sampling methodology

Task	Method / Approach
Surface water sampling	GHD undertook fresh water, estuarine and marine surface water sampling including: • Collection of water sample (grab) into laboratory prepared sample containers suitable for the analyte of concern • Laboratory analysis of primary and secondary soil samples at ALS (primary laboratory) and Eurofins (secondary laboratory) for analytes as specified in Table 5-2. • Surface waters were sampled first before the sediment sample at any given location in order to avoid collecting water with suspended sediments from the sample location • Surface water samples were collected directly into laboratory supplied bottles by submersing the laboratory sample bottle into the water by hand. • Record site observations, photographic records and water quality parameters including pH, EC, DO, ORP, TDS and temperature where possible are documented in Appendix E. Physico-chemical water quality parameters were unable to be measured at surface water locations SW01, SW05 and SW07 due to faulty water quality meter (YSI).

6.6 Sediment sampling

The methodology for surface water sampling is provided in Table 6-5 below and detailed procedures provided in the SAQP (GHD, 2019b).

Table 6-5 Sediment sampling methodology

Task	Method / Approach
Sediment sampling	GHD undertook terrestrial sediment sampling including: • Collection of sediment sample using hand held sampling tool (small spade and or gloved hand) and placed material directly into laboratory prepared sample containers suitable for analytes as specified in Table 5-2. • Laboratory analysis of primary and secondary soil samples at ALS (primary laboratory) and Eurofins (secondary laboratory) for analytes as specified in Section 6.8. • Record site observations, photographic records and sediment description are provided Appendix E.

6.7 Biota sampling

The methodology for surface water sampling is provided in and detailed procedures provided in the SAQP (GHD, 2019b) and summaries in Table 6-6 below.

Table 6-6 Biota sampling methodology

Task	Method / Approach
Biota sampling	GHD undertook terrestrial sediment sampling including: A General Fisheries Permit was obtained and filed from GHD (permit number 192406, dated 24 June 2019) to capture and euthanise fish and macrocrustaceans for chemical analysis using the following approved apparatus: • Fyke net – dual wing • Seine net • Cast nets • Crab pots • Notification was given to the Queensland Boating and Fisheries Patrol (via email) more than 48 hours prior to any of the collection activities commenced under this permit.

Task	Method / Approach
	- A number of methodologies were utilised to catch and collect fish species. Full procedures for all methodologies are provided in the SAQP (GHD, 2019). The following methods of capture were utilised and the following observations were made: - Crab pots were deployed upstream (Biota01) and downstream (Biota02) locations for up to 12 hours at each location and left over night using local frozen mullet for bait. No crabs were caught over the two day sampling period. - Fyke nets were set up at two locations, upstream (up to 3 hours) and downstream (up to 2.5 hours). No targeted fish species were caught. - Seine nets were used to capture all seven fish species identified, collected and processed for analysis –specific details are provided below in Section 6.7.1. - Laboratory analysis of primary and secondary soil samples at ALS (primary laboratory) and Eurofins (secondary laboratory) for analytes as specified in Table 5-2. - Record site observations, photographic records and weights of each sample are provided in Appendix E.
Processing for laboratory analysis	GHD undertook the biota sampling in accordance with the following sampling procedures: <i>Guidelines for sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination</i> (Queensland Health, 2018). The guide outlines the approach recommended by Queensland Health for sampling and analysis of marine and freshwater biota for PFAS with the intention of assessing public health risk and informing any human health risk assessment. GHD has noted the following key points as part of our sampling program method: - Biota samples were legally caught only in recognised fishing areas (excluding green zones, drains etc.) - Only edible species that are typically consumed from the area of interest were used. - GHD was unable to fillet smaller fish with only small amounts of edible flesh. In this situation where yellow-fined bream (two fish caught), boney bream (two fish caught) and mullet (four fish caught) were too small for filleting, whole samples were submitted for analysis, where the lab pulverised and created a composite sample to be analysed. Four barramundi caught were de-scaled and filleted for analysis and preparation. Laboratory preparation methodology are outlined in Appendix H (ALS report EB1920340). - Contamination of samples with PFAS during the handling of samples was avoided, by strict adherence to QA/QC procedures and avoidance of known and suspected contamination risks listed in Table 3 of the Queensland Health Guidelines. Knives and cutting boards used to fillet the fish were washed between the filleting of each sample using de-ionised water and liquinox detergent. Fish fillets were placed directly into laboratory provided, fully sealed plastic zip-lock bags and placed on ice.

6.7.1 Seine netting

Seine netting achieved the capture of all seven fish species during the field sampling program. Seine nets were used to actively sample small mid-water and benthic fish species. GHD used 10 m seines of 2 mm mesh size. Operation was via two people, one at each end, dragging the

net through open sections of water. Each seine trawl was standardised to 10 m transects. A total of 6 seine trawls were conducted over a 45 minute period to capture the quantity of target species collected during the field sampling.

After each seine trawl, target fish which met the preferred target species requirements were placed in a bucket of water (from the sampled waterbody) for euthanization and laboratory preparation. Non-target organisms identified as unsuitable for sampling were returned to the waterbody. Measures such as regularly replacing the water and using a small aerating pump to maintain oxygen levels using a battery-operated aerating pump were utilised whilst collecting and preparing the fish for processing.

6.8 Laboratory analysis program

GHD submitted all primary and duplicate QC samples (duplicates) of soil, sediment, surface water and groundwater samples to ALS and inter-laboratory duplicate (split) samples for QC purposes to a secondary laboratory (Eurofins).

The laboratories were National Association of Testing Authorities (NATA) accredited for the analytical program undertaken.

Certified laboratory documentation including chain of custody (CoC), sample receipt notifications, certificates of analysis and laboratory QA / QC reports are provided in Appendix H.

6.9 Sample handling and transport

All samples were placed directly into appropriately preserved laboratory supplied sample containers and placed on ice within coolers and delivered to the analysing laboratory under chain of custody (CoC) documentation. All samples were transported to the analysing laboratories within appropriate holding times. Specific protocols for sampling management to ensure cross contamination does not occur were followed as addressed in the PFAS specific SOPs within the SAQP (GHD, 2019).

6.10 Water Use Survey

GHD, on behalf of Airservices Australia (Airservices), undertook a water use survey of properties adjacent to the southern and eastern boundaries of Mackay Airport to assess the use of groundwater extraction bores on these properties.

The survey was designed to determine the extent of bore use in the area, what the bores are used for, and whether further environmental investigations are required.

The letter and information sheet were distributed on 3 July 2019 to 28 landholders. The letter also encouraged landholders to complete an online water use survey by 19 July 2019.

All respondents confirmed they are connected to town water and do not have a groundwater extraction bore(s) on their property.

A close out letter was distributed in November 2019 to the landholders who were initially contacted as part of these works. The letter provided a summary of the findings and outlined next steps.

A copy of all communication collateral can be found in Appendix J.

7. Results

7.1 Field results for GHD works

The following section details the observational results of the soil, sediment, groundwater and surface water sampling for works undertaken by GHD in June and July 2019.

7.1.1 Groundwater wells

Four groundwater monitoring wells were drilled and installed across the Site. The location of monitoring wells is shown in Figure 1, Appendix A and bore logs are included in Appendix B.

All soil bore locations were on grassed surfaces. The soil profile was described as follows:

- Natural soil – Comprising of CLAY and/or CLAY with/trace sand, brown, dark brown and grey, low plasticity closer to the surface (0.01 -4.3 m bgl) with often increasing plasticity down the profile. Clay was often firm, increasing in stiffness down the soil profile. Orange and red colours appear in the stiff clays deeper in the profile.
- Sand silt and silty sands (1.5 – 5.7 mbgl) became apparent near the water bearing zone covering the hard clay and was commonly found in lenses throughout the soil profile. Sand was fine to coarse grained (quartz sands) and saturated low plasticity marine silt.

Five soil samples were analysed for particle size distribution (PSD).

The PSD results were generally consistent with field observations of the soil bores, some differences were observed as reflected in the borehole logs presented in Appendix B. The PSD results are summarised below in Table 7-1.

Table 7-1 Summary of PSD results

Sample ID	Depth	PSD Results
MW06_3.0	3.0 mbgl	Gravel = 2.0% Sand = 82% Silt = 5.0% Clay = 11%
MW07_3.5	3.5 mbgl	Gravel = <1% Sand = 13% Silt = 44% Clay = 43%
MW08_2.0	2.0 mbgl	Gravel = 1.0% Sand = 42% Silt = 23% Clay = 34%
MW09_2.0	2.0 mbgl	Gravel = 1.0% Sand = 68% Silt = 12% Clay = 19%

There were two locations where the lithology prevented drilling to the full extent required. Hole collapses at MW06 and MW08 were encountered, where lithology consisted of saturated sand and marine silt in the vadose zone.

7.1.2 Groundwater sampling

Ten groundwater wells (six existing wells, four newly installed wells) were sampled. The groundwater monitoring sheets describing the water quality conditions at each groundwater

monitoring location are provided in Appendix D and locations of groundwater monitoring wells are presented in Figure 1 (Appendix A).

The following groundwater quality were reported across the 10 groundwater monitoring wells:

- DO ranged from 0.23 milligrams per litre (mg/L) (EW01) to 1.33 mg/L (GMW3).
- EC ranged from 226.6 micro Siemens per centimetre ($\mu\text{S}/\text{cm}$) (GMW6) to 38,829 $\mu\text{S}/\text{cm}$ (MW7), indicating fresh to saline conditions across the Site and the surrounding area. The EC of groundwater at each location appears to generally correlate to the locations' proximity to the ocean and/or tidally influenced Shellgrit Creek.
- pH ranged from 4.05 pH units (GMW2) to 6.74 (EW01) pH units. The majority of groundwater locations across the Site and surrounding area reported slightly acidic conditions.
- ORP ranged from -236.4 milli Volts (mV) (EW01) to 325.8 mV (GMW2).
- Temperature ranged from 24.0 degrees Celsius ($^{\circ}\text{C}$) to 27.0 $^{\circ}\text{C}$.

7.1.3 Groundwater contouring

Ten monitoring wells were gauged and a groundwater contour map was generated based on July 2019 gauging event, as presented in Figure 6, Appendix A. Groundwater depths ranged from 1.828 mAHD (MW06) to 3.366 mAHD (MW03). Groundwater is inferred to flow to the east north-east, toward Shellgrit Creek in the northern portion of the investigation area and to the east south-east, toward Shellgrit Creek, in the southern portion of the investigation area.

7.1.4 Surface water and sediment sampling

The sediment and water conditions at each of the sampled sites varied depending on the environment in which the sample was collected (marine, fresh water drainage line, tidal or estuarine environments etc.). Monitoring sheets describing the conditions at each of the sampled sites (surface water and sediments) are provided in Appendix E and the locations of the sampled sites are presented in Figure 2 (Appendix A).

Physico-chemical water quality parameters were unable to be measured at surface water locations SW01, SW05 and SW07 due to faulty water quality meter (YSI). Terrestrial surface water sample locations reported the following ranges for in-situ water quality parameters across three of the six locations (SW4, SW06 and SW08) sampled:

- DO ranged from 69.9 % (SW06) to 171.5 mg/L (SW04).
- EC ranged from 3,516 $\mu\text{S}/\text{cm}$ (SW08) to 46,602 $\mu\text{S}/\text{cm}$ (SW04). The EC of surface water at each location is highly correlated to the locations' proximity to the ocean and/or location within tidally influenced Shellgrit Creek, and would also have been influenced by the phase of the ocean tide at the time of sampling.
- pH ranged from 6.56 pH units (SW04) to 8.16 pH units (SW08), indicating slightly acidic to moderately alkaline conditions.
- ORP ranged from 52.6 mV (SW04) to 178.2 mV (SW06). SW04 was located within a drainage area with roots and organic matter, which is typical of anoxic conditions.
- Temperature ranged from 21.3 $^{\circ}\text{C}$ (SW08) to 26.2 $^{\circ}\text{C}$ (SW04).

Sediment samples (from surface drains and Shellgrit Creek) were clay and silt, brown to dark grey in colour, contained organic matter (roots and leaf litter) and included samples with no odour to the presence of anoxic odours (SS01, SS06). Marine sediment sample SW07 contained coarse sands, with some presence of shells.

7.2 Analytical results

The following section details the analytical results of soil, sediment, groundwater and surface water laboratory results samples collected during June and July 2019. The tabulated analytical results are presented in Appendix F and laboratory reports collated in Appendix H. Analytical results for soil, groundwater, surface water and sediment are described in the following sections. The nominated criteria have been compared to PFAS pre-TOPA results only.

7.2.1 Soil – Monitoring Wells

A full set of tabulated data for soil results is available in Tables F1a and F1b (Appendix F).

Soil

Twenty-six soil samples were collected. Nine soil samples were selected for analysis. Where PFAS were detected above laboratory LOR the concentrations were not above the nominated guidelines for human health [industrial/commercial and public open space (NEMP-FSANZ)) or interim ecological (NEMP indirect exposure) for pre-TOPA with the exception of sample MW09_0.5 (sample collected at 0.5m bgl). The concentration of PFOS (0.0209 mg/kg) for sample MW09_0.5 exceeded the NEMP interim ecological screening criteria for PFOS (0.01mg/kg) residential indirect exposure. The range of PFAS (pre-TOPA) concentrations detected were as follows:

- PFOS <0.0002 to 0.0209 mg/kg (MW09_0.5)
- PFOA <0.0002 to 0.0005 mg/kg (MW09_0.5)
- Sum of PFHxS and PFOS <0.0002 to 0.0276 mg/kg (MW09_0.5).

7.2.2 Groundwater

Ten groundwater monitoring wells were sampled and analysed (EW01, GMW2, GMW3, GMW6, MW02, MW03, MW06 to MW09). A full set of tabulated data for groundwater results is provided in Tables F2a and Table F2b, Appendix F. A summary of exceedances is illustrated in Figure 4, Appendix A.

The range of PFAS (pre-TOPA) concentrations for groundwater samples were:

- PFOS <00002 µg/L (MW07) to 170 µg/L (GMW6)
- PFOA <00002 µg/L (MW07, MW08, MW02) to 6.12 µg/L (MW03).
- PFHxS+PFOS 0.014 µg/L (MW08) to 246 µg/L (GMW6).

TOC in groundwater samples ranged from <1 mg/L to 10 mg/L. Two groundwater samples reporting the highest PFAS concentrations (GMW6 and GMW3) were selected for TOPA analysis. The following comparisons are made:

- TOF concentrations ranged from 43.2 µg/L (GMW3) to 141 µg/L (GMW6).
- PFHxS and PFOS (sum) concentrations in GMW6 decrease from pre-TOPA (289 µg/L) to post-TOPA (221 µg/L).
- PFHxS and PFOS (sum) concentrations in GMW3 increase from pre-TOPA (57 µg/L) to post-TOP (67.3 µg/L).
- Total PFAS and PFCA concentrations increased in GMW3 between pre- and post-TOPA analysis indicating no material loss and the probable presence of precursors. Complete oxidation occurred for PFAA compounds in this sample from Pre to post-TOPA
- The TOPA and TOF results suggest that there is little evidence of PFAS precursors in the groundwater sample from GMW6 [TOF < PFHxS and PFOS (sum)]. This is also likely due

to decreases in pre-TOPA and post-TOPA concentrations for PFHxS and PFOS (sum) and PFCAs. It is also noted that samples that highly impacted such as GMW6 were diluted at x100 and x1000 for TOPA laboratory preparation. With the samples requiring such significant dilutions this also means that experimental variation or uncertainty is potentially also being magnified.

- Post-TOPA results for PFHxS and PFOS (sum) exceeded the adopted human health, recreational and ecological guidelines for both samples.

Drinking water guideline

Three groundwater samples collected and analysed from GMW6 (4.22 µg/L), GMW3 (0.663 µg/L) and MW3 (6.12 µg/L) exceeded the adopted drinking water guideline for PFOA (0.56 µg/L). This criteria is selected as the most conservative value, however results from the water use survey suggests that wells on adjacent properties are not used for water extraction either for drinking water or other beneficial uses.

The adopted drinking water guideline for sum of PFHxS and PFOS (0.07 µg/L), was exceeded in eight of the 10 wells sampled. The highest value was detected in GMW6 with a total concentration of 246 µg/L.

Recreational guideline

MW03 (6.12 µg/L) exceeded the FZANZ recreational guideline value (5.6 µg/L) for PFOA, however the NHMRC recreational value of 10 µg/L is better representative of the recreational uses of Shellgrit Creek and was not exceeded at this location.

Five of the 10 groundwater samples however, EW01 (14.5 µg/L), GMW6 (246 µg/L), GMW3 (46.9 µg/L), MW03 (8.67 µg/L) and MW09 (5.07 µg/L) exceeded the adopted human health recreational guidelines (FSANZ 2018 and NHMRC 2019 Recreational) for sum of PFHxS and PFOS.

Ecological guideline

With the exception of MW07, the groundwater samples were greater than the nominated PFOS ecological guideline for 99% species protection (ANZG 2018 99% species protection) of 0.00023 µg/L. Exceedance concentrations ranged between 0.002 µg/L (MW08) and 170 µg/L (GMW6). No exceedances were recorded for the prescribed ecological values for PFOA (19 µg/L).

7.2.3 Surface water

A full set of tabulated data for surface water results is available in Tables F4a and Table F4b, Appendix F. Six samples were collected from drainage channels onsite and tidally influenced Shellgrit Creek both up and down stream. Six water and six sediment samples were collected from the same locations along open drains and Shellgrit Creek (up stream and down stream). A summary of exceedances is illustrated in Figure 5, Appendix A.

The range of PFAS (pre-TOPA) concentrations for surface waters (tidal creek/drains) were:

- PFOS 0.022 µg/L (SW04) to 7.2 µg/L (SW08)
- PFOA <0.002 µg/L (SW01, SW05, SW06 and SW07) to 0.199 µg/L (SW08)
- PFHxS+PFOS 0.092 µg/L (SW04) to 9.84 µg/L (SW08)

TOC in surface water samples ranged from 2 mg/L (MW07) to 8 mg/L (SW01)

Two samples reporting the highest PFAS concentrations (SW06 and SW08) were selected for TOPA analysis. The following comparisons are made:

- Sum of PFAS pre-TOPA increased in concentration post-TOPA in SW08 indicating the possible presence of precursors at this location. PFCA totals at SW08 also increased post-TOPA analysis.
- SW06 sum of PFAS pre-TOPA decreased by greater than 10% post-TOPA indicating compound loss during the oxidation process. PFCA and PFSA totals post-TOPA in SW06 were less than pre-TOPA totals.
- Pre- and post-TOPA results in SW06 and SW08 for PFAS were greater than the prescribed, human health (drinking water and ecological guideline (99% species protection) in SW06 and SW08. Both of the prescribed recreational guideline (FSANZ and NHMRC) values were exceeded in SW08.

Recreational guideline

All six samples were less than the adopted human health recreational guidelines (ANZG 2018 and NHMRC 2019) of 5.6 µg/L and 10 µg/L for PFOA, however one exceedance was recorded for SW08 (9.84 µg/L) greater than both of the adopted recreational values for the sum of PFHxS and PFOS (0.7 µg/L and 2 µg/L respectively).

Ecological guideline

All samples were greater than the nominated ecological guideline for 99% species protection (ANZG 2018 99% species protection) of 0.00023 µg/L for PFOS. Exceedance concentrations ranged between 0.022 µg/L (SW04) to 7.2 µg/L (SW08). No exceedances were recorded for the prescribed ecological guideline for PFOA.

7.2.4 Sediment

A full set of tabulated data for sediment results is available in Table F5, Appendix F. Six samples were collected from creeks/drains and marine environments.

The range of PFAS (pre-TOPA) concentrations for sediments (tidal creek/drains) were:

- PFOS 0.4 µg/kg (SS01) to 17 µg/kg (SS08)
- PFOA <0.002 µg/kg
- PFHxS+PFOS 0.6 µg/kg (SS07) to 19 µg/kg (SS08)

Terrestrial and marine guideline

All sediment samples collected were below the ecological screening (Class II Bakke *et al.* 2010) guideline value of 220 µg/kg. Analysis of pore water samples is used to assess direct risks to lower trophic level organisms within the target ecosystem. It is noted that this analysis was not undertaken for this investigation based on the low concentrations of PFAS detected in sediment samples and their low ecological risk.

7.2.5 Biota

GHD collected four species of fish, with seven individuals analysed as part of the sampling program. Four barramundi (filleted and analysed), two boney bream (whole specimens, composite sample), two yellow tailed bream (whole specimens, composite sample) and four mullet (whole specimens, composite sample). No fish were able to be caught at proposed sampling location Bioat02 (SAQP 2019, Figure 1, Appendix A) during the sampling period. Figure 2, Appendix A, provides the location point of Biota 01 where all seven fish were caught, approximately 20 meters up and down stream of this point.

Table 7-2 Species of fish sampled

Field ID	Species
Biota1_BAR1	Barramundi
Biota1_BAR2	Barramundi
Biota1_BAR3	Barramundi
Biota1_BAR4	Barramundi
Biota1_BBRIM1	Boney Bream
Biota1_BRIM1	Yellow-tailed Bream
Biota1_MULL1	Mullet

The range of PFAS (pre-TOPA) concentrations for biota caught upstream in Shellgrit Creek (tidal creek/drains) were:

- PFOS 2 µg/kg (BAR1) to 35 µg/kg (BBRIM1)
- PFOS (branched) 0.001 µg/kg (BAR1) to 0.007 µg/kg (BRIM1, MULL1, BAR2, BAR3)
- PFOS (linear) 0.001 µg/kg (BAR1) to 0.029 µg/kg (BBRIM1)
- PFOA <1 µg/kg
- PFHxS+PFOS 2 µg/kg (BRIM1) to 38 µg/kg (BBRIM1)

Table 7-2 includes the species names associated with each sample ID listed in the summary of results Table F3, Appendix F.

7.3 Waste classification

Soil sample MW09_0.5 was selected to TCLP analysis for PFAS (post-TOPA). The selection of this sample was based on the highest detectable concentrations of PFAS in the initial soil screening (PFAS low level full suite). PFOA concentrations were less than the PFAS NEMP interim landfill value of 0.56 µg/L. Total sum of PFHxS and PFOS concentration in the analysed sample (1.79 µg/L) exceeded both the adopted clay/single lined and unlined landfill criteria (PFAS NEMP) of 0.07 µg/L and 0.7 µg/L, respectively. It is noted however that this criteria is derived for ASLP analysis which is representative of natural conditions.

Soil cuttings generated from the drilling monitoring installation was collected in a 240L bin and disposed of by Cleanaway at Paget Waste Facility under soil disposal permit #874748. Docket of receivership and acceptance is provided in Appendix I.

7.4 Quality assurances and quality control

The following table (Table 7-3) is a summary of the QA/QC DQIs used for this investigation and an assessment of the compliance of the data set with these QA/QC DQIs. Details of the field and laboratory QA/QC are provided in Table 7-3.

Table 7-3 Summary of QAQC compliance

Item	Objective	Reference	Summary of Results	Compliance
Comparison of field and analytical data	Agreement between visual and olfactory evidence with laboratory results	-	Field observations correspond with the laboratory results.	Yes

Item	Objective	Reference	Summary of Results	Compliance
Calibration of field instruments	Meet calibration specifications	AS4482.1-2005	Equipment were all calibrated prior to sampling works.	Yes
Chain of Custody documentation	Completed	-	Completed in full Refer to Appendix H	Yes
Sample analysis and extraction holding times	Comply with holding times	AS4482.1-2005/NEPM (2013)	Refer Appendix G	Yes, noting some non-contaminant analytes are outside of holding times
Sample Preservation	Samples are collected in appropriately preserved containers	-	Completed in full Refer to Appendix H	Yes
Analysis of intra-laboratory duplicate samples	1 for every 20 samples RPD 30% - 50%	AS4482.1-2005	Objective met. Refer to Appendix H	Yes, noting Relative Percentage Difference (RPD) exceedances was reported for only one analyte and groundwater sample. Overall RPD are within the criteria.
Analysis of inter-laboratory duplicate samples	1 for every 20 samples RPD 30% - 50%	AS4482.1-2005	Objective met. Refer to Appendix H	Yes
Analysis of laboratory method blanks	No contamination of blanks	NEPM (2013)	Objective met. Refer to Appendix G	Yes
Analysis of matrix and laboratory control spikes	Recoveries within the laboratory specified recovery limits	NEPM (2013)	Objective met. Refer to Appendix H	Yes, noting outliers were reported for some samples. Overall laboratory QAQC results are within the criteria.
Analysis of laboratory surrogates	No surrogate recovery outliers	NEPM (2013)	Objective met. Refer to Appendix H	Yes,
Analysis of laboratory duplicates	Frequencies and RPDs within guideline and internal laboratory limits	NEPM (2013)	Objective met. Refer to Appendix H	Yes
Analysis of trip blanks	Frequencies within guideline limits, and reported concentrations less the laboratory LOR	NEPM (2013)	Objective met. Appendix H	Yes

Item	Objective	Reference	Summary of Results	Compliance
Analysis of field rinsate samples	Concentrations less than laboratory LOR	NEPM (2013)	Objective met. Refer to Appendix H	Yes

A summary of the QA/QC samples collected during fieldwork activities is presented in the QA/QC sample register below (Table 7-4).

Table 7-4 QAQC Samples

Sample Date	Parent Sample ID	QAQC Sample ID	Sample Matrix*	Analysing Laboratory	QAQC Sample Type / Comment
Soil Sampling and Well Installation Works – July 2019					
28 June 2019	MW07_2.0	DUP_190628	S	ALS	Blind
28 June 2019	MW07_2.0	DUP_190628	S	Eurofins	Split
02 July 2019	MW02	QA01_190702	W	ALS	Blind
02 July 2019	MW02	QA02_190702	W	Eurofins	Split

8. Discussion

A list of the PFAS present in the various media is presented in Table 8-1 in order of the number of detections to indicate which compounds were most common for sampling undertaken by GHD June and July 2019.

Table 8-1 Detectable PFAS in various media at the Site

Soil (total)	*C#	Groundwater	C#	Sediment	#C	Surface water	#C
PFOS	8	PFBS	4	PFOS	8	PFOS	8
PFHxS	6	PFPeS	5	PFHxS	6	PFHxA	6
PFBS	4	PFHxS	6	PFHxA	6	PFHxS	6
PFPeS	5	PFOS	8			PFPeS	5
PFPeA	5	PFHpS	7			PFHpS	7
PFHxA	6	PFPeA	5			PFBS	4
PFHpS	7	PFHxA	6			PFOA	8
PFHpA	7	PFHpA	7			PFHpA	7
PFOA	8	PFOA	8			PFPeA	5
		PFBA	3			PFBA	3
		PFNA	9			PFNA	9
		6:2 FTS	6				
		FOSA	8				
		PFDA	9				
		8:2 FTS	8				

Short-Chain Perfluoroalkyl Carboxylic Acids (PFCAs)

Long-Chain Perfluoroalkyl Carboxylic Acids (PFCAs)

Short-Chain Perfluoroalkane Sulfonates (PFSA)

Long-Chain Perfluoroalkane Sulfonates (PFSA)

Notes: #Refers to the number of per fluorinated carbon

8.1 Soil

Concentrations of PFAS in soils were low and were only detectable in two locations (MW06 and MW09). The dominant PFAS compound present was PFOS with concentrations ranging from 0.0004 (MW06) to 0.0209 mg/kg (MW09). MW09 showed detectable concentrations for a number of short and long chain compounds (see Table 8-1). Total sum of PFHxS and PFOS, which were the dominant analytes, ranged from 0.0004 (MW06) to 0.0276 mg/kg (MW09). All concentrations were below the nominated human health and ecological criteria.

Sample MW09_0.5 (PFOS 0.0209 mg/kg and sum of PFHxS plus PFOS 0.0276 mg/kg) was collected down gradient from GMW3 (elevated PFOS concentrations in groundwater) and a historically utilised adhoc training area (refer to Figure 3, Appendix A) toward the eastern boundary of the Site and upper estuary of Shellgrit Creek. A second sample collected at 2.0 m

(MW09_2.0) from this location during well installation also reported detections of PFOS (0.0015 mg/kg).

The sandy geology and shallow water table are conducive of conditions that would be expected to promote surface water and groundwater interactions, and the unconsolidated sandy environment is expected to be less conducive of attenuation of PFAS. These factors mean that Mackay Airport is sensitively located with respect to the potential for PFAS migration via surface water and groundwater flow.

8.2 Groundwater

The PFAS identified in the groundwater were dominated by short and long chain PFASs, followed by short chain PFCAs. The groundwater was dominated by PFAS containing compounds with less than eight perfluorinated carbons.

PFAS have been shown to sorb readily to organic material in an aquifer. Analysis of TOC was conducted to assess the relationship between PFAS and TOC. However, no obvious relationship was observed, largely due to the very low percentage of TOC present in the sand and clay dominated lithology. It is documented in a number of published articles that the solubility of PFAS, notably PFOS, decreases significantly from fresh water to seawater and that it can partition to sediments when entering the marine environment (You et al. 2010⁴). Elevated EC levels are consistent with monitoring wells located closer to the ocean and the tidally influenced Shellgrit Creek which runs adjacent to the north east boundary of the Site. No clear relationship could be distinguished between higher levels of PFAS detected in wells GMW6, GMW3, EW01 and MW03 with pH and alkalinity.

Results from the groundwater sampling showed a higher number of detections for PFAS compounds in comparison to other tested matrices (soil, surface waters and sediments) across the Site. In particular, a higher frequency of analytes with detections and higher concentrations were recorded in groundwater wells GMW6, GMW3, EW01 and MW03. The highest concentrations recorded across the Site were found in these four wells which is consistent with findings from the PSI (GHD 2019) in identified areas of historical AFFF use. The highest concentration of PFOS was recorded in GMW6 (170 µg/L), which is significantly greater than the concentration of 87.5 µg/L recorded during the last monitoring round in May 2017. All wells with the exception of MW07, exceeded the ANZG ecological screening criteria (99% SP) of 0.00023 µg/L. Eight of the 10 monitoring well locations exceeded the drinking water guidelines for sum of PFHxS and PFOS (0.07 µg/L) and five of the 10 locations exceeded the adopted recreational guidelines. These results are consistent with those recorded in 2017 and are documented in the PSI (GHD 2019).

8.3 Surface Water

The PFAS composition identified in the surface waters was similar to that of the groundwater with a higher frequency of analytes above LOR recorded near groundwater monitoring wells GMW3 (SW04) and GMW6 (SW08). The terrestrial waters were dominated by PFOS, PFHxS and PFHxA.

Concentrations of PFOS in all six water samples were above the ecological 99% species protection (SP) guideline with the highest concentrations being detected at SW08 (7.2 µg/L). This location is also down gradient from a known location on Site that has been identified as

⁴ YOU,C, JIA,C and PAN,G 2010. Effect of salinity and sediment characteristics on the sorption and desorption of perfluorooctane sulfonate at sediment-water interface. Environmental Pollution. 2010 May;158(5):1343-7. 2010 Feb 23

aformer Airservices fire training ground. It is also down gradient of know PFAS impacted groundwater well, GMW6 and adjacent to EW01.

Surface water location, SW06 also showed elevated PFOS (0.36 µg/L) and total sum of PFHxS and PFOS (0.392) levels. This locations is slightly upgradient from where the biota samples were collected from Biota01 and within downgradient vicinity of an potentialformer ad hoc training area.

All six surface water locations recorded sum of PFHxS and PFOS levels exceeding the adopted drinking water and total daily tolerable intake criteria. SW08 (9.84 µg/L) also exceeded the adopted recreational water quality guidelines of 0.7 µg/L and 2 µg/L respectively.

8.4 Sediments

Sediments results were dominated by PFOS PFHxS, long chain PFSA's and to a lesser extent PFHxA, which is a short chain PFCA. The shorter chain PFAS were more readily detected in waters (surface and groundwater) in comparison to sediments. This could be due to their lessened potential to sorb readily to soil particles than longer chain compounds and the increased solubilities of shorter chain PFAS. There was no observed relationship between concentrations of PFAS and TOC recorded in sediment samples.

Concentrations for sum of PFHxS and PFOS in all six sediment samples were below the nominated Norwegian PNEC of 0.22 mg/kg (Class II) which was selected as an initial screening criterion representing the concentration which has no toxic effects and where no remediation may be needed. The highest concentration of sum of PFHxS and PFOS was in SS08 (19 µg/kg) and SS03 (2.3 µg/kg), similar to elevated levels found in their corresponding surface water samples.

8.5 Biota

Six of the seven biota samples exceeded the FZANZ trigger point for investigation (5.2 µg/kg) and the adopted ecological direct exposure criteria for mammals and wildlife (4.6 µg/kg and 8.2 µg/kg) for sum of PFHxS and PFOS. It is noted however that three of the seven biota samples analysed, were submitted and analysed as whole samples including the fish's liver (Biota1_BBRIM1, Biota1_BRIM1 and Biota1_MULL1). It is therefore more appropriate to compare sum of PFHxS and PFOS values for these sample to the FZANZ fish liver trigger level (280 µg/kg) which no exceedances were recorded. No detections of PFOA were recorded in any of the biota samples analysed.

9. Conceptual Site Model

The following CSM has been updated from the PSI (GHD, 2019) and has been generated to identify the potential contamination *sources, pathways and receptors*, and the potential linkages (or pollutant linkages) between these.

9.1 Potential sources

The PSI identified the following potential sources of PFAS on the Mackay Airport. Some of these potential sources are unconfirmed and based on anecdotal evidence about use of an area for training:

- The FTG – regular use of foam at the FTG location until 2010 (including prior to the construction of the fire training pad)
- The current fire station, workshop and surrounding locality – wash down of equipment and trucks, test foam releases and dispensing of excess foam
- Possible AEP training exercise at a site (immediately beyond the Site boundary to the south-east of the Airport, near Shellgrit Creek (based on unconfirmed anecdotal information)
- Fire station workshop
- Historical fire training areas, including at the location of the current terminal building
- Fire extinguishers within hangars
- Fire Systems Queensland commercial outlet/depot (fire safety equipment suppliers)
- Surface water drainage channels, with the potential for sediment within the drainage channels to be a secondary source of PFAS.

9.2 Pathways

9.2.1 Contaminant transport mechanisms

The key mechanisms for contaminant transport at the Site have been identified as:

- *Surface water overland flow* – lateral overland flow and migration of contaminants via stormwater during rain events, causing re-deposition of contaminants on other areas of Mackay Airport or off-site. There is the potential for migration of contaminated surface water/stormwater in open drainage channels.
- *Groundwater advection/dispersion* - horizontal and vertical migration of contaminants from the Mackay Airport soils into the underlying aquifer and through groundwater (inferred groundwater direction *varies* towards the north east to south east directions) to the point of surface water discharge or via uptake in groundwater wells at nearby residential, commercial and/or recreational sports areas located to the north east of the Site (refer to Figure 6, Appendix A). The presence of a sandy aquifer and shallow water table are conducive of conditions that would be expected to promote surface water and groundwater interactions. This has the potential to increase the contaminant flux both within and off the Site. These factors place the Mackay Airport within a higher risk category in terms of the potential for contaminant migration via surface water and groundwater flow.

9.2.2 Potential pathways

Based on the identified potential receptors and the release and fate and transport characteristics of the contaminants of potential concern, the following contaminant uptake pathways through which receptors may become exposed to contamination have been identified. A Water Use Survey was conducted (refer Section 6.10) to identify if any groundwater wells were used by land owners to south or east of the Site. The findings of the Water Use Survey did not identify any land owners or lease holders with knowledge of any groundwater extraction for any purpose.

9.2.3 Direct contact

- Direct contact (oral/dermal) with surficial soils, sediments and surface waters.
- Direct contact (oral/dermal) with surface waters in the vicinity of the Airport (Shellgrit Creek).
- Direct contact (oral/dermal) with groundwater (sprinkler play, sampling).

9.2.4 Surface water and sediment migration

- Vertical and lateral migration of surficial soils via storm water and overland flow
- Migration of surficial water from overland flow, storm water and sediments through the drainage network across the Site, and subsequent discharge into adjacent off-site stormwater channels and tidally influenced Shellgrit Creek.

9.2.5 Groundwater migration

- Leaching of PFAS through the soil profile to groundwater
- Migration of contaminated groundwater by tidal movement across and hydraulically down gradient and off-Site
- Hydraulic connectivity between groundwater and surface water.

9.2.6 Human consumption

- Bioaccumulation of PFAS in fish and/or other edible species in surface waters in the vicinity of the Airport, and subsequent human consumption
- Possible consumption of crops/fruit/garden produce off-site that have been irrigated/watered with water from groundwater bores in properties adjacent to the Airport
- Possible consumption of poultry and beef sources from off-site that have been watered with water from groundwater bores adjacent to the airport or that have grazed on grass that has been watered from groundwater bores. It is also possible that grazing animals may consume water and subsequently sediments from the off-site creeks/estuaries.

9.2.7 Soil movement

- Migration of dust from surficial soils
- Movement of contaminated soil across the Airport during construction and upgrade works.

9.3 Potential receptors

The following are considered to be potential receptors on- and off-site and were developed based on a review of previous reports and publically available information and databases.

9.3.1 On-Site (Airport)

- Site workers whose activities including on-site maintenance such as clearing of storm water drains, construction and environmental monitoring, may result in exposure to site soils, surface water and groundwater

9.3.2 Surrounding marine environment

- Recreational users of Shellgrit Creek for activities such as fishing, sailing and boating that may ingest contaminants or have dermal exposure to contaminants
- Consumers of seafood from the down gradient drains/creeks and the marine receiving environment who may ingest contaminants
- Ecological ecosystems of surface waters in the vicinity of the Airport (Shellgrit Creek and open storm waters drains/channels).

9.3.3 Surrounding properties

- Extraction of groundwater for any of the following activities:
 - Drinking water
 - Irrigation of crops/watering of gardens
 - Filling of swimming pools or rainwater tanks

However it is noted that the water use survey conducted as part of this investigation for properties to the south and east of the Airport did not identify any land owners or lease holders who indicated they extracted groundwater for any use.

- Contractors involved in off-Site maintenance works which may come into contact with surface water, sediment and/or groundwater.

9.4 Potential source-pathway receptor linkages

The CSM has identified a number of potential source-pathway-receptor (PSR) linkages which are highlighted in **Table 9-1**. These are discussed below in the context of the Site setting.

Table 9-1 PFAS contamination – potential pathway receptors

Source	Pathway	Receptor	S-P-R Linkages	Comments / Data gaps
Surficial soils (Mackay Airport)	Direct contact (oral/dermal).	Mackay airport personnel in contact with surficial soil during shallow trenching or upgrade/maintenance works on-Site.	Potentially complete.	Unknown if soils remaining at site contain PFAS within certain areas. However sediment (on-site) and soil samples collected from drilling works during the PSI and post-PSI well installations confirm detections of PFAS compounds within the soil.
	Vertical and lateral migration via storm water and overland flow.	Ecological ecosystems including surface waters in the vicinity and in Shellgrit Creek. Stock watering and surficial soil interactions.	Partially complete. Sediment samples of stormwater and creek channels beyond the eastern and south, south-western boundaries (end receptor, Shellgrit Creek) were below the adopted screening criteria.	The associated sediment samples taken from surface water sampling location SW08 (SS08), located beyond the south western boundary in an identified area of AFFF training exercise/s also recorded the highest detection of PFAS (sum) across the Site, but less than the prescribed sediment screening value.

Residual PFAS in groundwater, surface water or sediment, resulting from historical use of AFFF on site	Vertical and lateral migration via overland flow and storm water.	Ecological ecosystems in surface waters in the vicinity of the Airport (Shellgrit Creek).	Partially complete. Surface water samples collected beyond the site boundary (SW04-SW08) are impacted by PFAS and pose a potential risk to the food chain species of Shellgrit Creek beyond the site boundary and down gradient.	PFAS concentrations found in six of the seven fish captured in the upper estuary of Shellgrit Creek exceeded the ecological values for direct exposure. These results pose a potential risk to the food chain of species within Shellgrit Creek. No capture and analysis of shell fish within the tidally influenced Shellgrit Creek was achieved during the Post-PSI biota sampling timeframe.
	Direct contact (oral/dermal) with surface waters off-site through overland flow/drainage and groundwater migration pathways	Recreational users of Shellgrit Creek for associated boating and swimming uses/activities	Partially complete.	Surface water locations most likely associated with dermal contact for recreational users include SW06 (upstream portion of Shellgrit Creek and SW07 (downstream portion of Shellgrit Creek adjacent to the break wall). PFAS concentrations at both of these locations were below the prescribed recreational screening values.

Residual PFAS in groundwater, surface water or sediment, resulting from historical use of AFFF on site	Groundwater migration - Leaching of PFAS through the soil profile to groundwater	Beneficial users of extracted groundwater in properties in the vicinity of the Site.	Partially complete.	An initial water use survey was conducted of the immediately surrounding properties of Mackay airport which indicated no use of groundwater extraction at these properties. Further investigation of the residential properties down gradient to the north east of the Site has yet to be undertaken.
	Direct contact (oral/dermal) with groundwater (sprinkler play, sampling).	Potential beneficial users of extracted groundwater from surrounding properties. Contractors involved in off-site maintenance works.	Partially complete.	Prior to the PSI and most recent post-PSI works, sampling programs did not include groundwater bores from off-Site.
		Staff undertaking groundwater monitoring.	Potentially complete. Of the on-site bores tested and analysed for PFAS five of the 10 were above recreational guidelines.	Can be managed through health and safety procedures and PPE.
	Human consumption. Future potential for water extracted from groundwater bores within the properties surrounding the airport to be used for drinking purposes.	Beneficial users of extracted groundwater from surrounding properties.	Potentially complete. The initial WUS did not identify any beneficial users extracting groundwater for drinking purposes.	

10. Conclusions

GHD completed a targeted investigation at Mackay Airport from June – July 2019, assessing PFAS contamination at and in the vicinity of the Site, to assess the ecological and health risks to potential receptors:

- Recreational users of Shellgrit Creek and ecological risk to Shellgrit Creek;
- Recreational users of the Illawong Parkland east of the airport and ecological risk to Illawong Parkland; and
- Risk to beneficial users of extracted groundwater, to the east and south of the airport.

The conclusions drawn from the targeted investigation are summarised below with regard to potential risk to the above receptors. Gaps remain in the assessment of risks and further investigation is recommended.

Samples from nine onsite groundwater monitoring wells exceeded the ecological screening criteria for PFOS (0.00023 µg/L). Samples from three groundwater monitoring wells exceeded the adopted human health drinking water guideline (0.56 µg/L). Exceedances were also recorded for sum of PFHxS and PFOS against the adopted human health drinking water (eight of 10 onsite wells) and NHMRC (2 µg/L) and FSANZ (0.7 µg/L) recreational guidelines (five of the 10).

PFAS was detected in groundwater at concentrations greater than human health and ecological criteria and therefore poses a potential risk to Shellgrit creek (groundwater and surface water interactions) and to the beneficial groundwater users to the east and south (including Illawong Parkland and agricultural properties). However, the water use survey did not indicate any known current extraction of groundwater on properties to the south and east of the Site, suggesting the risk to recreational uses of Illawong Parkland and users of extracted groundwater is low.

PFAS was detected in all six sediment samples collected (onsite and offsite) with the highest detection located at surface water location SW08 as mentioned above. However, PFAS concentrations detected in sediments were less than the ecological criteria and therefore is unlikely to pose an immediate risk to sensitive sediment hosted ecological receptors.

All six surface water samples (onsite and offsite) reported PFAS concentrations exceeding the drinking water and daily tolerable intake guideline values. One surface water sample (SW08, located next to the former training ground in the south of the Site) exceeded the prescribed human health recreational guidelines for sum of PFHxS and PFOS.

PFAS concentrations were detected in six of the seven fishes samples collected from Shellgrit Creek, reporting concentrations exceeding the applicable ecological (direct exposure mammalian and avian) and human health trigger point levels. The highest sum of PFAS was detected in the boney brim. As PFAS was detected in biota at concentrations greater than human health and ecological criteria a potential risk exists to consumers of biota (fish) within Shellgrit Creek and the ecology of Shellgrit Creek.

The following data gaps remain with regard to assessment of risks to receptors targeted in this investigation:

- The vertical and lateral extent of residual PFAS contamination in soil on Site remains undefined in some areas, in particular within the former training area in the south of the Site.
- The off-site extent of PFAS in groundwater remains undefined.

- A Water Use Survey was conducted at the properties immediately surrounding the Site identifying no use of groundwater extraction at these properties. The survey focused on potential use of groundwater, however other beneficial uses of the land and surface water which may be impacted by PFAS adjacent to the Site remain undefined.
- The PFAS concentrations in biota at the mouth of Shellgrit creek remains a gap, as no capture and analysis of fish or shellfish at the mouth of Shellgrit Creek was achieved during the Post-PSI biota sampling timeframe.
- The PFAS concentrations of shellfish remains a data gap, as no capture and analysis of fish or shellfish in Shellgrit Creek was achieved during the Post-PSI biota sampling timeframe.

11. References

- ANZECC & ARMCANZ 2000. National Water Quality Management Strategy, Paper No. 4, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October 2000, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)
- Australian Government, Department of Health, 2017, *Health based guidance values for PFAS for use in site investigations in Australia*. FSANZ
- Australian Government, National Health and Medical Research Council, 2008, updated 2019 *The Guidelines for Managing Risk in Recreational Waters*
- Australian Standard (AS4482.1-2005) *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds* (Australian Standard 2005)
- Australian Standard, (AS4482.2-1999) *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile substances*
- Bakke, T, Kallqvist, T, Ruus, A, Breedveld, GD & Hylland, K 2010, *Development of sediment quality criteria in Norway*, Journal of Soil and Sediments, 10, 172– 178
- Canadian Government, 2017. Canadian Environmental Protection Act, 1999. *Federal Environmental Quality Guidelines, Perfluorooctane Sulfonate (PFOS)*, February 2017.
- CRC CARE, 2017 *Technical Report No 38: Assessment, Management and Remediation for PFOS and PFOA*, CRC CARE
- Department of Health (federal), 2017, *Per – and poly-fluoroalkyl substances (PFAS)* (<http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas.htm>).
- Environmental Health Standing Committee (enHealth), 2016, *Interim National Guidance on Human health reference values for per-and poly-fluoroalkyl substances for use in site investigations in Australia*
- Environment Protection Authority Victoria, 2016, Publication 1633, *Victoria Incoming water standards for aquatic ecosystem protection: PFOS and PFOA*
- Food Standards Australia New Zealand (FSANZ), 2017. *Perfluorinated Chemicals in Food*. Australian guidance values for assessing exposure to perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (<http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas.htm>)
- GHD, 2019a, *Mackay Airport PFAS Investigations Preliminary Site Investigation* (Rev 1, Feb 2019)
- GHD, 2019b, *Mackay Airport PFAS Investigations Sampling Analysis and Quality Plan* (Rev 1, March 2019)
- Heads of EPAs (HEPA) Australia and New Zealand and the Australian Government Department of the Environment and Energy (DoEE), *PFAS National Environmental Management Plan*, January 2018
- Heads of EPAs (HEPA) Australia and New Zealand and the Australian Government Department of the Environment and Energy (DoEE), *PFAS National Environmental Management Plan, Version 2.0 DRAFT*, 2019
- National Uniform Drillers Licensing Committee, 2012, *Minimum Construction Requirements for Water Bores in Australia* (3rd edition)

NEPC 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*, National Environment Protection Council, May 2013 (NEPM 2013)

NHMRC, NRMCC (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

NHMRC, NHMRC (2019) *Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Waters*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

QLD Government, 2015, QLD Globe Groundwater Database

State of Queensland (Department of Natural Resources and Mines) database date 02/01/2018, accessed 09 January 2018.- <http://qldspatial.information.qld.gov.au>

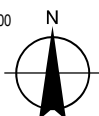
The State of Queensland (Department of Natural Resources and Mines) *Acid Sulfate Soils Mackay 2004*

Appendices

Appendix A - Figures



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0 500 1,000 1,500
Meters



Horizontal Datum: WGS 1984
Grid: GCS WGS 1984



Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

Project No. 41-32561
Revision No. A
Date 02 Aug 2019

Locality Map

FIGURE 1



1:15,000 (Paper Size A4)
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Meters



Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

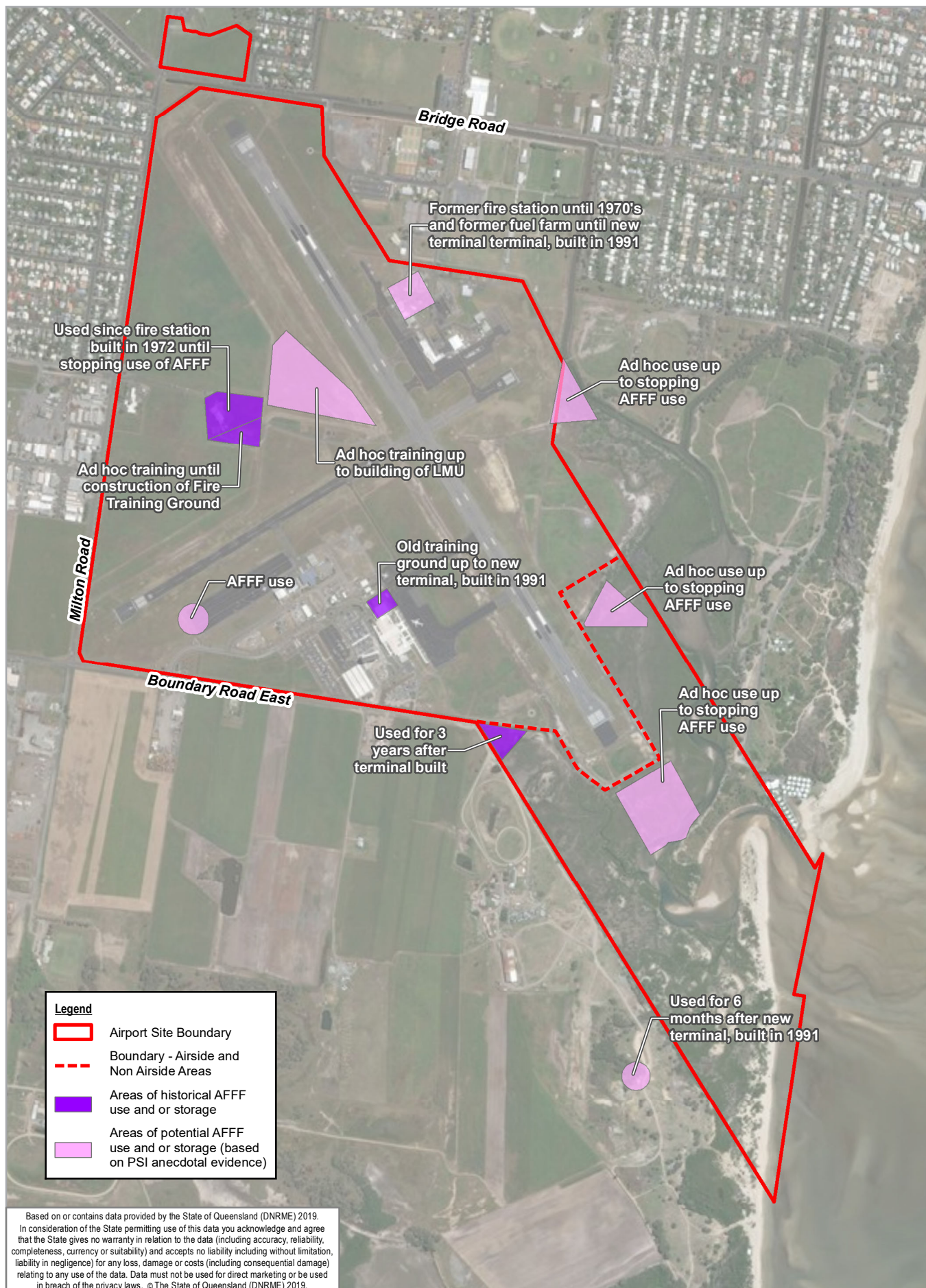


Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

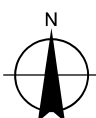
Project No. 41-32561
Revision No. A
Date 13 Aug 2019

Airport Sampling Locations

FIGURE 2



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Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

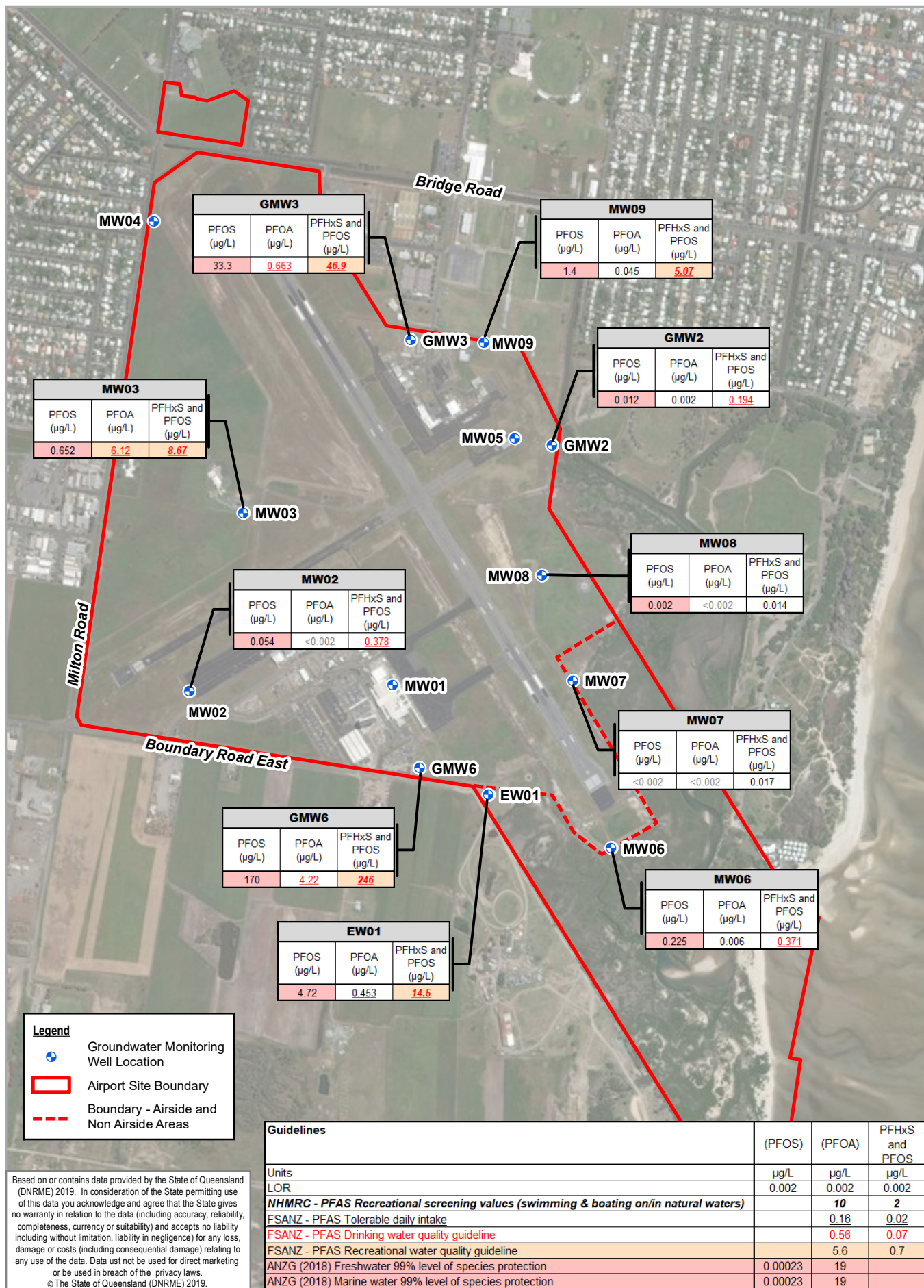


Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

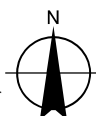
**Historical AFFF Use
and Stored Locations**

Project No. 41-32561
Revision No. A
Date 26 Aug 2019

FIGURE 3



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Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

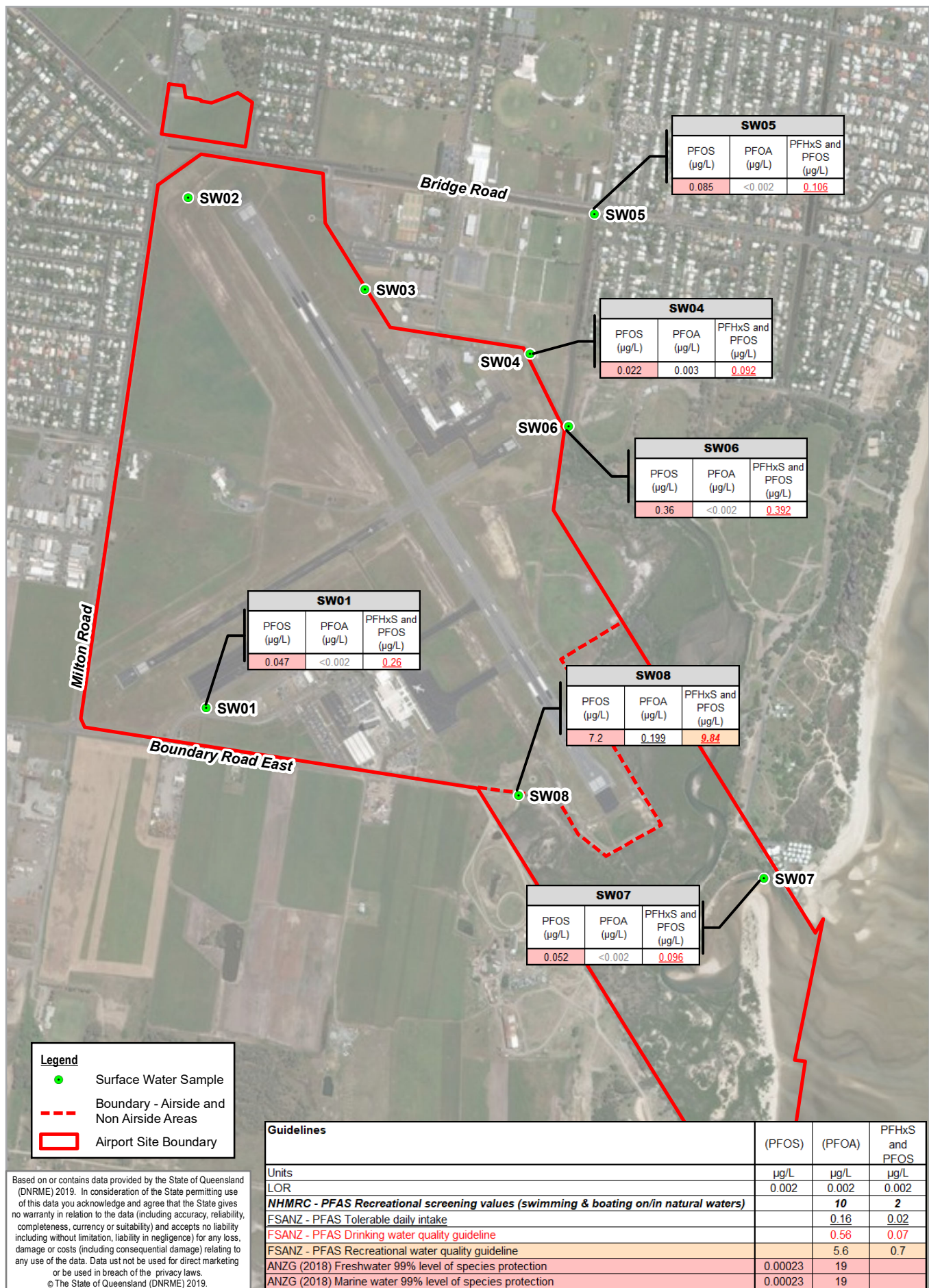


Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

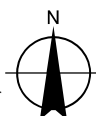
**Groundwater Laboratory
Exceedance Results**

Project No. 41-32561
Revision No. A
Date 06 Aug 2019

FIGURE 4



1:15,000 (Paper Size A4)
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Meters



Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

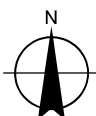
Surface Water Laboratory
Exceedance Results

Project No. 41-32561
Revision No. A
Date 06 Aug 2019

FIGURE 5



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Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

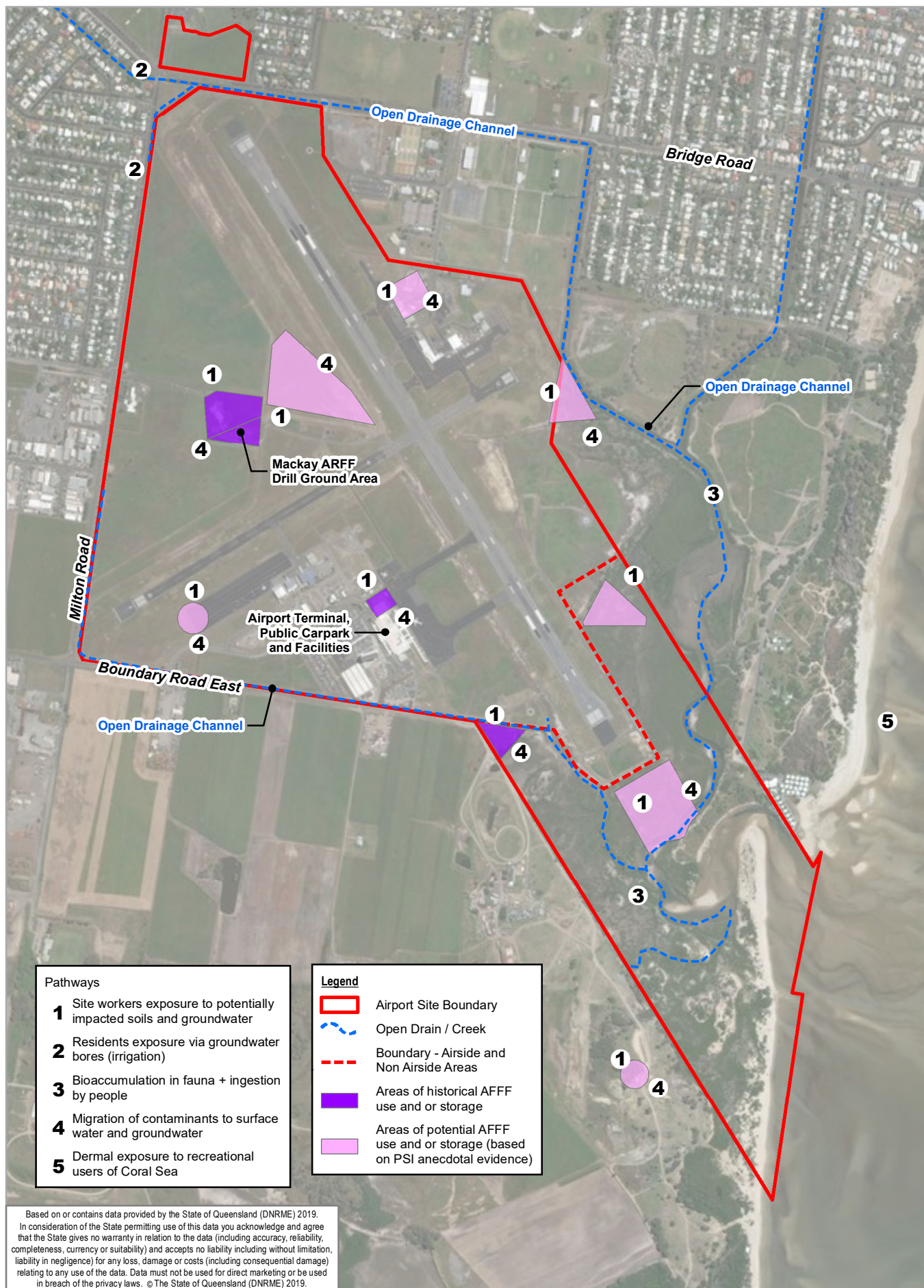


Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

Inferred Groundwater
Contours, July 2019

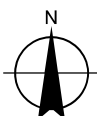
Project No. 41-32561
Revision No. A
Date 01 Aug 2019

FIGURE 6



1:15,000 (Paper Size A4)
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Meters

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Air Services Australia
Mackay Airport
Post-Preliminary Site Investigation

**Environmental
Concern Pathways**

Project No. 41-32561
Revision No. A
Date 26 Aug 2019

FIGURE 7

Appendix B - Borelogs



BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW06

Page 1 of 1

Client Air Services Australia Project Mackay Airport Post-PSI Investigation Project No. 4132561 Site Mackay Airport Location Boundary Rd East Date Drilled 28/06/2019	Drill Co. Backyard Bores Driller Matthew von Snarski Rig Type Purpose Built Drill Method NDD, SFA Total Depth (m) 5 Diameter (mm) 100	Easting, Northing , Grid Ref GDA94_MGA_zone_55 Elevation Collar RL - Logged By J. SKOPP Checked By D. TODD
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B.C.L No. N/A			Casing 50 mm		Screen 2.0-5.0 m		Surface Completion Flush mounted gatic				
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
	NDD		MW06_0.2		Grout		GRASS.	SM	S	rootlets.	
0.5			MW06_0.5				CLAY, low plasticity, brown, with fine grained sand, fine marine calcites.	M	F		-0.5
							CLAY, medium plasticity, light brown with orange mottling, with fine grained sand.	M	F-ST		
1			MW06_1.0		Bentonite		CLAY, high plasticity, light brown and orange, boulder.				-1
	SFA										
1.5							Silty SAND, fine to medium grained, dark grey, trace clay.	M	MD		-1.5
2			MW06_2.0								-2
2.5											-2.5
							Silty SAND, medium to coarse grained, dark grey, trace clay.	S	MD		
3			MW06_3.0								-3
					Sand						
3.5											-3.5
4											-4
										hole collapse approximately 4.3 - 4.5 m.	-4.5
4.5											
										no sample recovered for MW06_5.0	-5
5							Termination Depth at: 5.00 m				
5.5											-5.5

Notes This log is not intended for geotechnical purposes.			
Drilling Abbreviations AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler		Moisture Abbreviations D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	Consistency Abbreviations Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW07

Page 1 of 1

Client Air Services Australia Project Mackay Airport Post-PSI Investigation Project No. 4132561 Site Mackay Airport Location Boundary Rd East Date Drilled 28/06/2019	Drill Co. Backyard Bores Driller Matthew von Snarski Rig Type Purpose Built Drill Method NDD, SFA Total Depth (m) 5.7 Diameter (mm) 100	Easting, Northing , Grid Ref GDA94_MGA_zone_55 Elevation Collar RL - Logged By J. SKOPP Checked By D. TODD
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B.C.L No. N/A Casing 50 mm Screen 2.7-5.7 m Surface Completion Flush mounted gatic

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
	NDD		MW07_0.1				GRASS.	M	D	trace rootlets.	
0.5			MW07_0.5		Grout		SAND, fine to medium grained, dark grey, with clay.	M	F		-0.5
1			MW07_1.0				CLAY, low to medium plasticity, orange and red with grey, trace fine grained sand.				
1.5	SFA				Bentonite		CLAY, light and dark grey with orange mottling.	M	F		-1
2			MW07_2.0 (DUP01 & TRIP01)								-2
2.5											-2.5
3			MW07_3.0				CLAY, medium to high plasticity, grey.	M	ST		-3
3.5			MW07_3.5				CLAY, medium to high plasticity, grey.	W	ST		-3.5
4			MW07_4.0		Sand						-4
4.5							CLAY, high plasticity, brown.	M-W	VST		-4.5
5							Sandy Silty CLAY, low plasticity, light brown, fine to medium grained sand.	W	F	silty sand and trace sand layer, fine to medium grained, trace clay light brown at 4.6-4.8 mbgl.	-4.5
5.5											-5
											-5.5
							Termination Depth at: 5.70 m				

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW08

Page 1 of 1

Client Air Services Australia
Project Mackay Airport Post-PSI Investigation
Project No. 4132561
Site Mackay Airport
Location Boundary Rd East
Date Drilled 28/06/2019

Drill Co. Backyard Bores
Driller Matthew von Snarski
Rig Type Purpose Built
Drill Method NDD, SFA
Total Depth (m) 4.1
Diameter (mm) 100

Easting, Northing ,
Grid Ref GDA94_MGA_zone_55
Elevation
Collar RL -
Logged By J. SKOPP
Checked By D. TODD

B.C.L No. N/A **Casing** 50 mm **Screen** 3.1-4.1 m **Surface Completion** Flush mounted gate

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5	NDD		MW08_0.2		Grout		GRASS.	M	F	rootlets.	
			MW08_0.5		Bentonite		CLAY, low to medium plasticity, brown, trace fine grained sand.	W	F		-0.5
1			MW08_1.0				CLAY, high plasticity, grey with red and orange mottling, trace fine grained sand.	W	ST		-1
1.5	SFA						CLAY, high plasticity, light grey with red and orange mottling, trace fine grained sand.	W	S-F		-1.5
2			MW08_2.0				CLAY, medium plasticity, light grey with orange mottling, with silt.	W	S-F		-2
2.5					Sand		CLAY, medium plasticity, grey, with fine grain sand.	W	S-F		-2.5
3			MW08_3.0				Silty SAND, medium to coarse grained, grey, trace clay.	W	VL		-3
3.5										hole collapse at 3.6 m.	-3.5
4			MW08_4.0								-4
4.5							Termination Depth at: 4.10 m				-4.5
5											-5
5.5											-5.5

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard



BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW09

Page 1 of 1

Client Air Services Australia Project Mackay Airport Post-PSI Investigation Project No. 4132561 Site Mackay Airport Location Boundary Rd East Date Drilled 28/06/2019	Drill Co. Backyard Bores Driller Matthew von Snarski Rig Type Purpose Built Drill Method NDD, SFA Total Depth (m) 4.6 Diameter (mm) 100	Easting, Northing , Grid Ref GDA94_MGA_zone_55 Elevation Collar RL - Logged By J. SKOPP Checked By D. TODD
--	--	---

B.C.L No. N/A		Casing 50 mm		Screen 1.6-4.6 m		Surface Completion Flush mounted gate						
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	MW09	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5 												

Notes This log is not intended for geotechnical purposes.			
Drilling Abbreviations AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler		Moisture Abbreviations D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	Consistency Abbreviations Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

Appendix C – Survey Data

MGA ZONE 55, AHD				
POINT	EASTING	NORTHING	WELL ELEVATION	PVC COLLAR ELEVATION
MW01	726542.843	7656850.784	5.626	5.550
MW02	725953.499	7656832.533	5.093	5.002
MW03	726109.803	7657349.953	5.377	5.306
MW04	725851.136	7658193.700	5.094	5.010
MW05	726895.523	7657565.225	4.219	4.152

Appendix D – Groundwater Sampling and Purge Records

GROUNDWATER PURGING AND SAMPLING FIELD SHEET



PROJECT DETAILS

Project Number: 4132561

Project Name: ASA Mackay PFAS DSI

Client: Air Services Australia (ASA)

Site: Mackay Airport

Well Condition (i.e road box, locked etc): Monument

Depth to Water Table Pre-purge (from TOC): 2.545

Depth of PSH (from TOC):

Depth to Bottom of Casing (BOC) from TOC: 5.06

Depth to Water Table Post - purge (from TOC):

Borehole ID: EW01

Sample ID: EW01_190703

Date: 03 / 7 / 2019

Sampler: Jackson Skopp

Purge Method: Peristaltic Pump

Sample Method: Peristaltic Pump

Casing Type: uPVC Class 18

Well Diameter: 50 mm

QA Collected: No

FIELD PARAMETERS (RECORDED USING YSI/)

Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments
1023	0.25	2.615	0.41	4.9	2965	7.75	-127.4	25.9	Clear, no odour, no sheen, good recharge
1033	1	2.615	0.19		2716	7.11	-303.9	25.9	
1041	2	2.61	0.18	2.3	3069	6.92	-313.5	26.1	
1047	3	2.61	0.18	2.3	4614	6.74	-269.1	26.1	
1055	4	2.61	0.22	2.7	4650	6.74	-246.2	26	
1103	5	2.615	0.22	2.7	4601	6.74	-245.3	26.3	
1112	6	2.615	0.23	2.9	4482	6.74	-240.7	26.3	
1117	7	2.62	0.24	3.1	4397	6.74	-238.5	26.4	
1127	8	2.615	0.23	2.9	4399	6.74	-236.4	26.3	Sampled

Comments:

Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS						Borehole ID: GMW 2				
Project Number: 4132561						Sample ID: GMW2_190702				
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)						Date: 02 / 7 / 2019				
Site: Mackay Airport						Sampler: Jackson Skopp				
Well Condition (i.e road box, locked etc): Gattic						Purge Method: Peristaltic Pump				
Depth to Water Table Pre-purge (from TOC): 1.37						Sample Method: Peristaltic Pump				
Depth of PSH (from TOC):						Casing Type: uPVC Class 18				
Depth to Bottom of Casing (BOC) from TOC: 3.61						Well Diameter: 50 mm				
Depth to Water Table Post - purge (from TOC):						QA Collected: No				
FIELD PARAMETERS (RECORDED USING YSI)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
1016	0.25	1.37	0.54	8.3	23079	4.03	338.2	25.8	Clear, no odour, no sheen	
1023	1	1.38	0.39	5.1	23107	4.04	330.7	25.8		
1031	2	1.38	0.28	3.8	23221	4.05	327.1	25.9	low to moderate turbidity	
1041	3	1.38	0.26	3.4	23175	4.06	321	25.8		
1051	4	1.38	0.38	5.1	23166	4.05	323.2	25.9		
1059	5	1.38	0.33	4.5	23209	4.05	325	25.9		
1103	5.5	1.37	0.33	-	23187	4.05	325.8	26	sampled	
					Comments: Hydrosleeve in well tied to plug. Removed and put back after sampling					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS						Borehole ID: GMW3				
Project Number: 4132561						Sample ID: GMW3_190702				
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)						Date: 02 / 7 / 2019				
Site: Mackay Airport						Sampler: Jackson Skopp				
Well Condition (i.e road box, locked etc): Gattic						Purge Method: Peristaltic Pump				
Depth to Water Table Pre-purge (from TOC): 1.074						Sample Method: Peristaltic Pump				
Depth of PSH (from TOC):						Casing Type: uPVC Class 18				
Depth to Bottom of Casing (BOC) from TOC: 4.11						Well Diameter: 50 mm				
Depth to Water Table Post - purge (from TOC):						QA Collected: No				
FIELD PARAMETERS (RECORDED USING YSI)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C SPC (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
0804	0.25	1.125	3.02	28.4	1867	6.85	49.3	23	Clear low turbidity	
0810	1	1.161	1.89	23.4	1770	6.79	47.3	25.5		
0819	2	1.169	1.78	22.2	1813	6.77	23.2	26.1		
0826	3	1.17	19.8	19.8	1842	6.74	21.9	26.7		
0834	4	1.165	0.99	12.4	1845	6.7	13.4	27		
0841	5	1.165	1.31	16.3	1845	6.72	4.5	27		
0847	6	1.165	1.33	15.8	1844	6.71	5.6	27	Sampled	
					Comments: Hydrosleeve in well tied to plug. Removed and put back after sampling					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS						Borehole ID: GMW 6				
Project Number: 4132561						Sample ID: GMW6_190702				
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)						Date: 02 / 7 / 2019				
Site: Mackay Airport						Sampler: Jackson Skopp				
Well Condition (i.e road box, locked etc): Gattic						Purge Method: Peristaltic Pump				
Depth to Water Table Pre-purge (from TOC): 1.775						Sample Method: Peristaltic Pump				
Depth of PSH (from TOC):						Casing Type: uPVC Class 18				
Depth to Bottom of Casing (BOC) from TOC: 4.775						Well Diameter: 50 mm				
Depth to Water Table Post - purge (from TOC):						QA Collected: No				
FIELD PARAMETERS (RECORDED USING YSI)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
1452	0.25	1.79	0.7	8.3	255.7	6.17	99.1	24.5	Clear, no odour, no sheen	
1501	1	1.79	0.52	6.1	235.4	6.13	127.6	24.4		
1510	3	1.79	0.43	5.1	228.8	6.12	141.8	24.4		
1517	4	1.79	0.38	4.5	227.6	6.12	144	24.3		
1525	5	1.786	0.4	4.7	227.6	6.11	147.6	24.3		
1532	6	1.79	0.41	4.9	226.9	6.11	150.4	24.3		
1538	7	1.79	0.41	4.9	226.5	6.1	152.4	24.3		
1544	8	1.79	0.42	5	226.6	6.11	152.8	24.3	Sampled	
					Comments: Hydrosleeve in well tied to plug. Removed and put back after sampling. Gattic (PVC) broken, no bolts and plug broken but in place					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS						Borehole ID: MW02				
Project Number: 4132561						Sample ID: MW02_190702				
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)						Date: 02 / 7 / 2019				
Site: Mackay Airport						Sampler: Jackson Skopp				
Well Condition (i.e road box, locked etc): Gattic						Purge Method: Peristaltic Pump				
Depth to Water Table Pre-purge (from TOC): 1.895						Sample Method: Peristaltic Pump				
Depth of PSH (from TOC):						Casing Type: uPVC Class 18				
Depth to Bottom of Casing (BOC) from TOC: 3.93						Well Diameter: 50 mm				
Depth to Water Table Post - purge (from TOC):						QA Collected: QA01_190702 & QA02_190702				
FIELD PARAMETERS (RECORDED USING YSI/)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
1604	0.25	1.895	0.89	11.1	1495	6.58	128.5	26.2	Clear, no odour, no sheen	
1614	1	1.9	0.7	5.6	1513	6.58	129.2	26.2		
1622	2	1.905	0.53	6.6	1505	6.57	129.5	26.2		
1627	3	1.91	0.5	6.1	1490	6.57	129.1	26.2		
1632	4	1.91	0.43	5.4	1473	6.56	129	26.2	Becoming turbid (grey)	
1639	5	1.9	0.4	5	1424	5.56	128.3	25.6		
1648	6	1.9	0.43	5.2	1374	6.56	127.3	25.6		
1657	7	1.91	0.43	5.2	1378	6.56	126.5	25.7	Sampled	
					Comments:					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET



PROJECT DETAILS

Project Number: 4132561

Project Name: ASA Mackay PFAS DSI

Client: Air Services Australia (ASA)

Site: Mackay Airport

Well Condition (i.e road box, locked etc): Gattic

Depth to Water Table Pre-purge (from TOC): 1.94

Depth of PSH (from TOC):

Depth to Bottom of Casing (BOC) from TOC: 5.10

Depth to Water Table Post - purge (from TOC):

Borehole ID: MW03

Sample ID: MW03_190703

Date: 03 / 7 / 2019

Sampler: Jackson Skopp

Purge Method: Peristaltic Pump

Sample Method: Peristaltic Pump

Casing Type: uPVC Class 18

Well Diameter: 50 mm

QA Collected: No

FIELD PARAMETERS (RECORDED USING YSI/)

Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments
0730	0.25	-	1.05	12.2	1360	6.85	65.9	23.5	Clear, no odour, no sheen
0739	1	1.94	0.75	9	1375	6.83	30.3	24	
0744	2	2.28	0.82	10.2	1382	6.81	5	24.1	
0751	3	2.71	0.83	9.9	1398	6.77	-19.6	23.9	
0803	5	2.96	0.67	8	1406	6.75	-32	24	Moderate recharge - left 5 mins to recharge to 2.58 mbtoc
0816	6	2.405	0.34	4.2	1409	6.74	-32.7	24.3	
0821	7	2.405	0.31	3.7	1418	6.75	-37.4	24.2	
0826	7.5	2.4	0.34	4.1	1417	6.73	-36.1	24	
0834	8	2.4	0.3	-	1422	6.73	-38.7	24	Sampled

Comments: Dip metre issues at time of readings - possibly inaccurate readings

Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS							Borehole ID: MW06			
Project Number: 4132561							Sample ID: MW06_190703			
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)							Date: 03 / 7 / 2019			
Site: Mackay Airport							Sampler: Jackson Skopp			
Well Condition (i.e road box, locked etc): Gattic							Purge Method: Peristaltic Pump			
Depth to Water Table Pre-purge (from TOC): 1.68							Sample Method: Peristaltic Pump			
Depth of PSH (from TOC):							Casing Type: uPVC Class 18			
Depth to Bottom of Casing (BOC) from TOC: 4.35							Well Diameter: 50 mm			
Depth to Water Table Post - purge (from TOC):							QA Collected: No			
FIELD PARAMETERS (RECORDED USING YSI/)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
0858	0.25	1.7	1.31	17.8	3840	6.29	-88.2	24.6	Clear, no odour, no sheen	
0907	1	1.71	0.41	5.7	39238	6.32	-115.2	25.1		
0915	2	1.71	0.35	4.9	39265	6.32	-122.2	25.1		
0922	3	1.71	0.34	4.9	39157	6.31	-133.8	25		
0928	4	1.713	0.31	4.3	39057	6.31	-143.9	25.1		
0936	5	1.715	0.29	4.1	38902	6.31	-157.6	25.1		
0941	5.5	1.715	0.25	3.6	38914	6.31	-161.4	25.1		
0946	6	1.715	0.24	3.3	38841	6.31	-166.7	25.1		
0952	7	1.715	0.28	3.9	38818	6.31	-170	25.1		
0958	8	1.715	0.27	3.8	38829	6.31	-171.3	25.1	Sampled	
					Comments:					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS						Borehole ID: MW07				
Project Number: 4132561						Sample ID: MW07_190702				
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)						Date: 02 / 7 / 2019				
Site: Mackay Airport						Sampler: Jackson Skopp				
Well Condition (i.e road box, locked etc): Gattic						Purge Method: Peristaltic Pump				
Depth to Water Table Pre-purge (from TOC): 1.39						Sample Method: Peristaltic Pump				
Depth of PSH (from TOC):						Casing Type: uPVC Class 18				
Depth to Bottom of Casing (BOC) from TOC: 5.125						Well Diameter: 50 mm				
Depth to Water Table Post - purge (from TOC):						QA Collected: No				
FIELD PARAMETERS (RECORDED USING YSI/)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
1243	1	1.43	0.24	3.2	25191	5.99	94.9	25.6	Clear to slightly cloudy.	
1253	2	1.435	0.26	3.5	25152	5.98	97.9	25.4		
1300	3	1.45	0.24	3.1	25151	5.99	97.7	25.4		
1309	4	1.44	0.26	3.5	25101	5.99	98.6	25.4		
1315	5	1.455	0.27	3.5	25041	5.99	100.4	25.4		
1324	6	1.455	0.28	3.7	24999	5.98	99.8	25.3		
1331	7	1.455	0.27	3.6	25053	5.98	98.6	25.3		
1337	7.5	1.455	0.26	3.4	25052	5.99	98.6	25.3	Sampled	
					Comments:					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

GROUNDWATER PURGING AND SAMPLING FIELD SHEET



PROJECT DETAILS

Project Number: 4132561

Project Name: ASA Mackay PFAS DSI

Client: Air Services Australia (ASA)

Site: Mackay Airport

Well Condition (i.e road box, locked etc): Gattic

Depth to Water Table Pre-purge (from TOC): 1.07

Depth of PSH (from TOC):

Depth to Bottom of Casing (BOC) from TOC: 3.75

Depth to Water Table Post - purge (from TOC):

Borehole ID: MW08

Sample ID: MW08_190702

Date: 02 / 7 / 2019

Sampler: Jackson Skopp

Purge Method: Peristaltic Pump

Sample Method: Peristaltic Pump

Casing Type: uPVC Class 18

Well Diameter: 50 mm

QA Collected: No

FIELD PARAMETERS (RECORDED USING YSI/)

Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments
1127	0.5	1.12	1.03	12.5	5699	5.09	161.4	25.4	
1133	1	1.13	0.87	10.7	5651	5.08	116.5	25.4	
1140	2	1.13	0.71	8.8	5605	5.17	45.9	25.3	
1146	3		0.69	8.5	5631	5.24	25.7	25.5	
1152	4	1.13	0.58	7.2	5641	5.26	9.4	25.4	
1157	5	1.125	0.52	6.6	5640	5.27	12	25.4	
1202	5.5	1.13	0.51	6.3	5641	5.31	12.3	25.4	
1207	6	1.125	0.47	5.9	5644	5.31	2.6	25.3	
1214	7	1.132	0.44	5.5	5651	5.29	0.3	25.3	stopped pump for 5 mins to 1.07 m btoc - good recharge
1225	8	1.13	0.47	5.7	5640	5.31	1	25.4	
1231	8.5	1.13	0.47	5.4	5639	5.3	1	25.3	

Comments:

Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)

GROUNDWATER PURGING AND SAMPLING FIELD SHEET										
PROJECT DETAILS							Borehole ID: MW09			
Project Number: 4132561							Sample ID: MW09_190702			
Project Name: ASA Mackay PFAS DSI										
Client: Air Services Australia (ASA)							Date: 02 / 7 / 2019			
Site: Mackay Airport							Sampler: Jackson Skopp			
Well Condition (i.e road box, locked etc): Gattic							Purge Method: Peristaltic Pump			
Depth to Water Table Pre-purge (from TOC): 1.25							Sample Method: Peristaltic Pump			
Depth of PSH (from TOC):							Casing Type: uPVC Class 18			
Depth to Bottom of Casing (BOC) from TOC: 3.971							Well Diameter: 50 mm			
Depth to Water Table Post - purge (from TOC):							QA Collected: No			
FIELD PARAMETERS (RECORDED USING YSI/)										
Time	Volume (L)	Depth to Water from TOC(m)	D.O (mg/L)	D.O (%)	E.C (us/cm)	pH	Eh (mv)	Temp (°C)	Comments	
0904	0.25	1.26	0.96	11.7	8557	4.1	252	24.5	Clear, slighgtly cloudy, no odour, no sheen	
0911	1	1.26	1.19	14.9	8559	4.09	276	24.4		
0921	2	1.31	0.97	11.8	8545	4.08	285.3	24.6	becominhg turbid, brown	
0931	3	1.315	0.98	11.7	8555	4.08	297.7	24.5		
0941	4	1.315	0.76	11.6	8555	4.08	298.1	24.6		
0949	5	1.316	0.52	5.9	8556	4.07	304.1	24.6		
0953	5.5	1.32	0.71	8.5	8556	4.07	306.1	24.6		
0958	6	1.325	0.74	-	8554	4.07	308.8	24.6		
					Comments:					
Well Volume Calculation (50mm diameter) 3.8xH (H=height of water column)										

Appendix E – Surface Water, Sediment and Biota Sampling Records

EFFORT

FISH COUNT

[illegible]

Site:	Biota 2
Date:	25/06/2019
Team:	LP / JS

Method	Number	Date in	Time in	Date Out	Time out	Effort
Crab pot	1	25/06/2019	15:00	26/06/2019	09:30	
Seine	10 metres	25/06/2019	15:30	25/06/2019	16:30	4 x 10 m haul
Cast net	1	26/06/2019	07:30	26/06/2019	08:00	
Fyke	1	26/06/2019	07:00	26/06/2019	09:20	
Fyke	1	26/06/2019	09:40	26/06/2019	12:15	

[illegible]



Sediment Samples

Site: Mackay Airport

Date: 25/6/2019 - 03/7/2019

Monitoring Personnel: Jackson Skopp

Field Observations

Location	Time/ date	Comments
SS01	27/06/2019	Silt, brown, saturated, low plasticity, organic odour, no sheen
SS02	27/06/2019	Clay, brown, moist under surface where sample was taken (0.1m), low plasticity, no odour, no sheen
SS04	03/07/2019	SS04 not sampled
SS05	26/06/2019	Orange & grey clay and silt, saturated, High organic content with sub-angular gradules, no odour, no sheen
SS06	25/06/2019	Brown / grey, organic odour, silt with clay, saturated, no odour, no sheen.
SS07	26/06/2019	Coarse sand, grey / tan, saturated, no odour, no sheen.
SS08	27/06/2019	Medium coarse grained sand, grey, no odour, no sheen.

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	27 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW01 / SS01	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.....
	Long: 149.....

FIELD Physico-	Results:
pH	
Redox (mV)	
EC (uS/cm)	
Temperature (°C)	
DO (% satn.)	
Turbidity (NTU)	
Time of sampling	



Sediment Sample SS01 - Silt, brown, saturated, low plasticity, organic odour, no sheen

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Pounded [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	
Oil/petrochem (film/odour) Specify amount and intensity	no
Objectionable odour	organic odour
Algal blooms or floating vegetation mats etc	Floating green mat algae
Dead fauna/flora	no
Sources of suspended solids/colour of water	
Aquatic fauna life (list observed)	no
Other observations/notes	Concrete base drain with silt layer at base, shallow (approx 0.20m at deepest point)
Rain in past week	[] Yes [x] No
Weather	[x] No rain [x] Showers [] Heavy rain [x] Sunny [] Some Cloud [] Over cast [x] Calm [] Breeze [] Strong Wind

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	27 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW02 / SS02	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.16295699
	Long: 149.17596768

FIELD Physico-	Results:
pH	
Redox (mV)	
EC (uS/cm)	
Temperature (°C)	
DO (% satn.)	
Turbidity (NTU)	
Time of sampling	



Sediment sample SS02 - Clay, brown, moist under surface where sample was taken (0.1m), low plasticity, no odour, no sheen

FIELD

Photos taken (tick and No.)	
Flow rate	☒ Ponded ☐ Seeping/trickling ☐ Slight ☐ Moderate ☐ Fast
Floating litter, debris, scum, foam, objectionable matter	
Oil/petrochem (film/odour) Specify amount and intensity	
Objectionable odour	
Algal blooms or floating vegetation mats etc	
Dead fauna/flora	
Sources of suspended solids/colour of water	
Aquatic fauna life (list observed)	
Other observations/notes	No SW sample taken, no water in drain
Rain in past week	☐ Yes ☒ No
Weather	☐ No rain ☒ Showers ☐ Heavy rain ☐ Sunny ☐ Some Cloud ☐ Over cast ☐ Calm ☐ Breeze ☐ Strong Wind

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	03 / 7 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW04	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.16691127
	Long: 149.18554307

FIELD Physico-	Results:
pH	6.56
Redox (mV)	52.6
EC (uS/cm)	46602
Temperature (°C)	26.2
DO (% satn.)	171.5
Turbidity (NTU)	
Time of sampling	1251



Sediment Sample SS04 not sampled due to high organic mater and roots, insufficient sample

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Ponded [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	Floating grass & brown algae
Oil/petrochem (film/odour) Specify amount and intensity	organic sheen
Objectionable odour	no
Algal blooms or floating vegetation mats etc	Yes
Dead fauna/flora	leaves, submerged grass
Sources of suspended solids/colour of water	clear - brown
Aquatic fauna life (list observed)	No
Other observations/notes	
Rain in past week	[x] Yes

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	26 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW05 / SS05	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.16324314
	Long: 149.18728027

FIELD Physico-	Results:
pH	6.56
Redox (mV)	52.6
EC (uS/cm)	46602
Temperature (°C)	26.2
DO (% satn.)	171.5
Turbidity (NTU)	
Time of sampling	1251



Sediment Sample SS05 - Orange & grey clay and silt, saturated, High organic content with sub-angular gradules, no odour, no sheen

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Pondered [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	Leaves, gravels and rocks, sticks and logs (moderate to high)
Oil/petrochem (film/odour) Specify amount and intensity	no
Objectionable odour	no
Algal blooms or floating vegetation mats etc	leaves, sticks & logs
Dead fauna/flora	dead leaves & logs on creek bed
Sources of suspended solids/colour of water	clear - brown
Aquatic fauna life (list observed)	No
Other observations/notes	
Rain in past week	[x] Yes

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	25 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW06 / SS06	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.6879377
	Long: 149.18664265

Sediment Sample SS06 - Brown / grey, organic odour, silt with clay, saturated, no odour, no sheen.

No image.

FIELD Physico-	Results:
pH	7.30
Redox (mV)	178.2
EC (uS/cm)	31380
Temperature (°C)	22.90
DO (% satn.)	69.9
Turbidity (NTU)	
Time of sampling	1345

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Ponded [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	1 or 2 logs, little debris evident, clean
Oil/petrochem (film/odour) Specify amount and intensity	no
Objectionable odour	organics muds
Algal blooms or floating vegetation mats etc	no
Dead fauna/flora	no
Sources of suspended solids/colour of water	brown
Aquatic fauna life (list observed)	small fish (10 - 30 mm)
Other observations/notes	
Rain in past week	[] Yes [x] No
Weather	[] No rain [] Showers [] Heavy rain [x] Sunny [] Some Cloud [x] Over cast [] Calm [x] Breeze [] Strong Wind

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	26 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW07 / SS07	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.18054749
	Long: 149.19224868



FIELD Physico-	Results:
pH	
Redox (mV)	
EC (uS/cm)	
Temperature (°C)	
DO (% satn.)	
Turbidity (NTU)	
Time of sampling	

Sediment Sample SS07 - Coarse sand, grey / tan, saturated, no odour, no sheen.

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Pounded [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	Leaves, gravels and rocks, sticks and logs (moderate to high)
Oil/petrochem (film/odour) Specify amount and intensity	no
Objectionable odour	no
Algal blooms or floating vegetation mats etc	no
Dead fauna/flora	no
Sources of suspended solids/colour of water	Clear, low turbidity
Aquatic fauna life (list observed)	Toad fish
Other observations/notes	River mouth, near wall of resort
Rain in past week	[] Yes [x] No
Weather	[x] No rain [] Showers [] Heavy rain [x] Sunny [] Some Cloud [] Over cast [x] Calm [] Breeze [] Strong Wind

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Surface Water & Sediment Monitoring



Job number: 4132561	Date:	27 / 6 / 2019
Location: Mackay Airport ASA	Sampled by:	Jackson Skopp
Site ID: SW08 / SS08	Site used for QA sample:	

Field data and observations

GPS co-ordinates	Lat: -21.17846384
	Long: 149.18338759

FIELD Physico-	Results:
pH	8.16
Redox (mV)	103.0
EC (uS/cm) SPC	3516
Temperature (°C)	21.3
DO (% satn.)	101.7
Turbidity (NTU)	
Time of sampling	13.45



Sediment Sample SS08 - Medium coarse grained sand, grey, no odour, no sheen.

FIELD

Photos taken (tick and No.)	
Flow rate	[x] Ponded [] Seeping/trickling [] Slight [] Moderate [] Fast
Floating litter, debris, scum, foam, objectionable matter	Some leaves, minimal litter or dead debris
Oil/petrochem (film/odour) Specify amount and intensity	no
Objectionable odour	no
Algal blooms or floating vegetation mats etc	no
Dead fauna/flora	no
Sources of suspended solids/colour of water	Clear, some floating organic sheen
Aquatic fauna life (list observed)	no
Other observations/notes	Sampled taken just beyond Airport boundary fence, accessed via gate
Rain in past week	[] Yes [x] No
Weather	[x] No rain [x] Showers [] Heavy rain [x] Sunny [] Some Cloud [] Over cast [x] Calm [] Breeze [] Strong Wind

Generic Describing words key:

No Detect	Trace	Mild	Moderate	High
0%	< 25 %	25-50 %	50- 80%	>80 %

Appendix F – Summary Tables

[illegible]



Appendix F
Table F1b
Leachate - PFAS TOPA Results

Air Services Australia
Mackay Airport
Mackay Airport Post-PSI Investigation

		PFAS																																	
		Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of TOP C4 - C14 as Fluorine	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates		
EOL		HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	HR/L	
PFAS NEMP 2018 Interim Landfill Clay/Single (Leachate)		0.02	0.02	0.02	0.02	0.01	0.02	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01		
PFAS NEMP 2018 Interim Landfill Double (Leachate)												5.6 ¹¹																			0.7 ¹¹				
PFAS NEMP 2018 Interim Landfill Unlined (Leachate)												5.6 ¹²																			0.7 ¹²				
ERA60 version 3.02 2018 Max TCLP for clay lined landfills												0.56 ¹³																		50 ¹¹	0.07 ¹³				
Site ID	Location Code	Field ID	Sampled Date Time		0.11	0.08	0.48	0.03	1.31	<0.02	<0.1	0.06	0.12	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	2.21	1.79	1.4	2.21
Mackay Airport	MW09	MW09_0.5	25/07/2019																																
Statistical Summary			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Number of Results		1	1	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	
Number of Detects		0.11	0.08	0.48	0.03	1.31	ND	ND	0.06	0.12	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	1.79	1.4	2.21	
Minimum Concentration		0.11	0.08	0.48	0.03	1.31	<0.02	<0.1	0.06	0.12	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	2.21	1.79	1.4	2.21	
Maximum Concentration		0.11	0.08	0.48	0.03	1.31	ND	ND	0.06	0.12	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	1.79	1.4	2.21	
Minimum Detect		0.11	0.08	0.48	0.03	1.31	ND	ND	0.06	0.12	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	1.79	1.4	2.21	
Maximum Detect		0.11	0.08	0.48	0.03	1.31	ND	ND	0.06	0.12	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.21	1.79	1.4	2.21	
Median Concentration		0.11	0.08	0.48	0.03	1.31	0.01	0.05	0.06	0.12	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.025	0.01	0.025	0.025	0.025	0.01	0.01	0.025	0.025	0.025	0.025	2.21	1.79	1.4	2.21			
Number of Guideline Exceedances		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Number of Guideline Exceedances (Detects Only)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Env Stds Comments

#1: Total fluorinated organic compounds 50 ug/L if not reused on site (if leachate reused on or off-site 0.03 ug/L)

[illegible]

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



Appendix F
Table F2b
Groundwater - PFAS TOPA Results

Air Services Australia
Mackay Airport
Mackay Airport Post-PSI Investigation

	PFAS																																
	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSEA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of TOP C4 - C14 as Fluorine	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates	
EQL	0.02	0.02	0.02	0.02	0.01	0.02	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01
NHMRC - PFAS Recreational screening values (swimming & boating on/in natural waters)											10 ^{#2}																						
FSANZ - PFAS Tolerable daily intake											0.16 ^{#3}																						
FSANZ - PFAS Drinking water quality guideline											0.56																						
FSANZ - PFAS Recreational water quality guideline											5.6																						
NHMRC Recreational Guidelines 2008 - Health					0.00023						19																						
PFAS NEMP 2018 Freshwater 99%					0.00023 ^{#1}						19 ^{#1}																						

Site ID	Location Code	Sampled Date	Time	5.88	6	57.3	3.18	92.4	<0.2	7	7	37.2	1.4	3.08	0.32	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	221	150	141	221
Mackay Airport	GMW 6	2/07/2019		1.76	1.51	13	0.56	26.7	<0.1	2.2	2.63	17.5	0.65	0.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.25	<0.1	<0.25	<0.25	<0.25	<0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	67.3	39.7	43.2	67.3

Statistical Summary																																			
Number of Results	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Number of Detects	2	2	2	2	2	0	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	1.76	1.51	13	0.56	26.7	<0.1	2.2	2.63	17.5	0.65	0.75	<0.1	<0.1	<0.1	<0.1	<0.25	<0.1	<0.25	<0.25	<0.25	<0.25	<0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	67.3	39.7	43.2	67.3			
Minimum Detect	1.76	1.51	13	0.56	26.7	ND	2.2	2.63	17.5	0.65	0.75	0.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	67.3	39.7	43.2	67.3		
Maximum Concentration	5.88	6	57.3	3.18	92.4	<0.2	7	7	37.2	1.4	3.08	0.32	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	221	150	141	221			
Maximum Detect	5.88	6	57.3	3.18	92.4	ND	7	7	37.2	1.4	3.08	0.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	221	150	141	221		
Average Concentration																																			
Median Concentration	3.82	3.755	35.15	1.87	59.55	0.075	4.6	4.82	27.35	1.025	1.915	0.185	0.075	0.075	0.075	0.075	0.1875	0.075	0.1875	0.1875	0.1875	0.1875	0.075	0.075	0.075	0.075	0.075	0.075	0.075	144.2	94.85	92.1	144.2		
Standard Deviation																																			
Number of Guideline Exceedances	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0		
Number of Guideline Exceedances(Detects Only)	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0		

Env Stds Comments

#1: 99% species protection - high conservation value systems

#2: Recreational screening values for PFOS+PFHxS (2 µg/L) and PFOA (10 µg/L) to be applied for swimming and boating activities on/in natural waters and water bodies such as rivers and lakes.

Does not apply to any other recreational use or non-natural water bodies such as pools. For the latter, must continue to use the DoH values (0.7 µg/L for PFOS+PFHxS, 5.6 µg/L for PFOA)

#3: Daily tolerable intake µg/kgbw/d = micrograms per kilogram body weight per day)

[illegible][illegible]

[illegible]

#1: 99% species protection - high conservation value systems
 #2: Recreational screening values for PFOS+PFHxS (2 µg/L) and PFOA (10 µg/L) to be applied for swimming and boating activities on/in natural waters and water bodies such as rivers and lakes.
 Does not apply to any other recreational use or non-natural water bodies such as pools. For the latter, must continue to use the DoH values (0.7µg/L for PFOS+PFHxS, 5.6 µg/L for PFOA)
 #3: Daily tolerable intake µg/kgbw/d = micrograms per kilogram body weight per day)

#1 Reported Analyte LOR is higher than Requested Analyte LOR



Appendix F
Table F4b
Surface water - PFAS TOPA Results

Air Services Australia
Mackay Airport
Mackay Airport Post-PSI Investigation

	PFAS																																				
	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of TOP C4 - C14 as Fluorine	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates					
EQL	0.02	0.02	0.02	0.02	0.01	0.02	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.01				
NHMRC - PFAS Recreational screening values (swimming & boating on/in natural waters)																																					
FSANZ - PFAS Tolerable daily intake																														10 ⁻²							
FSANZ - PFAS Drinking water quality guideline																														0.16 ²¹							
FSANZ - PFAS Recreational water quality guideline																														0.56							
NHMRC Recreational Guidelines 2008 - Health																														5.6							
PFAS NEMP 2018 Freshwater 99%																														19 ²¹							
																														19 ²¹							
																														2 ⁻²							
																														0.02 ²³							
																														0.07							
																														0.7							

Site ID	Location Code	Sampled Date Time	<0.05	<0.05	<0.05	<0.05	0.2	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.05	<0.12	<0.12	<0.12	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	0.2	0.13	0.2
Mackay Airport	SW06	25/06/2019	<0.05	<0.05	<0.05	<0.05	0.2	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.05	<0.12	<0.12	<0.12	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	0.2	0.13	0.2
Mackay Airport	SW08	27/06/2019	0.24	0.3	2.97	0.2	6.92	<0.02	0.4	0.41	3.05	0.1	0.2	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	14.8	9.89	9.51	14.8

Statistical Summary																																				
Number of Results	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Number of Detects	1	1	1	1	2	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Minimum Concentration	<0.05	<0.05	<0.05	<0.05	0.2	<0.02	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	0.2	0.13	0.2	
Minimum Detect	0.24	0.3	2.97	0.2	0.2	ND	0.4	0.41	3.05	0.1	0.2	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	0.2	0.13	0.2		
Maximum Concentration	0.24	0.3	2.97	0.2	6.92	<0.05	0.4	0.41	3.05	0.1	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.12	<0.05	<0.12	<0.12	<0.12	<0.12	<0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	14.8	9.89	9.51	14.8		
Maximum Detect	0.24	0.3	2.97	0.2	6.92	ND	0.4	0.41	3.05	0.1	0.2	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14.8	9.89	9.51	14.8		
Average Concentration																																				
Median Concentration	0.13	0.163	1.498	0.11	3.56	0.0175	0.23	0.22	1.5375	0.063	0.113	0.0225	0.0175	0.0175	0.0175	0.0175	0.0425	0.0175	0.0425	0.0425	0.0425	0.0425	0.0425	0.0175	0.0175	0.025	0.025	0.025	0.025	0.025	7.5	5.045	4.82	7.5		
Standard Deviation																																				
Number of Guideline Exceedances	#####	#####	#####	#####	#VALUE!	#####	#####	#####	#####	#####	#####	1	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	
Number of Guideline Exceedances(Detects Only)	#####	#####	#####	#####	#VALUE!	#####	#####	#####	#####	#####	#####	1	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	

Env Stds Comments

#1:99% species protection - high conservation value systems

#2: Recreational screening values for PFOS+PFHxS (2 µg/L) and PFOA (10 µg/L) to be applied for swimming and boating activities on/in natural waters and water bodies such as rivers and lakes.

Does not apply to any other recreational use or non-natural water bodies such as pools. For the latter, must continue to use the DoH values (0.7µg/L for PFOS+PFHxS, 5.6 µg/L for PFOA)

#3: Daily tolerable intake µg/kgbw/d = micrograms per kilogram body weight per day)



Appendix F
Table F5
Sediment results - Norwegian environmental quality classification

	Inorganics		PFAS																																	
	Moisture (%)	Total Organic Carbon																																		
			Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	PFAS (Sum of Total)(WA DER List)			
EQL	0.1	0.02	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.5	0.5	0.5	0.5	0.2	0.2	0.5	0.5	0.5	0.5	0.2	0.2	0.2
PFAS Sediment Norwegian Predicted No Effect Concentration																																			220	

Site_ID	Location_Code	Field_ID	Sampled_Date																																
Mackay Airport	SS01	SS01_190627	27/06/2019	25.8	0.38	<0.2	<0.2	0.5	<0.2	0.4	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	0.9	0.9
	SS02	SS02_190627	27/06/2019	18.8	0.34	<0.2	<0.2	<0.2	<0.2	0.7	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.7	0.7
	SS05	SS05_190626	26/06/2019	38.7	0.78	<0.2	<0.2	<0.2	<0.2	0.8	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.8	0.8
	SS06	SS06_190625	25/06/2019	33.6	0.58	<0.2	<0.2	<0.2	<0.2	2.3	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	2.3	2.3	2.3
	SS07	SS07_190626	26/06/2019	19.6	0.07	<0.2	<0.2	<0.2	<0.2	0.6	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	0.6
	SS08	SS08_190627	27/06/2019	17.1	0.1	<0.2	<0.2	2	<0.2	17	<0.2	<1	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	19.3	19	19.3

Statistical Summary																																		
Number of Results	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
Number of Detects	6	6	0	0	2	0	6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	6		
Minimum Concentration	17.1	0.07	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	0.6
Minimum Detect	17.1	0.07	ND	ND	0.5	ND	0.4	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	0.6	0.6		
Maximum Concentration	38.7	0.78	<0.2	<0.2	2	<0.2	17	<0.2	<1	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	19.3	19	19.3	
Maximum Detect	38.7	0.78	ND	ND	2	ND	17	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19.3	19	19.3		
Average Concentration	26	0.38	0.1	0.1	0.48	0.1	3.6	0.1	0.5	0.1	0.13	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.25	0.1	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	0.25	4.1	4.1	4.1	
Median Concentration	22.7	0.36	0.1	0.1	0.1	0.1	0.75	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.25	0.1	0.25	0.25	0.25	0.25	0.1	0.1	0.25	0.25	0.25	0.25	0.85	0.85	0.85	
Standard Deviation	8.8	0.27	0	0	0.76	0	6.6	0	0	0	0.082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.5	7.4	7.5		
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Appendix G – Quality Assurance / Quality Control

0.1 Field QA/QC

A series of QA/QC procedures were implemented for the field investigation works, which included:

- Collection of QC samples
- Use of standard sampling procedures
- Use of standard field sampling forms, including CoCs
- Documenting the calibration and use of field equipment.

All field works were conducted by a GHD environmental scientist in accordance with GHD's *Standard Field Operating Procedures* (SFOP).

0.1.1 QA/QC sampling

Field QA/QC samples were collected and analysed. Field QC sampling was conducted in reference to AS 4482.1: 2005 and NEPM 2013 Schedule B (3) requirements and included the analysis of the following types of samples in Table O-1.

Table O-1 Field QA/QC sample details

Field QA/QC sample type	Details
Intra-Laboratory Duplicate (Blind)	Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the primary project laboratory. Blind duplicates provide an indication of the analytical precision of the laboratory, but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity.
Inter-Laboratory Duplicate (Split)	Inter-Laboratory Duplicate (Split) samples are two separate samples collected at the same location and analysed by two separate laboratories to assess the analytical proficiency of the primary laboratory.
Trip Blank	Trip blank samples provide an indication of cross contamination from volatile substances during field sampling and / or during transport.
Rinsate	A sample of analyte free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples to assess the adequacy of the decontamination process. One sample of water from the non-destructive drilling unit tank was also analysed as part of the sampling program to confirm that NDD water was PFAS free.

GHD adopts an RPD limit of 30% - 50% for results greater than 10 times the LOR and no limit for results <10 times LOR for field duplicates. Blind duplicate and split samples should have RPDs less than the criteria in each instance. However, it is noted that the criteria will not always be achieved, particularly in heterogeneous materials, or at low analyte concentrations.

In the instance where samples and their corresponding duplicates have concentrations of target analytes less than the laboratory LOR, no quantitative comparison can be carried out and therefore the RPD is undefined. This is also the case for situations where the sample result is less than 10 times the laboratory LOR.

Duplicate and split sample results and RPD calculations are presented in Appendix G

0.1.2 Sample handling and preservation

All soil/sediment samples were collected by hand, using single use nitrile gloves between each sample, and placed directly into pre-treated laboratory supplied jars and bags. The samples were placed immediately into an insulated ice box for storage while on site and upon completion of site works the sealed ice box was delivered, via courier, to the laboratory.

Groundwater samples were collected using disposable equipment and transferred to the laboratory-supplied applicable sample bottles. Samples were placed directly into the insulated ice box and delivered upon return from site to the laboratory.

All samples were received intact as per the Sample Receipt Notifications (included in Appendix H

O.1.3 Chain of custody

Unique Chain of Custody documentation and distinct batch numbers accompanied all sample batches. This documentation is included in Appendix

O.2 Laboratory QA/QC

The laboratories employed to analyse samples (ALS and Eurofins) are certified by the NATA for the required analysis. NATA certification provides for laboratory QA procedures to be in place and to be carried out on an on-going basis.

As part of the NATA requirements, ALS and Eurofins carried out and reported analysis of laboratory quality control samples, such as:

- Duplicate samples (the same sample analysed more than once)
- Blanks (containing none of the analytes to be analysed)
- Spiked samples (containing known additions of the analytes to appropriate matrices)
- Standard samples (samples containing known concentrations of the analytes - also known as reference standards).

O.2.1 Laboratory QA/QC procedures

As part of NATA requirements, ALS and Eurofins incorporate a range of QA methods to ensure accuracy of data. This includes the analyses of internal laboratory QC samples, details of which have been provided in Table O-2.

Table O-2 Laboratory QC sample details

Laboratory QA/QC sample	Details
Laboratory (Method) Blank	Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.
Laboratory Control Sample	A reference standard of known concentration is analysed along with a batch of samples. The Laboratory Control Sample provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.
Laboratory Spike	An authentic field sample is 'spiked' by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.
Surrogate Samples	These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are 'spiked' into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard / Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.
Laboratory Duplicates	The analytical laboratory collects duplicate sub samples from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result. The precision of analysis performed by the laboratory is determined by the calculation of the RPD. The RPD is calculated based on a comparison of an intra-laboratory split of the sample material with results representing the percent difference between the two sample concentrations for a specific contaminant. The RPD is calculated using the following formula: $RPD(\%) = \frac{ C_o - C_d }{C_o + C_d} \times 200$ Where Co = Analyte concentration of the original sample Cd = Analyte concentration of the duplicate sample

The laboratories are required to provide this information to GHD. The individual analytical laboratories conduct an assessment of the laboratory QC program internally; however, the results are also reviewed and assessed by GHD.

O.3 Field QC results

O.3.1 Soil

A total of 26 soil samples were collected and eight were analysed during the site sampling program. Three of five soil QC samples collected (including two intra-laboratory and one inter-laboratory samples) were analysed as part of the field work program. The target frequency for collection and analysis of field QC samples is 1 in 10 (10%). In this instance, this frequency was achieved for analysis (12.5%) and collection.

Table O-3 Field QC samples collected

Sample Date	Parent Sample ID	QAQC Sample ID	Sample Matrix*	Analysing Laboratory	QAQC Sample Type / Comment
Soil Sampling and Well Installation Works – July 2018					
28 June 2019	MW07_2.0	DUP_190628	S	ALS	Blind
28 June 2019	MW07_2.0	DUP_190628	S	Eurofins	Split

Four soil QC samples (two intra-laboratory and two inter-laboratory samples) were collected and analysed as part of this Post-PSI sampling. Field soil QC samples collected are provided in Table O-4.

The target frequency for collection and analysis of field QC samples is 1 in 10 (10%). In this instance, this frequency was achieved for both collection and analysis.

RPDs were calculated between the duplicate results. RPD results were reported within the adopted assessment criteria for all four samples, with <LOR detections for all analytes.

O.3.2 Water

Four water QC samples (two intra-laboratory and two inter-laboratory samples) were collected and analysed as part of this Post-PSI groundwater sampling. Field soil QC samples collected are provided in the Table O-4.

Table O-4 Field QC samples collected

Sample Date	Parent Sample ID	QAQC Sample ID	Sample Matrix*	Analysing Laboratory	QAQC Sample Type / Comment
02 July 2019	MW02	QA01_190702	W	ALS	Blind
02 July 2019	MW02	QA02_190702	W	Eurofins	Split

The target frequency for collection and analysis of field QC samples is 1 in 20 (5%). In this instance, this frequency was achieved for both collection and analysis

RPDs were calculated between the duplicate results. RPD results were reported within the adopted assessment criteria for all four samples with the exception of the following summarised in Table O-5.

Table O-5 RPD exceedances summary (Soil and sediment)

Primary & QA Pair	Analytes	Primary (mg/kg)	QA/QC (mg/kg)	RPD (%)
MW02_190702 & QA01_190702	Ionic Balance	0.51 %	1.54 %	100

O.4 Laboratory program

The NATA certified laboratories utilised for this assessment (ALS and Eurofins) undertook their own internal quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached as Appendix H.

The majority of the internal laboratory QA QC analysis, including method blanks, laboratory duplicates, control samples, laboratory spikes and surrogates spikes were within the data quality criteria, with the exception of those summarised in Table O-6. Most outliers were matrix spike recoveries which are due to matrix interferences in the sample.

Table O-6 Laboratory internal QAQC outlier summary

Laboratory Reports	Sample ID	Analytes	Comment
ES1920340	Biota1_BAR2	PFOS 6:2 FTS	Matrix spike recovery not determined, background level greater than or equal to 4 times spike level.
ES1920563	Anonymous	6:2 FTS	Matrix spike recovery not determined, background level greater than or equal to 4 times spike level.
ES1920574	Anonymous	6:2 FTS	Matrix spike recovery not determined, background level greater than or equal to 4 times spike level.
EB1917295	Anonymous	Sulfate as SO4	Matrix spike recovery not determined, background level greater than or equal to 4 times spike level.
EB1917295	Anonymous	10:2 FTS	Recovery less than the data quality objective

O.5 Holding times

All PFAS analysis was reported as being extracted/prepared and analysed within the holding times as recommended by the testing laboratories.

The majority of other non-PFAS analytes/parameters were reported as being extracted/prepared and/or analysed within the holding times as recommended by the testing laboratories, with the exception of those listed in Table O-8.

Comments on the data quality impacts of holding time breaches are provided in Table O-8.

Table H-8 Holding time outlier summary

Laboratory Reports	Sample ID	Analyte / Parameter	Overdue for?	Days Overdue	Data Quality Impact
ES1920340	SW05_190626 SW06_190625 SW07_190326	Dissolved Major Cations and TOC	Analysis	1	Negligible
ES1920563	MW08_2.0 MW09_2.0	pH	Extraction	3	Minor – not a contaminant. Used for additional commentary around water chemistry
ES1920574	MW06_3.0 MW07_3.0	pH	Extraction	3	Minor – not a contaminant. Used for additional commentary around water chemistry
EB1917295	GNW2-190702 GMW6_190702 GMW3_190702 MW02_190702, MW07_190702 MW08_190702 MW09_190702	TOC	Analysis	2	Minor – not a contaminant. Used for additional commentary around water chemistry
EB1917295	MW03_190703 MW06_190703 EW01_190703 QC sample	TOC	Analysis	1	Minor – not a contaminant. Used for additional commentary around water chemistry

0.6 TOP Assay

The PFAS NEMP (HEPA 2018) prescribes the following QA/QC checks for TOP assay analysis:

- the total PFAS concentration post-TOPA should be greater or equal to the total PFAS concentration pre-TOPA, which signifies no material losses observed in preparation steps, noting a decrease of up to 10% might be expected due to normal analytical variability
- the sum of PFCA post-TOPA should be equal to or greater than the sum of PFCA pre-TOPA, which signifies any precursors being converted to PFCA products
- the sum of PFSA post-TOPA should approximate the sum of PFSA pre-TOPA, signifying that precursors did not convert to PFSA products
- for a full oxidation, no PFAA precursors (e.g. 6:2 FtS, FOSA) are detectable post oxidation, signifying complete oxidation
- for situations where a near complete oxidation is acceptable, minimal PFAA precursors are detectable post oxidation signified by
 - for aqueous samples, sum of PFAA precursors divided by sum of Total PFAS <5%
 - for soil samples, sum of PFAA precursors divided by sum of Total PFAS <10%
 - noting greater leniency may be applied for samples where PFAS were detected ≤ 10 times LOR.

The following provides a brief discussion for each of the analysed sample matrices. Only primary samples collected by GHD, and where pre- and post-TOPA analysis has been undertaken, have been discussed.

Terrestrial Surface Water and Terrestrial Sediment

Two surface water samples (SW06 and SW08) were analysed for standard PFAS and TOPA PFAS. TOF post-TOPA were less than the pre-TOPA sum of PFAS.

SW06 sum of PFAS pre-TOPA decreased by an order of magnitude greater than 10% post-TOPA indicating material loss. PFCA and PFSA totals post-TOPA in SW06 were less than pre-TOPA totals.

Sum of PFAS pre-TOPA increased in concentration post-TOPA in SW08 indicating the possible presence of precursors at this location. PFCA totals at SW08 also increased from pre-TOPA to post-TOPA analysis

Groundwater

Two groundwater samples (GMW6 and GMW3) were analysed for standard PFAS and TOPA PFAS.

Total PFAS and PFCA concentrations increased in GMW3 between pre- and post-TOPA analysis indicating no material loss and the probable presence of precursors.

GMW6 pre- and post-TOPA sum of PFAS decreased by greater than 10% indicating material loss which may be attributed to oxidation into compound(s) not yet detectable by the laboratory. Increase in PFCA concentrations from pre-TOPA to post-TOPA indicated transformation of precursors to PFCA compounds.

TOF post-TOPA results were less than the pre-TOPA sum of PFAS results. PFAA concentrations were <LOR pre- and post-TOPA analysis for GMW6. It is also noted that samples that were highly impacted such as GMW6 were diluted during the extraction process due to high electrical conductivity. With the samples requiring such significant dilutions this also means that experimental variation or uncertainty is also being magnified.

Detections of PFAA found in GMW3 pre-TOPA was reduced to <LOR post-TOPA indicating complete oxidation.

0.7 Overall assessment of data quality

With the exception of the minor non-conformances listed above, the QA/QC parameters were within the specified requirements, and therefore the data is considered to be valid and of sufficient quality for the purposes of this report.



Appendix G
Table G1
Soil QAQC Results

Air Services Australia
Mackay Airport
Mackay Airport Post-PSI Investigation

		Field ID	MW07_ 2.0	DUP01_ 190628	RPD	MW07_ 2.0	TRIP01_ 190628	RPD
		Date	28/06/2019	28/06/2019		28/06/2019	28/06/2019	
		Lab Report Number	ES1920574	ES1920563		ES1920574	663949	
		Matrix Type	soil	soil		soil	soil	
	Unit	EQL						
Inorganics								
Moisture (%)	%	0.1	17.6	17.2	2	17.6		
Moisture Content (%)	%	1					17	
pH (aqueous extract)	pH Units	0.1					7.5	
TOC								
Total Organic Carbon	%	0.1					0.1	
PFAS								
Perfluoropropanesulfonic acid (PFPrS)	µg/kg	0.1					<0.1	
Perfluorobutane sulfonic acid (PFBS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluoropentane sulfonic acid (PFPeS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorohexane sulfonic acid (PFHxS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluoroheptane sulfonic acid (PFHpS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorooctane sulfonic acid (PFOS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorononane sulfonate (PFNS)	µg/kg	0.1					<0.1	
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorobutanoic acid (PFBA)	µg/kg	0.5	<1	<1	0	<1	<0.5	0
Perfluoropentanoic acid (PFPeA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorononanoic acid (PFNA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorodecanoic acid (PFDA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0
Perfluorooctane sulfonamide (FOSA)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.1	<0.5	<0.5	0	<0.5	<0.1	0
PFAS (Sum of Total)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0
Sum of PFHxS and PFOS	µg/kg	0.1	<0.2	<0.2	0	<0.2	<0.1	0
PFAS (Sum of Total)(WA DER List)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0
Sum of US EPA PFAS (PFOS + PFOA)*	µg/kg	0.1					<0.1	
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	µg/kg	0.1					<0.1	

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 999 (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



Appendix G
Table G2
Groundwater QAQC Results

Air Services Australia
Mackay Airport
Mackay Airport Post-PSI Investigation

		Field ID	MW02_190702	QA01_190702	RPD	MW02_190702	QA02_190702	RPD
		Date	2/07/2019	3/07/2019		2/07/2019	2/07/2019	
		Lab Report Number	EB1917295	EB1917295		EB1917295	664834	
		Matrix Type	water	water		water	water	
	Unit	EQL						
Acidity & Alkalinity								
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1	0	<1		
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	278	282	1	278		
Alkalinity (Hydroxide as CaCO3)	mg/L	1	<1	<1	0	<1		
Alkalinity (total as CaCO3)	mg/L	1	278	282	1	278		
Major Ions								
Calcium (filtered)	mg/L	1	36	37	3	36		
Magnesium (filtered)	mg/L	1	25	24	4	25		
Potassium (filtered)	mg/L	1	1	1	0	1		
Sodium (filtered)	mg/L	1	218	218	0	218		
Chloride	mg/L	1	258	264	2	258		
Sulfate (filtered)	mg/L	1	32	32	0	32		
Cations Total	meq/L	0.01	13.4	13.3	1	13.4		
Anions Total	meq/L	0.01	13.5	13.7	1	13.5		
Ionic Balance	%	0.01	0.51	1.54	100	0.51		
TOC								
Total Organic Carbon	mg/L	1	<1	<1	0	<1		
PFAS								
Perfluoropropanesulfonic acid (PFPrS)	µg/L	0.001					0.008	
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.001	0.019	0.018	5	0.019	0.018	5
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.001	0.030	0.032	6	0.030	0.034	13
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.001	0.324	0.322	1	0.324	0.39	18
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.001	0.005	0.005	0	0.005	0.006	18
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.001	0.054	0.055	2	0.054	0.075	
Perfluorononane sulfonate (PFNS)	µg/L	0.001					<0.001	
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorobutanoic acid (PFBA)	µg/L	0.005	<0.01	<0.01	0	<0.01	<0.005	0
Perfluoropentanoic acid (PFPeA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	<0.002	<0.002	0	<0.002	0.002	0
Perfluoroheptanoic acid (PFHpA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorooctanoic acid (PFOA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorononanoic acid (PFNA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorodecanoic acid (PFDA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorododecanoic acid (PFDoDA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.001	<0.002	<0.002	0	<0.002	<0.001	0
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.001	<0.005	<0.005	0	<0.005	<0.001	0
Perfluorooctane sulfonamide (FOSA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.005	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.005	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.005	0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.005	<0.005	0	<0.005	<0.001	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.005	<0.005	0	<0.005	<0.005	0
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.001	<0.005	<0.005	0	<0.005	<0.001	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.005	<0.005	0	<0.005	<0.001	0
PFAS (Sum of Total)	µg/L	0.002	0.432	0.432	0	0.432	0.533	21
Sum of PFHxS and PFOS	µg/L	0.001	0.378	0.377	0	0.378	0.465	21
PFAS (Sum of Total)(WA DER List)	µg/L	0.002	0.397	0.395	1	0.397	0.485	20
Sum of US EPA PFAS (PFOS + PFOA)*	µg/L	0.001					0.075	
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	µg/L	0.001					0.465	

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 999 (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

Appendix H – Laboratory Reports

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : ES1920563

Client : AIR SERVICES AUSTRALIA Contact : Daniel Todd Address : GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008 E-mail : daniel.todd@ghd.com Telephone : ---- Facsimile : ---- Project : 4132561-Mackay Airport Post-PSI Target Sampling Order number : 4132561 C-O-C number : ---- Site : ---- Sampler : Jackson Skopp	Laboratory : Environmental Division Sydney Contact : Customer Services ES Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : ALSEnviro.Sydney@ALSGlobal.com Telephone : +61-2-8784 8555 Facsimile : +61-2-8784 8500 Page : 1 of 3 Quote number : ES2017AIRSER0001 (EN/054A/17) QC Level : NEPM 2013 B3 & ALS QC Standard
---	--

Dates

Date Samples Received : 02-Jul-2019 09:45 Client Requested Due Date : 09-Jul-2019	Issue Date : 04-Jul-2019 Scheduled Reporting Date : 09-Jul-2019
---	--

Delivery Details

Mode of Delivery : Carrier No. of coolers/boxes : 3 Receipt Detail :	Security Seal : Intact. Temperature : 0.4°C - Ice present No. of samples received / analysed : 13 / 5
--	---

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **4/7/19: SRN has been resent to acknowledge that EP231X has been added to DUP01_190628 as per email request from Jackson Scopp on the 4/7/19. For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- "Particle Size Distribution" analysis to be conducted by ALS Newcastle.
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

- 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 - EA002 pH (1:5)	SOIL - EA055-103 Moisture Content	SOIL - EA150H Particle Size Analysis by Hydrometer: AS1289	SOIL - EP004 Organic Matter in Soil (Walkley Black)	SOIL - EP231X (solids)	PFAS - Full Suite (28 analytes)
ES1920563-001	27-Jun-2019 00:00	MW08_0.2	✓						
ES1920563-002	27-Jun-2019 00:00	MW08_0.5		✓	✓		✓	✓	
ES1920563-003	27-Jun-2019 00:00	MW08_1.0	✓						
ES1920563-004	28-Jun-2019 00:00	MW08_2.0		✓	✓	✓	✓	✓	
ES1920563-005	28-Jun-2019 00:00	MW08_3.0	✓						
ES1920563-006	28-Jun-2019 00:00	MW08_4.0	✓						
ES1920563-007	27-Jun-2019 00:00	MW09_0.2	✓						
ES1920563-008	27-Jun-2019 00:00	MW09_0.5		✓	✓		✓	✓	
ES1920563-009	27-Jun-2019 00:00	MW09_1.0	✓						
ES1920563-010	28-Jun-2019 00:00	MW09_2.0		✓	✓	✓	✓	✓	
ES1920563-011	28-Jun-2019 00:00	MW09_3.0	✓						
ES1920563-012	28-Jun-2019 00:00	MW09_4.0	✓						
ES1920563-013	28-Jun-2019 00:00	DUP01_190628			✓				✓

Proactive Holding Time Report

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

ACCOUNTS PAYABLE

Email accounts.payable@airservicesaustralia.com

[illegible][illegible]

CERTIFICATE OF ANALYSIS

Work Order : **ES1920563**
Client : **AIR SERVICES AUSTRALIA**
Contact : Daniel Todd
Address : GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM
 BRISBANE QLD, AUSTRALIA 4008

Telephone : ----
Project : 4132561-Mackay Airport Post-PSI Target Sampling
Order number : 4132561
C-O-C number : ----
Sampler : Jackson Skopp
Site : ----
Quote number : EN/054A/17
No. of samples received : 13
No. of samples analysed : 5

Page : 1 of 6
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 02-Jul-2019 09:45
Date Analysis Commenced : 04-Jul-2019
Issue Date : 11-Jul-2019 12:03



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Franco Lentini		Sydney Organics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW08_0.5	MW08_2.0	MW09_0.5	MW09_2.0	DUP01_190628
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920563-002	ES1920563-004	ES1920563-008	ES1920563-010	ES1920563-013
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		6.3	4.4	6.4	4.6	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		25.1	29.1	29.9	25.5	17.2
EA150: Particle Sizing									
+75µm	----	1	%		----	38	----	64	----
+150µm	----	1	%		----	14	----	8	----
+300µm	----	1	%		----	4	----	4	----
+425µm	----	1	%		----	3	----	3	----
+600µm	----	1	%		----	2	----	2	----
+1180µm	----	1	%		----	1	----	1	----
+2.36mm	----	1	%		----	<1	----	<1	----
+4.75mm	----	1	%		----	<1	----	<1	----
+9.5mm	----	1	%		----	<1	----	<1	----
+19.0mm	----	1	%		----	<1	----	<1	----
+37.5mm	----	1	%		----	<1	----	<1	----
+75.0mm	----	1	%		----	<1	----	<1	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	34	----	19	----
Silt (2-60 µm)	----	1	%		----	23	----	12	----
Sand (0.06-2.00 mm)	----	1	%		----	42	----	68	----
Gravel (>2mm)	----	1	%		----	1	----	1	----
Cobbles (>6cm)	----	1	%		----	<1	----	<1	----
EP004: Organic Matter									
Organic Matter	----	0.5	%		0.5	0.6	0.5	<0.5	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	0.0016	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	0.0011	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	<0.0002	0.0067	0.0005	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	0.0004	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	0.0209	0.0015	<0.0002



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW08_0.5	MW08_2.0	MW09_0.5	MW09_2.0	DUP01_190628
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920563-002	ES1920563-004	ES1920563-008	ES1920563-010	ES1920563-013
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
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	0.0009	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	<0.0002	0.0027	<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	0.0005	<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
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



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW08_0.5	MW08_2.0	MW09_0.5	MW09_2.0	DUP01_190628
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920563-002	ES1920563-004	ES1920563-008	ES1920563-010	ES1920563-013
					Result	Result	Result	Result	Result
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		<0.0002	<0.0002	0.0350	0.0020	<0.0002
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	0.0276	0.0020	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		<0.0002	<0.0002	0.0335	0.0020	<0.0002
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		67.5	73.5	68.0	71.5	61.5
13C8-PFOA	----	0.0002	%		68.5	75.0	77.0	83.0	78.5



Surrogate Control Limits

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

Certificate of Analysis

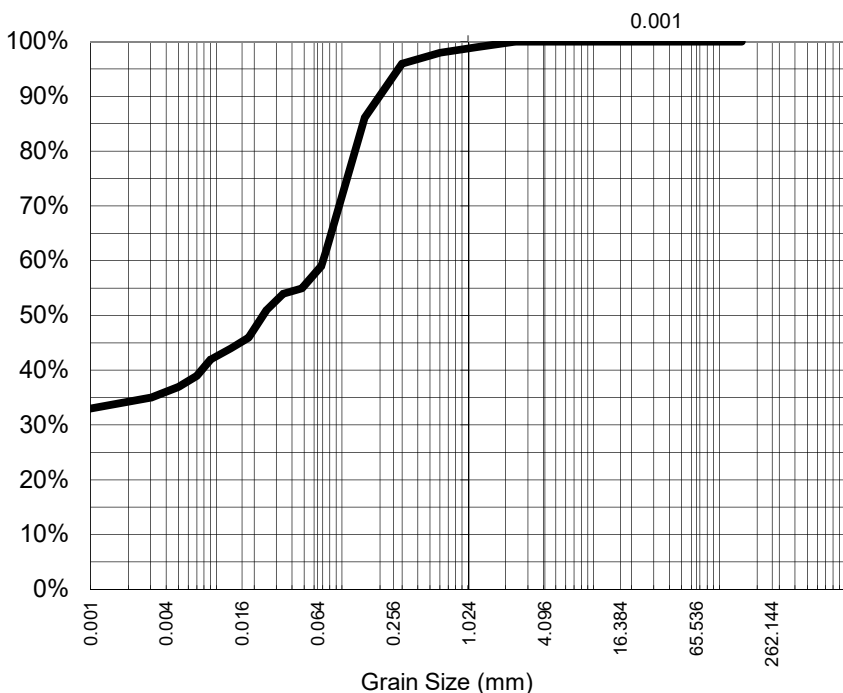
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Daniel Todd **DATE REPORTED:** 10-Jul-2019
COMPANY: AIR SERVICES AUSTRALIA **DATE RECEIVED:** 2-Jul-2019
ADDRESS: Gate 12A Baeckea **REPORT NO:** ES1920563-004 / PSD
Lock Bag 747 Eagle Farm
Brisbane Qld, Australia
PROJECT: 4132561-Mackay Airport Post- **SAMPLE ID:** MW08_2.0
PSI Target Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	96%
0.150	86%
0.075	62%
Particle Size (microns)	
48	55%
34	54%
25	51%
18	46%
13	44%
9	42%
7	39%
5	37%
1	33%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.024
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: SAND, FINES

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) #N/A

Analysed: 9-Jul-19

Limit of Reporting: 1%

Dispersion Method Shaker

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

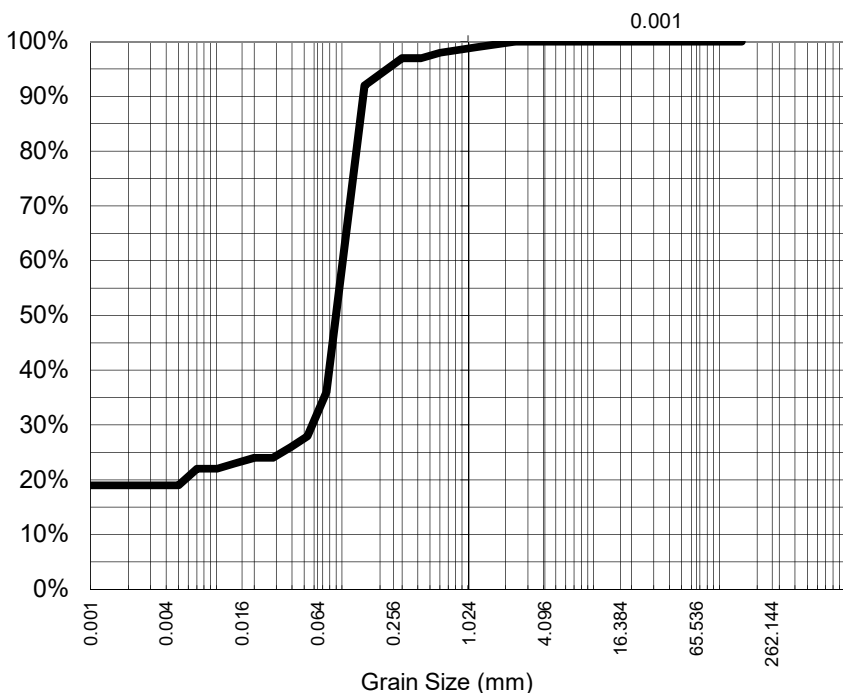
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Daniel Todd **DATE REPORTED:** 10-Jul-2019
COMPANY: AIR SERVICES AUSTRALIA **DATE RECEIVED:** 2-Jul-2019
ADDRESS: Gate 12A Baeckea **REPORT NO:** ES1920563-010 / PSD
Lock Bag 747 Eagle Farm
Brisbane Qld, Australia
PROJECT: 4132561-Mackay Airport Post- **SAMPLE ID:** MW09_2.0
PSI Target Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	97%
0.150	92%
0.075	36%
Particle Size (microns)	
53	28%
39	26%
28	24%
20	24%
14	23%
10	22%
7	22%
5	19%
1	19%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.094
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: SAND, FINES

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) #N/A

Analysed: 9-Jul-19

Limit of Reporting: 1%

Dispersion Method Shaker

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Laboratory Coordinator
Authorised Signatory

QUALITY CONTROL REPORT

Work Order	: ES1920563	Page	: 1 of 7
Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Contact	: Customer Services ES
Address	: GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 4132561-Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 02-Jul-2019
Order number	: 4132561	Date Analysis Commenced	: 04-Jul-2019
C-O-C number	: ----	Issue Date	: 11-Jul-2019
Sampler	: Jackson Skopp		
Site	: ----		
Quote number	: EN/054A/17		
No. of samples received	: 13		
No. of samples analysed	: 5		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Franco Lentini		Sydney Organics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002: pH 1:5 (Soils) (QC Lot: 2445146)									
ES1920245-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.0	6.9	0.00	0% - 20%
ES1920385-002	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.9	5.9	0.00	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 2451373)									
ES1920734-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.7	6.5	3.78	0% - 20%
ES1920293-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.7	6.9	4.12	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 2451989)									
ES1920297-005	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.8	5.6	4.40	0% - 20%
ES1920560-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.8	7.9	1.40	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2447869)									
ES1920385-001	Anonymous	EA055: Moisture Content	----	0.1	%	14.8	15.1	2.02	0% - 50%
ES1920563-013	DUP01_190628	EA055: Moisture Content	----	0.1	%	17.2	16.3	5.39	0% - 20%
EP004: Organic Matter (QC Lot: 2445906)									
ES1920531-003	Anonymous	EP004: Organic Matter	----	0.5	%	11.0	9.1	19.0	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2449553)									
EP1906180-043	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	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP1906180-059	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



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: 2449553) - continued									
EP1906180-059	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2449553)									
EP1906180-043	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
		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
EP1906180-059	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
		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
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2449553)									
EP1906180-043	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
		EP1906180-059	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2449553) - continued									
EP1906180-059	Anonymous	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: 2449553)									
EP1906180-043	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	0.0061	0.0062	0.00	0% - 50%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0018	0.0017	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
EP1906180-059	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



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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			LCS	Low
EP004: Organic Matter (QCLot: 2445906)								
EP004: Organic Matter	----	0.5	%	<0.5	2.53 %	87.0	82	98
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2449553)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.8	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.2	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	60.8	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2449553)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	53.7	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.0	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	53	134
EP231X: Perfluorotridecanoic acid (PFTriDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	67.9	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	66.0	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	73.6	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.5	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	74.0	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	65.2	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	74.0	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	69.6	54	130

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 Work Order : ES1920563
 Client : AIR SERVICES AUSTRALIA
 Project : 4132561-Mackay Airport Post-PSI Target Sampling



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553) - continued								
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	72.4	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	64.8	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	82.4	60	130

Matrix Spike (MS) Report

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

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP004: Organic Matter (QCLot: 2445906)							
ES1920531-003	Anonymous	EP004: Organic Matter	----	6.13 %	113	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	57.6	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	78.0	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	59.2	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	79.2	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	71.2	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	74.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	62.2	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	70.0	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	56.8	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	66.8	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	58.4	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	64.8	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	50.8	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	74.4	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	72.0	50	130
		EP231X: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.00125 mg/kg	38.4	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	34.6	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	72.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	52.4	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	36.4	30	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553) - continued							
EP1906180-043	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	33.0	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	32.7	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	56.0	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	47.2	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	66.8	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# Not Determined	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	105	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	60.8	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1920563	Page	: 1 of 5
Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Telephone	: +61-2-8784 8555
Project	: 4132561-Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 02-Jul-2019
Site	: ----	Issue Date	: 11-Jul-2019
Sampler	: Jackson Skopp	No. of samples received	: 13
Order number	: 4132561	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- 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
Matrix Spike (MS) Recoveries							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP1906180--043	Anonymous	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)							
Soil Glass Jar - Unpreserved							
MW08_2.0,	MW09_2.0	08-Jul-2019	05-Jul-2019	3	----	----	----

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA002: pH 1:5 (Soils)								
Soil Glass Jar - Unpreserved (EA002) MW08_0.5, MW09_0.5	27-Jun-2019	04-Jul-2019	04-Jul-2019	✓	04-Jul-2019	04-Jul-2019	✓	
Soil Glass Jar - Unpreserved (EA002) MW08_2.0, MW09_2.0	28-Jun-2019	08-Jul-2019	05-Jul-2019	✗	08-Jul-2019	08-Jul-2019	✓	
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) MW08_0.5, MW09_0.5	27-Jun-2019	----	----	----	05-Jul-2019	11-Jul-2019	✓	
Soil Glass Jar - Unpreserved (EA055) MW08_2.0, DUP01_190628	28-Jun-2019	----	----	----	05-Jul-2019	12-Jul-2019	✓	
EA150: Particle Sizing								
Snap Lock Bag (EA150H) MW08_2.0, MW09_2.0	28-Jun-2019	----	----	----	10-Jul-2019	25-Dec-2019	✓	



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H) MW08_2.0, MW09_2.0	28-Jun-2019	----	----	----	10-Jul-2019	25-Dec-2019	✓
EP004: Organic Matter							
Soil Glass Jar - Unpreserved (EP004) MW08_0.5, MW09_0.5	27-Jun-2019	05-Jul-2019	25-Jul-2019	✓	05-Jul-2019	25-Jul-2019	✓
Soil Glass Jar - Unpreserved (EP004) MW08_2.0, MW09_2.0	28-Jun-2019	05-Jul-2019	26-Jul-2019	✓	05-Jul-2019	26-Jul-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) MW08_0.5, MW09_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
HDPE Soil Jar (EP231X) MW08_2.0, DUP01_190628	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) MW08_0.5, MW09_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
HDPE Soil Jar (EP231X) MW08_2.0, DUP01_190628	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) MW08_0.5, MW09_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
HDPE Soil Jar (EP231X) MW08_2.0, DUP01_190628	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) MW08_0.5, MW09_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
HDPE Soil Jar (EP231X) MW08_2.0, DUP01_190628	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) MW08_0.5, MW09_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓
HDPE Soil Jar (EP231X) MW08_2.0, DUP01_190628	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-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	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	6	47	12.77	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3).
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
Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)
Sample Extraction for PFAS	EP231-PR	SOIL	In house

Due : 9/07/2019

CHAIN OF CUSTODY

ALS Laboratory please tick →

DANIEL TODD 481 4078 7441 E. glenstone@alslab.com.au
PH: 07 4078 7441 E. glenstone@alslab.com.au
DANIEL TODD 481 4078 7441 E. glenstone@alslab.com.au
PH: 07 4078 7441 E. glenstone@alslab.com.au

PROJECT NO.: 4132561
PURCHASE ORDER NO.: 4132561

PROJECT MANAGER: Daniel Todd

SAMPLER: Jackson Skopp

COC Emailed to ALS? (YES / NO)

Email Reports to (will default to PM if no other addresses are listed): daniel.todd@ghd.com; jackson.skopp@ghd.com

Email Invoice to (will default to PM if no other addresses are listed): daniel.todd@ghd.com; jackson.skopp@ghd.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):

(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)

ALS QUOTE NO.: EN005/18

COUNTRY OF ORIGIN: Australia

CONTACT PH: 073316 3333 or 0400 662 677

SAMPLER MOBILE: 0491 120 596

EDD FORMAT (or default): Esdat

RECEIVED BY: N. Sutton

DATE/TIME: 28/06/19

DATE/TIME: 17/7/19

DATE/TIME: 09/05/19

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? ☒ Yes ☐ No

Freezer frozen ice bricks present upon receipt? ☒ Yes ☐ No

Random Sample Temperature on Receipt: 0.4 °C

Other comment:

RECEIVED BY: N. Sutton

DATE/TIME: 28/06/19

DATE/TIME: 17/7/19

DATE/TIME: 09/05/19

ANALYSIS REQUIRED INCLUDING SUITES (N/A. Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (filtered bottle required).

Particle size Distribution

PH 1:5

Hold

X

X

X

X

X

X

X

X

X

X

X

X

X

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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : ES1920574

Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Contact	: Customer Services ES
Address	: GATE 12A BAECHEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: daniel.todd@ghd.com	E-mail	: ALSEnviro.Sydney@ALSGlobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 4132561-Mackay Airport Post-PSI Target Sampling	Page	: 1 of 3
Order number	: 4132561	Quote number	: ES2017AIRSER0001 (EN/054A/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Jackson Skopp		

Dates

Date Samples Received	: 02-Jul-2019 09:45	Issue Date	: 04-Jul-2019
Client Requested Due Date	: 09-Jul-2019	Scheduled Reporting Date	: 09-Jul-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 3	Temperature	: 0.4°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 14 / 5

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
- **Samples: MW06_4.0 & MW07_5.0 received as an extra samples.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **4/7/19: SRN has been resent to acknowledge that EP231X has been added to MW07_2.0 as per email request from Jackson Skopp on the 4/7/19. For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- "Particle size distribution" analysis to be conducted by ALS Newcastle.
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

- 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 - EA002 pH (1:5)	SOIL - EA055-103 Moisture Content	SOIL - EA150H Particle Size Analysis by Hydrometer: AS1289	SOIL - EP004 Organic Matter in Soil (Walkley Black)	SOIL - EP231X (solids)	PFAS - Full Suite (28 analytes)
ES1920574-001	27-Jun-2019 00:00	MW06_0.2	✓						
ES1920574-002	27-Jun-2019 00:00	MW06_0.5		✓	✓		✓	✓	
ES1920574-003	27-Jun-2019 00:00	MW06_1.0	✓						
ES1920574-004	28-Jun-2019 00:00	MW06_2.0	✓						
ES1920574-005	28-Jun-2019 00:00	MW06_3.0		✓	✓	✓	✓	✓	
ES1920574-006	27-Jun-2019 00:00	MW07_0.1	✓						
ES1920574-007	27-Jun-2019 00:00	MW07_0.5	✓						
ES1920574-008	27-Jun-2019 00:00	MW07_1.0	✓						
ES1920574-009	28-Jun-2019 00:00	MW07_2.0			✓			✓	
ES1920574-010	28-Jun-2019 00:00	MW07_3.0		✓	✓		✓	✓	
ES1920574-011	28-Jun-2019 00:00	MW07_3.5				✓			
ES1920574-012	28-Jun-2019 00:00	MW07_4.0	✓						
ES1920574-013	28-Jun-2019 00:00	MW06_4.0	✓						
ES1920574-014	28-Jun-2019 00:00	MW07_5.0	✓						

Proactive Holding Time Report

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

ACCOUNTS PAYABLE

Email accounts.payable@airservicesaustralia.com

[illegible][illegible]

CERTIFICATE OF ANALYSIS

Work Order : **ES1920574**
Client : **AIR SERVICES AUSTRALIA**
Contact : Daniel Todd
Address : GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM
 BRISBANE QLD, AUSTRALIA 4008
Telephone : ----
Project : 4132561-Mackay Airport Post-PSI Target Sampling
Order number : 4132561
C-O-C number : ----
Sampler : Jackson Skopp
Site : ----
Quote number : EN/054A/17
No. of samples received : 14
No. of samples analysed : 5

Page : 1 of 6
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 02-Jul-2019 09:45
Date Analysis Commenced : 04-Jul-2019
Issue Date : 09-Jul-2019 20:37



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Franco Lentini		Sydney Organics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW06_0.5	MW06_3.0	MW07_2.0	MW07_3.0	MW07_3.5
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920574-002	ES1920574-005	ES1920574-009	ES1920574-010	ES1920574-011
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		8.2	7.4	----	8.3	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		19.5	20.3	17.6	24.6	----
EA150: Particle Sizing									
+75µm	----	1	%		----	83	----	----	12
+150µm	----	1	%		----	73	----	----	8
+300µm	----	1	%		----	56	----	----	5
+425µm	----	1	%		----	46	----	----	3
+600µm	----	1	%		----	30	----	----	2
+1180µm	----	1	%		----	4	----	----	<1
+2.36mm	----	1	%		----	<1	----	----	<1
+4.75mm	----	1	%		----	<1	----	----	<1
+9.5mm	----	1	%		----	<1	----	----	<1
+19.0mm	----	1	%		----	<1	----	----	<1
+37.5mm	----	1	%		----	<1	----	----	<1
+75.0mm	----	1	%		----	<1	----	----	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	11	----	----	43
Silt (2-60 µm)	----	1	%		----	5	----	----	44
Sand (0.06-2.00 mm)	----	1	%		----	82	----	----	13
Gravel (>2mm)	----	1	%		----	2	----	----	<1
Cobbles (>6cm)	----	1	%		----	<1	----	----	<1
EP004: Organic Matter									
Organic Matter	----	0.5	%		0.6	1.0	----	<0.5	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<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	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	<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	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		0.0004	0.0004	<0.0002	<0.0002	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW06_0.5	MW06_3.0	MW07_2.0	MW07_3.0	MW07_3.5
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920574-002	ES1920574-005	ES1920574-009	ES1920574-010	ES1920574-011
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<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	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<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	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<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	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<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	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<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	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<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	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<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	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<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	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<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	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW06_0.5	MW06_3.0	MW07_2.0	MW07_3.0	MW07_3.5
Client sampling date / time					27-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00	28-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920574-002	ES1920574-005	ES1920574-009	ES1920574-010	ES1920574-011
					Result	Result	Result	Result	Result
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	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<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	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		0.0004	0.0004	<0.0002	<0.0002	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		0.0004	0.0004	<0.0002	<0.0002	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		0.0004	0.0004	<0.0002	<0.0002	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		61.5	76.0	60.5	61.0	----
13C8-PFOA	----	0.0002	%		61.5	76.0	66.5	69.5	----

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Work Order : ES1920574
Client : AIR SERVICES AUSTRALIA
Project : 4132561-Mackay Airport Post-PSI Target Sampling



Surrogate Control Limits

Sub-Matrix: **SOIL**

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

Certificate of Analysis

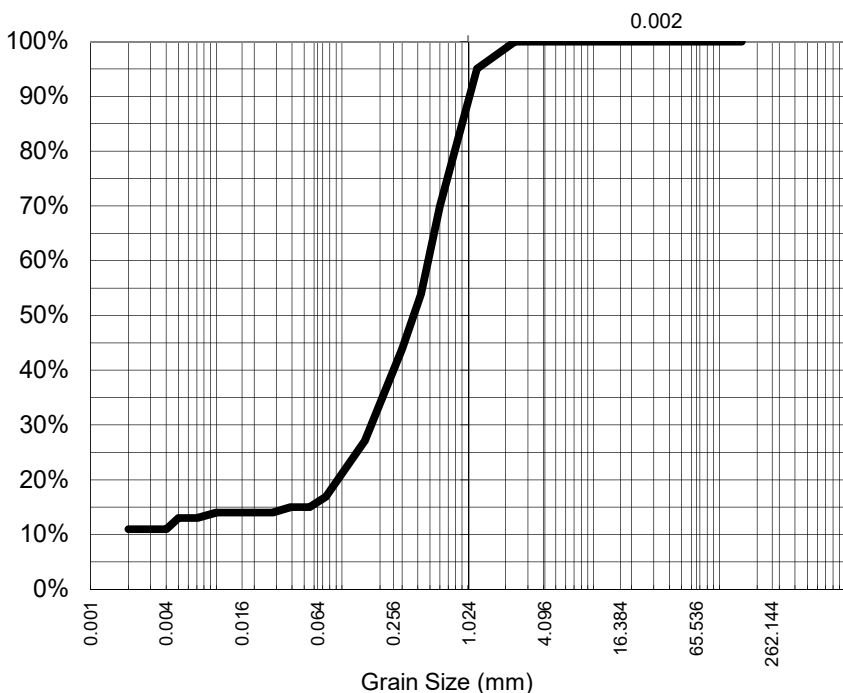
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Daniel Todd **DATE REPORTED:** 9-Jul-2019
COMPANY: AIR SERVICES AUSTRALIA **DATE RECEIVED:** 2-Jul-2019
ADDRESS: Gate 12A Baeckea **REPORT NO:** ES1920574-005 / PSD
Lock Bag 747 Eagle Farm
Brisbane Qld, Australia
PROJECT: 4132561-Mackay Airport Post- **SAMPLE ID:** MW06_3.0
PSI Target Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	95%
0.600	70%
0.425	54%
0.300	44%
0.150	27%
0.075	17%
Particle Size (microns)	
55	15%
39	15%
28	14%
20	14%
14	14%
10	14%
7	13%
5	13%
2	11%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.375
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: SAND, FINES, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) #N/A

Analysed: 5-Jul-19

Limit of Reporting: 1%

Dispersion Method Shaker

NATA Accreditation: 825 Site: Newcastle
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Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

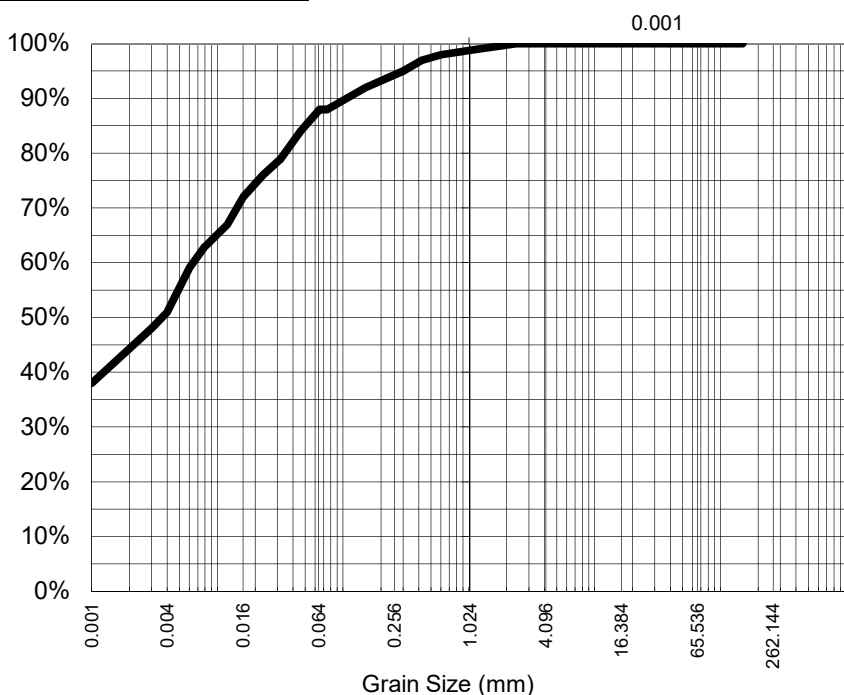
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Daniel Todd **DATE REPORTED:** 9-Jul-2019
COMPANY: AIR SERVICES AUSTRALIA **DATE RECEIVED:** 2-Jul-2019
ADDRESS: Gate 12A Baeckea **REPORT NO:** ES1920574-011 / PSD
Lock Bag 747 Eagle Farm
Brisbane Qld, Australia
PROJECT: 4132561-Mackay Airport Post- **SAMPLE ID:** MW07_3.5
PSI Target Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	95%
0.150	92%
0.075	88%
Particle Size (microns)	
46	84%
32	79%
23	76%
16	72%
12	67%
8	63%
6	59%
4	51%
1	38%

Analysis Notes

Samples analysed as received.

* Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	<0.006
----------------------------	--------

Sample Comments:

Analysed: 5-Jul-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) #N/A

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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QUALITY CONTROL REPORT

Work Order	: ES1920574	Page	: 1 of 7
Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Contact	: Customer Services ES
Address	: GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 4132561-Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 02-Jul-2019
Order number	: 4132561	Date Analysis Commenced	: 04-Jul-2019
C-O-C number	: ----	Issue Date	: 09-Jul-2019
Sampler	: Jackson Skopp		
Site	: ----		
Quote number	: EN/054A/17		
No. of samples received	: 14		
No. of samples analysed	: 5		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Franco Lentini		Sydney Organics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW

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

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 (%)
EA002: pH 1:5 (Soils) (QC Lot: 2445146)									
ES1920245-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.0	6.9	0.00	0% - 20%
ES1920385-002	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.9	5.9	0.00	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 2451373)									
ES1920734-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.7	6.5	3.78	0% - 20%
ES1920293-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.7	6.9	4.12	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2447869)									
ES1920385-001	Anonymous	EA055: Moisture Content	----	0.1	%	14.8	15.1	2.02	0% - 50%
ES1920563-013	Anonymous	EA055: Moisture Content	----	0.1	%	17.2	16.3	5.39	0% - 20%
EP004: Organic Matter (QC Lot: 2445906)									
ES1920531-003	Anonymous	EP004: Organic Matter	----	0.5	%	11.0	9.1	19.0	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2449553)									
EP1906180-043	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	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP1906180-059	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	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2449553)									



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: 2449553) - continued									
EP1906180-043	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
		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
EP1906180-059	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
		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
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2449553)									
EP1906180-043	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
EP1906180-059	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

Page : 4 of 7
 Work Order : ES1920574
 Client : AIR SERVICES AUSTRALIA
 Project : 4132561-Mackay Airport Post-PSI Target Sampling



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2449553) - continued									
EP1906180-059	Anonymous	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: 2449553)									
EP1906180-043	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	0.0061	0.0062	0.00	0% - 50%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0018	0.0017	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
EP1906180-059	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



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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP004: Organic Matter (QCLot: 2445906)								
EP004: Organic Matter	----	0.5	%	<0.5	2.53 %	87.0	82	98
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2449553)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.8	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.2	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	60.8	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2449553)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	53.7	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.0	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	67.9	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	66.0	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	73.6	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.5	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	74.0	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	65.2	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	74.0	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	69.6	54	130



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553) - continued								
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	72.4	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	64.8	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	82.4	60	130

Matrix Spike (MS) Report

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

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP004: Organic Matter (QCLot: 2445906)							
ES1920531-003	Anonymous	EP004: Organic Matter	----	6.13 %	113	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	57.6	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	78.0	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	59.2	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	79.2	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	71.2	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	74.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	62.2	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	70.0	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	56.8	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	66.8	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	58.4	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	64.8	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	50.8	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	74.4	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	72.0	50	130
		EP231X: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.00125 mg/kg	38.4	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	34.6	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	72.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	52.4	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	36.4	30	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2449553) - continued							
EP1906180-043	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	33.0	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	32.7	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	56.0	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	47.2	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2449553)							
EP1906180-043	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	66.8	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# Not Determined	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	105	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	60.8	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1920574	Page	: 1 of 5
Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Telephone	: +61-2-8784 8555
Project	: 4132561-Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 02-Jul-2019
Site	: ----	Issue Date	: 09-Jul-2019
Sampler	: Jackson Skopp	No. of samples received	: 14
Order number	: 4132561	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- 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
Matrix Spike (MS) Recoveries							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP1906180--043	Anonymous	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)							
Soil Glass Jar - Unpreserved MW06_3.0,		MW07_3.0	08-Jul-2019	05-Jul-2019	3	----	----

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)								
Soil Glass Jar - Unpreserved (EA002) MW06_0.5		27-Jun-2019	04-Jul-2019	04-Jul-2019	✔	04-Jul-2019	04-Jul-2019	✔
Soil Glass Jar - Unpreserved (EA002) MW06_3.0,		28-Jun-2019	08-Jul-2019	05-Jul-2019	✖	08-Jul-2019	08-Jul-2019	✔
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) MW06_0.5		27-Jun-2019	----	----	----	05-Jul-2019	11-Jul-2019	✔
Soil Glass Jar - Unpreserved (EA055) MW06_3.0, MW07_3.0		28-Jun-2019	----	----	----	05-Jul-2019	12-Jul-2019	✔
EA150: Particle Sizing								
Snap Lock Bag (EA150H) MW06_3.0,		28-Jun-2019	----	----	----	09-Jul-2019	25-Dec-2019	✔



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) MW06_3.0, MW07_3.5	28-Jun-2019	----	----	----	09-Jul-2019	25-Dec-2019	✓	
EP004: Organic Matter								
Soil Glass Jar - Unpreserved (EP004) MW06_0.5	27-Jun-2019	05-Jul-2019	25-Jul-2019	✓	05-Jul-2019	25-Jul-2019	✓	
Soil Glass Jar - Unpreserved (EP004) MW06_3.0, MW07_3.0	28-Jun-2019	05-Jul-2019	26-Jul-2019	✓	05-Jul-2019	26-Jul-2019	✓	
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X) MW06_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
HDPE Soil Jar (EP231X) MW06_3.0, MW07_3.0, MW07_2.0,	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X) MW06_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
HDPE Soil Jar (EP231X) MW06_3.0, MW07_3.0, MW07_2.0,	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X) MW06_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
HDPE Soil Jar (EP231X) MW06_3.0, MW07_3.0, MW07_2.0,	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X) MW06_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
HDPE Soil Jar (EP231X) MW06_3.0, MW07_3.0, MW07_2.0,	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
EP231P: PFAS Sums								
HDPE Soil Jar (EP231X) MW06_0.5	27-Jun-2019	06-Jul-2019	24-Dec-2019	✓	07-Jul-2019	15-Aug-2019	✓	
HDPE Soil Jar (EP231X) MW06_3.0, MW07_3.0, MW07_2.0,	28-Jun-2019	06-Jul-2019	25-Dec-2019	✓	07-Jul-2019	15-Aug-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	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	4	31	12.90	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organic Matter	EP004	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3).
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
Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)
Sample Extraction for PFAS	EP231-PR	SOIL	In house



Melbourne Laboratory

663949

Sample Receipt Advice

Company name: **GHD Pty Ltd QLD**
Contact name: **Jackson Skopp**
Project name: **MACKAY AIRPORT POST-PSI TARGET SAMPLING**
Project ID: **4132561**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Jul 3, 2019 11:10 AM**
Eurofins | mgt reference: **663949**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 2.6 degrees Celsius.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ryan Gilbert on Phone : or by e.mail: RyanGilbert@eurofins.com

Results will be delivered electronically via e.mail to Jackson Skopp - jackson.skopp@ghd.com.

Company Name: GHD Pty Ltd QLD
Address: 145 Ann Street
Brisbane
QLD 4000

Project Name: MACKAY AIRPORT POST-PSI TARGET SAMPLING
Project ID: 4132561

Order No.: 4132561
Report #: 663949
Phone: 07 3316 3000
Fax: 07 3316 3333

Received: Jul 3, 2019 11:10 AM
Due: Jul 10, 2019
Priority: 5 Day
Contact Name: Jackson Skopp

Eurofins | mgt Analytical Services Manager : Ryan Gilbert

Sample Detail						pH (1:5 Aqueous extract at 25°C as rec.)	Total Organic Carbon	Moisture Set	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X		
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794								X	X
Perth Laboratory - NATA Site # 23736									
External Laboratory									
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID				
1	TRIP01_190628	Jun 28, 2019		Soil	B19-JI04878	X	X	X	X
Test Counts						1	1	1	1

GHD Pty Ltd QLD
145 Ann Street
Brisbane
QLD 4000



NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or
measurements included in this document are traceable
to Australian/national standards.

Attention: Jackson Skopp

Report 663949-S
Project name MACKAY AIRPORT POST-PSI TARGET SAMPLING
Project ID 4132561
Received Date Jul 03, 2019

Client Sample ID			TRIP01_19062
Sample Matrix			Soil
Eurofins mgt Sample No.			B19-JI04878
Date Sampled			Jun 28, 2019
Test/Reference	LOR	Unit	
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	7.5
Total Organic Carbon	0.1	%	0.1
% Moisture	1	%	17
PFASs Summations			
Sum (PFHxS + PFOS)(trace)*	0.1	ug/kg	< 0.1
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)(trace)*	0.1	ug/kg	< 0.1
Sum of PFASs (n=30)(trace)*	0.5	ug/kg	< 0.5
Sum of US EPA PFAS (PFOS + PFOA)(trace)*	0.1	ug/kg	< 0.1
Sum of WA DWER PFAS (n=10)(trace)*	0.5	ug/kg	< 0.5
Perfluoroalkyl sulfonamido substances- Trace			
Perfluorooctane sulfonamide (FOSA)(trace) ^{N11}	0.5	ug/kg	< 0.5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace) ^{N11}	0.5	ug/kg	< 0.5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace) ^{N11}	0.5	ug/kg	< 0.5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace) ^{N11}	0.5	ug/kg	< 0.5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace) ^{N11}	0.5	ug/kg	< 0.5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace) ^{N11}	0.5	ug/kg	< 0.5
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace) ^{N11}	0.5	ug/kg	< 0.5
13C8-FOSA (surr.)	1	%	111
D3-N-MeFOSA (surr.)	1	%	78
D5-N-EtFOSA (surr.)	1	%	90
D7-N-MeFOSE (surr.)	1	%	77
D9-N-EtFOSE (surr.)	1	%	60
D5-N-EtFOSAA (surr.)	1	%	64
D3-N-MeFOSAA (surr.)	1	%	74
Perfluoroalkyl carboxylic acids (PFCAs) - Trace			
Perfluorobutanoic acid (PFBA)(trace) ^{N11}	0.5	ug/kg	< 0.5
Perfluoropentanoic acid (PFPeA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorohexanoic acid (PFHxA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluoroheptanoic acid (PFHpA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorooctanoic acid (PFOA)(trace) ^{N11}	0.1	ug/kg	< 0.1

Client Sample ID			TRIP01_190628
Sample Matrix			Soil
Eurofins mgt Sample No.			B19-JI04878
Date Sampled			Jun 28, 2019
Test/Reference	LOR	Unit	
Perfluoroalkyl carboxylic acids (PFCAs) - Trace			
Perfluorononanoic acid (PFNA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorodecanoic acid (PFDA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorotridecanoic acid (PFTrDA)(trace) ^{N15}	0.1	ug/kg	< 0.1
Perfluoroundecanoic acid (PFUnDA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorododecanoic acid (PFDoDA)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorotetradecanoic acid (PFTeDA)(trace) ^{N11}	0.1	ug/kg	< 0.1
13C4-PFBA (surr.)	1	%	51
13C5-PFPeA (surr.)	1	%	43
13C5-PFHxA (surr.)	1	%	65
13C4-PFHpA (surr.)	1	%	89
13C8-PFOA (surr.)	1	%	91
13C5-PFNA (surr.)	1	%	141
13C6-PFDA (surr.)	1	%	86
13C2-PFUnDA (surr.)	1	%	108
13C2-PFDoDA (surr.)	1	%	102
13C2-PFTeDA (surr.)	1	%	71
Perfluoroalkyl sulfonic acids (PFSA)s- Trace			
Perfluorobutanesulfonic acid (PFBS)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorononanesulfonic acid (PFNS)(trace) ^{N15}	0.1	ug/kg	< 0.1
Perfluoropropanesulfonic acid (PFPrS)(trace) ^{N15}	0.1	ug/kg	< 0.1
Perfluoropentanesulfonic acid (PFPeS)(trace) ^{N15}	0.1	ug/kg	< 0.1
Perfluorohexanesulfonic acid (PFHxS)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluoroheptanesulfonic acid (PFHpS)(trace) ^{N15}	0.1	ug/kg	< 0.1
Perfluorooctanesulfonic acid (PFOS)(trace) ^{N11}	0.1	ug/kg	< 0.1
Perfluorodecanesulfonic acid (PFDS)(trace) ^{N15}	0.1	ug/kg	< 0.1
13C3-PFBS (surr.)	1	%	113
18O2-PFHxS (surr.)	1	%	95
13C8-PFOS (surr.)	1	%	121
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace) ^{N11}	0.1	ug/kg	< 0.1
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace) ^{N11}	0.5	ug/kg	< 0.5
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace) ^{N11}	0.1	ug/kg	< 0.1
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace) ^{N15}	0.1	ug/kg	< 0.1
13C2-4:2 FTSA (surr.)	1	%	56
13C2-6:2 FTSA (surr.)	1	%	78
13C2-8:2 FTSA (surr.)	1	%	67

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
pH (1:5 Aqueous extract at 25°C as rec.) - Method: LTM-GEN-7090 pH in soil by ISE	Melbourne	Jul 05, 2019	7 Days
Total Organic Carbon - Method: LTM-INO-4060 Total Organic Carbon in water and soil	Melbourne	Jul 05, 2019	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Brisbane	Jul 03, 2019	14 Days
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
Perfluoroalkyl sulfonamido substances- Trace - Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)	Brisbane	Jul 03, 2019	180 Days
Perfluoroalkyl carboxylic acids (PFCAs) - Trace - Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)	Brisbane	Jul 03, 2019	180 Days
Perfluoroalkyl sulfonic acids (PFSAs)- Trace - Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)	Brisbane	Jul 03, 2019	180 Days
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace - Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)	Brisbane	Jul 03, 2019	180 Days

Company Name: GHD Pty Ltd QLD
Address: 145 Ann Street
Brisbane
QLD 4000

Project Name: MACKAY AIRPORT POST-PSI TARGET SAMPLING
Project ID: 4132561

Order No.: 4132561
Report #: 663949
Phone: 07 3316 3000
Fax: 07 3316 3333

Received: Jul 3, 2019 11:10 AM
Due: Jul 10, 2019
Priority: 5 Day
Contact Name: Jackson Skopp

Eurofins | mgt Analytical Services Manager : Ryan Gilbert

Sample Detail						pH (1:5 Aqueous extract at 25°C as rec.)	Total Organic Carbon	Moisture Set	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X		
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794								X	X
Perth Laboratory - NATA Site # 23736									
External Laboratory									
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID				
1	TRIP01_190628	Jun 28, 2019		Soil	B19-JI04878	X	X	X	X
Test Counts						1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Organic Carbon	%	< 0.1			0.1	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)(trace)	ug/kg	< 0.5			0.5	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	ug/kg	< 0.5			0.5	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	ug/kg	< 0.5			0.5	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	ug/kg	< 0.5			0.5	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	ug/kg	< 0.5			0.5	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	ug/kg	< 0.5			0.5	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)	ug/kg	< 0.5			0.5	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)(trace)	ug/kg	< 0.5			0.5	Pass	
Perfluoropentanoic acid (PFPeA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorohexanoic acid (PFHxA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorooctanoic acid (PFOA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorononanoic acid (PFNA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorodecanoic acid (PFDA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorotridecanoic acid (PFTTrDA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)	ug/kg	< 0.1			0.1	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSA)s- Trace							
Perfluorobutanesulfonic acid (PFBS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)	ug/kg	< 0.1			0.1	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)	ug/kg	< 0.1			0.1	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	ug/kg	< 0.1			0.1	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	ug/kg	< 0.5			0.5	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	ug/kg	< 0.1			0.1	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	ug/kg	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Organic Carbon	%	99			70-130	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)(trace)	%	106			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	%	129			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	%	110			50-150	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)			%	99			50-150	Pass		
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)			%	102			50-150	Pass		
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)			%	146			50-150	Pass		
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)			%	109			50-150	Pass		
LCS - % Recovery										
Perfluoroalkyl carboxylic acids (PFCAs) - Trace										
Perfluorobutanoic acid (PFBA)(trace)			%	110			50-150	Pass		
Perfluoropentanoic acid (PFPeA)(trace)			%	133			50-150	Pass		
Perfluorohexanoic acid (PFHxA)(trace)			%	116			50-150	Pass		
Perfluoroheptanoic acid (PFHpA)(trace)			%	117			50-150	Pass		
Perfluorooctanoic acid (PFOA)(trace)			%	132			50-150	Pass		
Perfluorononanoic acid (PFNA)(trace)			%	129			50-150	Pass		
Perfluorodecanoic acid (PFDA)(trace)			%	117			50-150	Pass		
Perfluorotridecanoic acid (PFTTrDA)(trace)			%	145			50-150	Pass		
Perfluoroundecanoic acid (PFUnDA)(trace)			%	125			50-150	Pass		
Perfluorododecanoic acid (PFDoDA)(trace)			%	128			50-150	Pass		
Perfluorotetradecanoic acid (PFTeDA)(trace)			%	145			50-150	Pass		
LCS - % Recovery										
Perfluoroalkyl sulfonic acids (PFSAs)- Trace										
Perfluorobutanesulfonic acid (PFBS)(trace)			%	88			50-150	Pass		
Perfluorononanesulfonic acid (PFNS)(trace)			%	109			50-150	Pass		
Perfluoropropanesulfonic acid (PFPrS)(trace)			%	146			50-150	Pass		
Perfluoropentanesulfonic acid (PFPeS)(trace)			%	108			50-150	Pass		
Perfluorohexanesulfonic acid (PFHxS)(trace)			%	123			50-150	Pass		
Perfluoroheptanesulfonic acid (PFHpS)(trace)			%	88			50-150	Pass		
Perfluorooctanesulfonic acid (PFOS)(trace)			%	95			50-150	Pass		
Perfluorodecanesulfonic acid (PFDS)(trace)			%	123			50-150	Pass		
LCS - % Recovery										
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace										
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)			%	109			50-150	Pass		
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)			%	135			50-150	Pass		
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)			%	118			50-150	Pass		
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)			%	80			50-150	Pass		
Test		Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery										
Perfluoroalkyl sulfonamido substances- Trace					Result 1					
Perfluorooctane sulfonamide (FOSA)(trace)		M19-JI05959	NCP	%	108			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)		M19-JI05959	NCP	%	125			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)		M19-JI05959	NCP	%	101			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)		M19-JI05959	NCP	%	85			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)		M19-JI05959	NCP	%	90			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)		M19-JI05959	NCP	%	139			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)		M19-JI05959	NCP	%	106			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1					
Perfluorobutanoic acid (PFBA)(trace)	M19-JI05959	NCP	%	116			50-150	Pass	
Perfluoropentanoic acid (PFPeA)(trace)	M19-JI05959	NCP	%	130			50-150	Pass	
Perfluorohexanoic acid (PFHxA)(trace)	M19-JI05959	NCP	%	111			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)	M19-JI05959	NCP	%	116			50-150	Pass	
Perfluorooctanoic acid (PFOA)(trace)	M19-JI05959	NCP	%	119			50-150	Pass	
Perfluorononanoic acid (PFNA)(trace)	M19-JI05959	NCP	%	124			50-150	Pass	
Perfluorodecanoic acid (PFDA)(trace)	M19-JI05959	NCP	%	120			50-150	Pass	
Perfluorotridecanoic acid (PFTTrDA)(trace)	M19-JI05959	NCP	%	142			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)	M19-JI05959	NCP	%	123			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)	M19-JI05959	NCP	%	130			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)	M19-JI05959	NCP	%	136			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)(trace)	M19-JI05959	NCP	%	84			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)	M19-JI05959	NCP	%	133			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)	M19-JI05959	NCP	%	121			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)	M19-JI05959	NCP	%	105			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)	M19-JI05959	NCP	%	116			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)	M19-JI05959	NCP	%	112			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)	M19-JI05959	NCP	%	106			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)	M19-JI05959	NCP	%	118			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	M19-JI05959	NCP	%	114			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	M19-JI05959	NCP	%	123			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	M19-JI05959	NCP	%	99			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	M19-JI05959	NCP	%	98			50-150	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
pH (1:5 Aqueous extract at 25°C as rec.)	S19-JI03775	NCP	pH Units	7.2	7.3	pass	30%	Pass	
Total Organic Carbon	M19-JI05004	NCP	%	0.7	0.7	<1	30%	Pass	
% Moisture	B19-JI03100	NCP	%	4.4	4.5	3.0	30%	Pass	

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
Perfluorooctane sulfonamide (FOSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
Duplicate								
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorooctanoic acid (PFOA)(trace)	B19-JI07759	NCP	ug/kg	0.2	0.2	14	30%	Pass
Perfluorononanoic acid (PFNA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorodecanoic acid (PFDA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorotridecanoic acid (PFTTrDA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Perfluoroalkyl sulfonic acids (PFSA)s- Trace				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorononanesulfonic acid (PFNS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluoropropanesulfonic acid (PFPrS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
Perfluorooctanesulfonic acid (PFOS)(trace)	B19-JI07759	NCP	ug/kg	2.2	2.9	26	30%	Pass
Perfluorodecanesulfonic acid (PFDS)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass

Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.5	< 0.5	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	B19-JI07759	NCP	ug/kg	< 0.1	< 0.1	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

Authorised By

Ryan Gilbert	Analytical Services Manager
Bryan Wilson	Senior Analyst-PFAS (QLD)
Julie Kay	Senior Analyst-Inorganic (VIC)



Glenn Jackson

General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 311 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comDRAKEBANK 2700 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comADELAIDE 311 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
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Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
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Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.comMACKAY 1818 Byma Road, Pterodactyls 51, 5105
Ph: 08 8182 5105 E: ade@ade@adelaide.com

CLIENT: Air Services Australia

OFFICE: Mackay, Queensland

PROJECT: Mackay Airport Post-PSI Target Sampling

PROJECT NO.: 4132561

ORDER NUMBER: 4132561

PURCHASE ORDER NO.: 4132561

PROJECT MANAGER: Daniel Todd

CONTACT PH: 073316 3333 or 0400 862 877

SAMPLER: Jackson Skopp

SAMPLER MOBILE: 0491 120 596

COC Emailed to ALS? (YES / NO)

EDD FORMAT (or default): Esdat

Email Reports to (will default to PM if no other addresses are listed): daniel.todd@ghd.com; jackson.skopp@ghd.com

Email Invoice to (will default to PM if no other addresses are listed): daniel.todd@ghd.com; jackson.skopp@ghd.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:

(Standard TAT may be longer for some tests
e.g., Ultra Trace Organics)

ALS QUOTE NO.: EN/005/18

COUNTRY OF ORIGIN: Australia

Standard TAT (List due date):

Non Standard or urgent TAT (List due date):

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

RELINQUISHED BY:

J. Skopp

DATE/TIME:

03/7/19 1545

RECEIVED BY:

N. Sutton

DATE/TIME:

3/7/19 3:45pm

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comment:

RELINQUISHED BY:

N. Sutton

DATE/TIME:

3/7/19 4:00pm

RECEIVED BY:

J. Skopp

DATE/TIME:

8:30am 4/7

ALS USE ONLY

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

Comments on likely contaminant levels,
dilutions, or samples requiring specific QC
analysis etc.

LAB ID

SAMPLE ID

DATE / TIME

MATRIX

TYPE & PRESERVATIVE
(refer to codes below)TOTAL
BOTTLESPFAS low level full 2g suite
including linear and branched
chainNT-1 & NT-2 Major anions and
cations

Total Organic Carbon (TOC)

1

GMW2_190702

2/07/2019 0:00

W

P

2

X

X

X

2

GMW3_190702

2/07/2019 0:00

W

P

2

X

X

X

3

GMW6_190702

2/07/2019 0:00

W

P

2

X

X

X

4

MW02_190702

2/07/2019 0:00

W

P

2

X

X

X

5

MW03_190703

3/07/2019 0:00

W

P

2

X

X

X

6

MW06_190703

3/07/2019 0:00

W

P

2

X

X

X

7

MW07_190702

2/07/2019 0:00

W

P

2

X

X

X

8

MW08_190702

2/07/2019 0:00

W

P

2

X

X

X

9

MW09_190702

2/07/2019 0:00

W

P

2

X

X

X

10

EW01_190703

3/07/2019 0:00

W

P

2

X

X

X

11

QA01_190702

3/07/2019 0:00

W

P

2

X

X

X

12

SW04_190703

3/07/2019 0:00

W

P

2

X

X

TOTAL 24

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; 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; LI = Lugals Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Environmental Division
Brisbane

Work Order Reference

EB1917295



Telephone: + 61-7-3243 7222

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EB1917295

Client : GHD PTY LTD Contact : MR DANIEL TODD Address : LEVEL 1/21 WOOD STREET MACKAY QLD, AUSTRALIA 4740 E-mail : Daniel.Todd@ghd.com Telephone : +61 08 6222 8222 Facsimile : +61 08 9429 6555 Project : 4132561 Mackay Airport Post-PSI Target Sampling Order number : 4132561 C-O-C number : ---- Site : Sampler : JACKSON SKOPP	Laboratory : Environmental Division Brisbane Contact : Andrew Epps Address : 2 Byth Street Stafford QLD Australia 4053 E-mail : andrew.epps@alsglobal.com Telephone : +61 7 3552 8639 Facsimile : +61-7-3243 7218 Page : 1 of 3 Quote number : ES2018GHDSE0025 (EN/005/18) QC Level : NEPM 2013 B3 & ALS QC Standard
---	---

Dates

Date Samples Received : 04-Jul-2019 08:30	Issue Date : 04-Jul-2019
Client Requested Due Date : 11-Jul-2019	Scheduled Reporting Date : 11-Jul-2019

Delivery Details

Mode of Delivery : Carrier	Security Seal : Intact.
No. of coolers/boxes : 1	Temperature : 3.5°C - Ice present
Receipt Detail : MEDIUM ESKY	No. of samples received / analysed : 12 / 12

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
- **Samples were originally received by ALS Mackay on 03/07/19, and forwarded to ALS Brisbane for analysis.**
- **Please be advised that Sample "QA02_190702" will be forwarded to Eurofins as requested.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Total Organic Carbon : EP005		
GMW2_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
GMW3_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
GMW6_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW02_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW03_190703	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW06_190703	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW07_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW08_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
MW09_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
EW01_190703	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
QA01_190702	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid

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: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EP005 Total Organic Carbon (TOC)	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO ₄ , Alkalinity
EB1917295-001	02-Jul-2019 00:00	GMW2_190702	✓	✓	✓
EB1917295-002	02-Jul-2019 00:00	GMW3_190702	✓	✓	✓
EB1917295-003	02-Jul-2019 00:00	GMW6_190702	✓	✓	✓
EB1917295-004	02-Jul-2019 00:00	MW02_190702	✓	✓	✓
EB1917295-005	03-Jul-2019 00:00	MW03_190703	✓	✓	✓
EB1917295-006	03-Jul-2019 00:00	MW06_190703	✓	✓	✓
EB1917295-007	02-Jul-2019 00:00	MW07_190702	✓	✓	✓
EB1917295-008	02-Jul-2019 00:00	MW08_190702	✓	✓	✓
EB1917295-009	02-Jul-2019 00:00	MW09_190702	✓	✓	✓
EB1917295-010	03-Jul-2019 00:00	EW01_190703	✓	✓	✓
EB1917295-011	03-Jul-2019 00:00	QA01_190702	✓	✓	✓
EB1917295-012	03-Jul-2019 00:00	SW04_190703		✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

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

Method		Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
Client Sample ID(s)		Container					
EP005: Total Organic Carbon							
GMW2_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
GMW3_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
GMW6_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
MW02_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
MW07_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
MW08_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----
MW09_190702	Clear Plastic Bottle - Natural	----	03-Jul-2019	04-Jul-2019	✗	----	----

CERTIFICATE OF ANALYSIS

Work Order : **EB1917295**
Client : **GHD PTY LTD**
Contact : **MR DANIEL TODD**
Address : **LEVEL 1/21 WOOD STREET**
MACKAY QLD, AUSTRALIA 4740
Telephone : **+61 08 6222 8222**
Project : **4132561 Mackay Airport Post-PSI Target Sampling**
Order number : **4132561**
C-O-C number : **----**
Sampler : **JACKSON SKOPP**
Site :
Quote number : **EN/005/18**
No. of samples received : **12**
No. of samples analysed : **12**

Page : 1 of 12
Laboratory : Environmental Division Brisbane
Contact : Andrew Epps
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61 7 3552 8639
Date Samples Received : 04-Jul-2019 08:30
Date Analysis Commenced : 04-Jul-2019
Issue Date : 11-Jul-2019 10:35



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
Santusha Pandra	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-LL: Samples were diluted due to matrix interference. LOR adjusted accordingly.
- EP231X-LL: Matrix spike shows results out of control limit due to primary sample matrix interference.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW2_190702	GMW3_190702	GMW6_190702	MW02_190702	MW03_190703
Client sampling date / time					02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EB1917295-001	EB1917295-002	EB1917295-003	EB1917295-004	EB1917295-005
					Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		<1	243	48	278	510
Total Alkalinity as CaCO3	----	1	mg/L		<1	243	48	278	510
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		2730	415	5	32	37
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		7630	217	39	258	185
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		448	9	3	36	42
Magnesium	7439-95-4	1	mg/L		748	14	5	25	21
Sodium	7440-23-5	1	mg/L		4270	402	40	218	281
Potassium	7440-09-7	1	mg/L		86	7	<1	1	3
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		272	19.6	2.16	13.5	16.2
∅ Total Cations	----	0.01	meq/L		272	19.3	2.30	13.4	16.1
∅ Ionic Balance	----	0.01	%		0.04	0.90	----	0.51	0.17
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		4	1	<1	<1	<1
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		0.034	1.37	6.42	0.019	2.73
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		0.028	1.62	7.28	0.030	2.18
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		0.182	13.6	75.8	0.324	8.02
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		0.002	0.709	6.62	0.005	0.163
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		0.012	33.3	170	0.054	0.652
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.02	0.52	1.41	<0.01	12.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW2_190702	GMW3_190702	GMW6_190702	MW02_190702	MW03_190703
Client sampling date / time					02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EB1917295-001	EB1917295-002	EB1917295-003	EB1917295-004	EB1917295-005
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		0.004	0.971	2.50	<0.002	23.5
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		0.009	2.89	12.7	<0.002	11.8
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		0.002	0.448	1.53	<0.002	12.5
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		0.002	0.663	4.22	<0.002	6.12
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	0.016	0.348	<0.002	0.246
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	0.024
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	<0.025	<0.025	<0.005	<0.025
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	0.024	<0.010	<0.002	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	<0.025	<0.025	<0.005	<0.025
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	<0.025	<0.025	<0.005	<0.025
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	<0.025	<0.025	<0.005	<0.025
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	<0.025	<0.025	<0.005	<0.025
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	<0.010	<0.010	<0.002	<0.010
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.005	<0.010	<0.010	<0.005	<0.010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	0.672	<0.010	<0.005	1.02



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GMW2_190702	GMW3_190702	GMW6_190702	MW02_190702	MW03_190703
Client sampling date / time					02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EB1917295-001	EB1917295-002	EB1917295-003	EB1917295-004	EB1917295-005
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	0.162	<0.010	<0.005	<0.010
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.010	<0.010	<0.005	<0.010
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		0.275	57.0	289	0.432	81.8
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		0.194	46.9	246	0.378	8.67
Sum of PFAS (WA DER List)	----	0.002	µg/L		0.245	54.6	274	0.397	79.2
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		86.4	82.6	112	98.8	87.0
13C8-PFOA	----	0.002	%		80.2	99.8	129	80.2	117



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				MW06_190703	MW07_190702	MW08_190702	MW09_190702	EW01_190703
Client sampling date / time				03-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit	EB1917295-006	EB1917295-007	EB1917295-008	EB1917295-009	EB1917295-010
				Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	210	96	3	<1	290
Total Alkalinity as CaCO3	----	1	mg/L	210	96	3	<1	290
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2140	1520	1210	3860	133
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	13900	8620	1230	1240	1220
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	421	246	162	559	26
Magnesium	7439-95-4	1	mg/L	1000	549	125	361	65
Sodium	7440-23-5	1	mg/L	8310	5210	975	1280	836
Potassium	7440-09-7	1	mg/L	281	143	23	16	28
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	441	277	59.9	115	43.0
∅ Total Cations	----	0.01	meq/L	472	288	61.4	114	43.7
∅ Ionic Balance	----	0.01	%	3.41	1.95	1.17	0.72	0.86
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	3	2	5	10	<1
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.010	0.186	0.007	1.18	1.51
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.012	0.053	0.004	0.925	1.41
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.146	0.017	0.012	3.67	9.81
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.005	<0.002	<0.002	0.040	0.559
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.225	<0.002	0.002	1.40	4.72
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	<0.01	0.09	0.27



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				MW06_190703	MW07_190702	MW08_190702	MW09_190702	EW01_190703
Client sampling date / time				03-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit	EB1917295-006	EB1917295-007	EB1917295-008	EB1917295-009	EB1917295-010
				Result	Result	Result	Result	Result

EP231B: Perfluoroalkyl Carboxylic Acids - Continued

Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.005	<0.002	<0.002	0.099	0.443
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.015	<0.002	<0.002	0.677	2.18
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.003	<0.002	<0.002	0.046	0.245
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.006	<0.002	<0.002	0.045	0.453
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	0.012
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.025	<0.025

EP231C: Perfluoroalkyl Sulfonamides

Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	<0.025	<0.025
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.025	<0.025
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.025	<0.025
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.025	<0.025
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.010	<0.010

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	<0.010	<0.010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.010	<0.010



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW06_190703	MW07_190702	MW08_190702	MW09_190702	EW01_190703
Client sampling date / time					03-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	02-Jul-2019 00:00	03-Jul-2019 00:00
Compound	CAS Number	LOR	Unit		EB1917295-006	EB1917295-007	EB1917295-008	EB1917295-009	EB1917295-010
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	<0.005	<0.010	<0.010
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	<0.005	<0.010	<0.010
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		0.427	0.256	0.025	8.17	21.6
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		0.371	0.017	0.014	5.07	14.5
Sum of PFAS (WA DER List)	----	0.002	µg/L		0.410	0.203	0.021	7.21	19.6
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		93.3	98.4	96.2	89.5	90.8
13C8-PFOA	----	0.002	%		90.1	84.4	81.5	124	120



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QA01_190702	SW04_190703	----	----	----
Client sampling date / time					03-Jul-2019 00:00	03-Jul-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB1917295-011	EB1917295-012	-----	-----	-----
				Result	Result		----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1		----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1		----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	282	62		----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	282	62		----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	32	3010		----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	264	18200		----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	37	536		----	----	----
Magnesium	7439-95-4	1	mg/L	24	1340		----	----	----
Sodium	7440-23-5	1	mg/L	218	10800		----	----	----
Potassium	7440-09-7	1	mg/L	1	381		----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	13.7	577		----	----	----
∅ Total Cations	----	0.01	meq/L	13.3	616		----	----	----
∅ Ionic Balance	----	0.01	%	1.54	3.29		----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	<1	----		----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.018	0.013		----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.032	0.011		----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.322	0.070		----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.005	<0.002		----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.055	0.022		----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002		----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.02		----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				QA01_190702	SW04_190703	----	----	----
Client sampling date / time				03-Jul-2019 00:00	03-Jul-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1917295-011	EB1917295-012	-----	-----	-----
				Result	Result	----	----	----

EP231B: Perfluoroalkyl Carboxylic Acids - Continued

Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.005	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.016	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.002	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.003	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	----	----	----

EP231C: Perfluoroalkyl Sulfonamides

Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<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	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QA01_190702	SW04_190703	----	----	----
Client sampling date / time					03-Jul-2019 00:00	03-Jul-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB1917295-011	EB1917295-012	-----	-----	-----
				Result	Result		----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		0.432	0.142	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		0.377	0.092	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		0.395	0.131	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		99.9	72.4	----	----	----
13C8-PFOA	----	0.002	%		76.4	71.0	----	----	----



Surrogate Control Limits

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 : **EB1917295**

Page : 1 of 10

Client : **GHD PTY LTD**

Contact : **MR DANIEL TODD**

Address : **LEVEL 1/21 WOOD STREET
MACKAY QLD, AUSTRALIA 4740**

Telephone : **+61 08 6222 8222**

Project : **4132561 Mackay Airport Post-PSI Target Sampling**

Order number : **4132561**

C-O-C number : **----**

Sampler : **JACKSON SKOPP**

Site :

Quote number : **EN/005/18**

No. of samples received : **12**

No. of samples analysed : **12**

Laboratory : **Environmental Division Brisbane**

Contact : **Andrew Epps**

Address : **2 Byth Street Stafford QLD Australia 4053**

Telephone : **+61 7 3552 8639**

Date Samples Received : **04-Jul-2019**

Date Analysis Commenced : **04-Jul-2019**

Issue Date : **11-Jul-2019**



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
Santusha Pandra	Organic Chemist	Brisbane Organics, Stafford, QLD

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

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 (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 2447691)									
EB1916232-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	228	228	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	245	244	0.503	0% - 20%
EB1916235-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	236	235	0.489	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	236	235	0.489	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2447692)									
EB1917295-002	GMW3_190702	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	243	245	0.780	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	243	245	0.780	0% - 20%
EB1917295-012	SW04_190703	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	62	62	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	62	62	0.00	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2446095)									
EB1917295-009	MW09_190702	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3860	3890	0.973	0% - 20%
EB1917213-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	348	354	1.67	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2446097)									
EB1917295-009	MW09_190702	ED045G: Chloride	16887-00-6	1	mg/L	1240	1260	1.93	0% - 20%
EB1917213-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	125	125	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2447180)									



Sub-Matrix: **WATER**

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 (%)
ED093F: Dissolved Major Cations (QC Lot: 2447180) - continued									
EB1917034-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	160	170	6.13	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	14	14	0.00	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	30	32	4.14	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.00	No Limit
EB1916752-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	63	63	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	38	39	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	133	133	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.00	No Limit
ED093F: Dissolved Major Cations (QC Lot: 2447181)									
EB1917295-008	MW08_190702	ED093F: Calcium	7440-70-2	1	mg/L	162	163	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	125	125	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	975	965	1.09	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	23	23	0.00	0% - 20%
ET1902049-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	117	119	1.10	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	168	170	0.792	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	441	454	2.84	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	1	1	0.00	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 2447355)									
EB1917295-001	GMW2_190702	EP005: Total Organic Carbon	----	1	mg/L	4	5	0.00	No Limit
EB1917295-010	EW01_190703	EP005: Total Organic Carbon	----	1	mg/L	<1	<1	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2446137)									
EB1916936-028	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EB1917295-006	MW06_190703	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.010	0.008	18.2	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.012	0.012	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.146	0.147	0.888	0% - 20%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.005	0.006	0.00	No Limit



Sub-Matrix: **WATER**

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: 2446137) - continued									
EB1917295-006	MW06_190703	EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.225	0.258	13.4	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: 2446137)									
EB1916936-028	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
EB1917295-006	MW06_190703	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.005	0.006	19.8	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.015	0.016	6.58	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.003	0.004	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.006	0.005	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
EB1916936-028	Anonymous	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: 2446137)									
EB1916936-028	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



Sub-Matrix: **WATER**

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: 2446137) - continued									
EB1916936-028	Anonymous	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
EB1917295-006	MW06_190703	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: 2446137)							
EB1916936-028	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
EB1917295-006	MW06_190703	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: 2446137)									
EB1916936-028	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EB1917295-006	MW06_190703	EP231X-LL: Sum of PFAS	----	0.002	µg/L	0.427	0.462	7.87	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 (%)
EP231P: PFAS Sums (QC Lot: 2446137) - continued									
EB1917295-006	MW06_190703	EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	0.371	0.405	8.76	0% - 20%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	0.410	0.444	7.96	0% - 20%



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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
ED037P: Alkalinity by PC Titrator (QCLot: 2447691)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	99.1	80	120
ED037P: Alkalinity by PC Titrator (QCLot: 2447692)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	99.2	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2446095)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	85	118
				<1	100 mg/L	102	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 2446097)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	90.1	90	115
				<1	1000 mg/L	102	90	115
ED093F: Dissolved Major Cations (QCLot: 2447180)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations (QCLot: 2447181)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EP005: Total Organic Carbon (TOC) (QCLot: 2447355)								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	87.8	79	113
				<1	100 mg/L	91.6	79	113
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2446137)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	88.0	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	87.8	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	87.3	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	85.9	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	77.8	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	66.0	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2446137)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	79.3	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	87.0	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	88.4	50	130



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2446137) - continued								
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	91.0	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	86.2	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	80.4	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	78.2	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	72.8	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	67.2	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	95.6	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	79.7	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2446137)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	70.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	64.8	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	64.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	64.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	62.9	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	68.6	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	58.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2446137)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	98.5	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	103	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	94.2	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	60.2	50	130
EP231P: PFAS Sums (QCLot: 2446137)								
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: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High



Sub-Matrix: **WATER**

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
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2446095)							
EB1917213-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2446097)							
EB1917213-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	102	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 2447355)							
EB1917295-002	GMW3_190702	EP005: Total Organic Carbon	----	100 mg/L	100	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2446137)							
EB1917132-001	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	74.2	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	82.2	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	77.4	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	80.6	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	72.2	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	54.8	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2446137)							
EB1917132-001	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	79.7	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	80.4	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	78.0	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	85.8	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	60.0	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	82.4	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	74.2	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	62.8	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	60.0	40	130
		EP231X-LL: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.05 µg/L	89.8	40	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	83.9	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2446137)							
EB1917132-001	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	62.8	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	58.6	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	56.6	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	57.8	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	53.8	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	51.8	50	130

Page : 10 of 10
 Work Order : EB1917295
 Client : GHD PTY LTD
 Project : 4132561 Mackay Airport Post-PSI Target Sampling



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: 2446137) - continued							
EB1917132-001	Anonymous	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	52.8	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2446137)							
EB1917132-001	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	86.2	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	90.2	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	87.6	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	# 48.0	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1917295	Page	: 1 of 7
Client	: GHD PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR DANIEL TODD	Telephone	: +61 7 3552 8639
Project	: 4132561 Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 04-Jul-2019
Site	:	Issue Date	: 11-Jul-2019
Sampler	: JACKSON SKOPP	No. of samples received	: 12
Order number	: 4132561	No. of samples analysed	: 12

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- 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: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EB1917213--002	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1917132--001	Anonymous	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	48.0 %	50-130%	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP005: Total Organic Carbon (TOC)							
Clear Plastic Bottle - Natural							
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	----	----	----	05-Jul-2019	03-Jul-2019	2
Clear Plastic Bottle - Natural							
MW03_190703, EW01_190703,	MW06_190703, QA01_190702	----	----	----	05-Jul-2019	04-Jul-2019	1

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



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	----	----	----	05-Jul-2019	16-Jul-2019	✓
Clear Plastic Bottle - Natural (ED037-P)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	----	----	----	05-Jul-2019	17-Jul-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	----	----	----	04-Jul-2019	30-Jul-2019	✓
Clear Plastic Bottle - Natural (ED041G)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	----	----	----	04-Jul-2019	31-Jul-2019	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	----	----	----	04-Jul-2019	30-Jul-2019	✓
Clear Plastic Bottle - Natural (ED045G)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	----	----	----	04-Jul-2019	31-Jul-2019	✓
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural (ED093F)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	----	----	----	08-Jul-2019	09-Jul-2019	✓
Clear Plastic Bottle - Natural (ED093F)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	----	----	----	08-Jul-2019	10-Jul-2019	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP005: Total Organic Carbon (TOC)								
Clear Plastic Bottle - Natural (EP005)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	----	----	----	05-Jul-2019	03-Jul-2019	✖
Clear Plastic Bottle - Natural (EP005)								
MW03_190703, EW01_190703,	MW06_190703, QA01_190702	03-Jul-2019	----	----	----	05-Jul-2019	04-Jul-2019	✖
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	04-Jul-2019	29-Dec-2019	✔	04-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	04-Jul-2019	30-Dec-2019	✔	04-Jul-2019	30-Dec-2019	✔
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-LL)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	04-Jul-2019	29-Dec-2019	✔	04-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	04-Jul-2019	30-Dec-2019	✔	04-Jul-2019	30-Dec-2019	✔
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-LL)								
GMW2_190702, GMW6_190702, MW07_190702, MW09_190702	GMW3_190702, MW02_190702, MW08_190702,	02-Jul-2019	04-Jul-2019	29-Dec-2019	✔	04-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL)								
MW03_190703, EW01_190703, SW04_190703	MW06_190703, QA01_190702,	03-Jul-2019	04-Jul-2019	30-Dec-2019	✔	04-Jul-2019	30-Dec-2019	✔



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL) GMW2_190702, GMW6_190702, MW07_190702, MW09_190702 GMW3_190702, MW02_190702, MW08_190702	02-Jul-2019	04-Jul-2019	29-Dec-2019	✔	04-Jul-2019	29-Dec-2019	✔	
HDPE (no PTFE) (EP231X-LL) MW03_190703, EW01_190703, SW04_190703 MW06_190703, QA01_190702	03-Jul-2019	04-Jul-2019	30-Dec-2019	✔	04-Jul-2019	30-Dec-2019	✔	
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-LL) GMW2_190702, GMW6_190702, MW07_190702, MW09_190702 GMW3_190702, MW02_190702, MW08_190702	02-Jul-2019	04-Jul-2019	29-Dec-2019	✔	04-Jul-2019	29-Dec-2019	✔	
HDPE (no PTFE) (EP231X-LL) MW03_190703, EW01_190703, SW04_190703 MW06_190703, QA01_190702	03-Jul-2019	04-Jul-2019	30-Dec-2019	✔	04-Jul-2019	30-Dec-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: **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)							
Alkalinity by PC Titrator	ED037-P	4	39	10.26	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	39	10.26	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	39	5.13	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	39	5.13	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	11	9.09	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
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO ₄ DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS)	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house



CHAIN OF CUSTODY RECORD



Sydney Laboratory
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Brisbane Laboratory
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(08) 9251 9000 EnviroSamples(PH)@eurofins.com

Melbourne Laboratory
2 Kippax Town Close, Oakleigh VIC 3166
(03) 8564 5200 EnviroSamples(ME)@eurofins.com

Company		GHD Limited		Project No		4132561		Project Manager		Daniel Todd 0400662677/0733163333	
Address		Level 9 145 Ann Street, Brisbane 4000		Project Name		Mackay Airport Post-PSI Target Sampling		Report Format		Excel	
Contact Name		Jackson Skopp		Analyte		PFAS low level full 28 suite including linear and branched chain		Relinquished by		Email For Results jackson.skopp@ghd.com; daniel.todd@ghd.com	
Phone No		491120596		Matrix		W		Containers		Turn Around Requirements	
Special Direction				Date		2/07/2019		125mL Plastic		Overnight (Sat)* ☐ 1 Day* ☐ 2 Day* ☐ 3 Day* ☒ 5 Day* ☐ Other ()	
Purchase Order		4132561		Client Sample ID		QA02_190702		125mL Plastic		Sample Comments / DG Hazardous Wasting	
Quote ID No				Date		2/07/2019		200mL Amber Glass			
No				Date				125mL Plastic			
1				Date				125mL Plastic			
2				Date				125mL Plastic			
3				Date				125mL Plastic			
4				Date				125mL Plastic			
5				Date				125mL Plastic			
6				Date				125mL Plastic			
7				Date				125mL Plastic			
8				Date				125mL Plastic			
9				Date				125mL Plastic			
10				Date				125mL Plastic			
Total Counts		2		Hand Delivered		2		Date		Time	
Method of Shipment		Courier (#)		Post		Name		Signature		Date	
Laboratory Use Only		Received By		Signature		Date		Signature		Date	
		Received By		Signature		Date		Signature		Date	

When a sample is prepared for an analysis, it will be checked for accuracy of analysis using appropriate tests and equipment. A copy of the results will be provided to the client within 10 working days of receipt.

664834

Sample Receipt Advice

Company name: **GHD Pty Ltd QLD**
Contact name: **Jackson Skopp**
Project name: **MACKAY AIRPORT POST-PSI TARGET SAMPLING**
Project ID: **4132561**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Jul 5, 2019 11:00 AM**
Eurofins | mgt reference: **664834**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 5 degrees Celsius.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☒ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ryan Gilbert on Phone : or by e.mail: RyanGilbert@eurofins.com

Results will be delivered electronically via e.mail to Jackson Skopp - jackson.skopp@ghd.com.

Company Name: GHD Pty Ltd QLD
Address: 145 Ann Street
Brisbane
QLD 4000

Project Name: MACKAY AIRPORT POST-PSI TARGET SAMPLING
Project ID: 4132561

Order No.:
Report #: 664834
Phone: 07 3316 3000
Fax: 07 3316 3333

Received: Jul 5, 2019 11:00 AM
Due: Jul 12, 2019
Priority: 5 Day
Contact Name: Jackson Skopp

Eurofins | mgt Analytical Services Manager : Ryan Gilbert

Sample Detail						Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						X
Perth Laboratory - NATA Site # 23736						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	QA02_190702	Not Provided		Water	B19-JI11870	X
Test Counts						1

GHD Pty Ltd QLD
145 Ann Street
Brisbane
QLD 4000



NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or
measurements included in this document are traceable
to Australian/national standards.

Attention: Jackson Skopp

Report 664834-W
Project name MACKAY AIRPORT POST-PSI TARGET SAMPLING
Project ID 4132561
Received Date Jul 05, 2019

Client Sample ID			QA02_190702
Sample Matrix			Water
Eurofins mgt Sample No.			B19-JI11870
Date Sampled			Not Provided
Test/Reference	LOR	Unit	
PFASs Summations			
Sum (PFHxS + PFOS)(trace)*	0.001	ug/L	0.465
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)(trace)*	0.001	ug/L	0.465
Sum of PFASs (n=30)(trace)*	0.005	ug/L	0.533
Sum of US EPA PFAS (PFOS + PFOA)(trace)*	0.001	ug/L	0.075
Sum of WA DWER PFAS (n=10)(trace)*	0.005	ug/L	0.485
Perfluoroalkyl sulfonamido substances- Trace			
Perfluorooctane sulfonamide (FOSA)(trace) ^{N11}	0.005	ug/L	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace) ^{N11}	0.005	ug/L	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace) ^{N11}	0.005	ug/L	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace) ^{N11}	0.005	ug/L	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace) ^{N11}	0.005	ug/L	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace) ^{N11}	0.005	ug/L	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace) ^{N11}	0.005	ug/L	< 0.005
13C8-FOSA (surr.)	1	%	131
D3-N-MeFOSA (surr.)	1	%	53
D5-N-EtFOSA (surr.)	1	%	39
D7-N-MeFOSE (surr.)	1	%	67
D9-N-EtFOSE (surr.)	1	%	63
D5-N-EtFOSAA (surr.)	1	%	101
D3-N-MeFOSAA (surr.)	1	%	90
Perfluoroalkyl carboxylic acids (PFCAs) - Trace			
Perfluorobutanoic acid (PFBA)(trace) ^{N11}	0.005	ug/L	< 0.005
Perfluoropentanoic acid (PFPeA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorohexanoic acid (PFHxA)(trace) ^{N11}	0.001	ug/L	0.002
Perfluoroheptanoic acid (PFHpA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorooctanoic acid (PFOA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorononanoic acid (PFNA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorodecanoic acid (PFDA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorotridecanoic acid (PFTTrDA)(trace) ^{N15}	0.001	ug/L	< 0.001
Perfluoroundecanoic acid (PFUnDA)(trace) ^{N11}	0.001	ug/L	< 0.001

Client Sample ID			QA02_190702
Sample Matrix			Water
Eurofins mgt Sample No.			B19-JI11870
Date Sampled			Not Provided
Test/Reference	LOR	Unit	
Perfluoroalkyl carboxylic acids (PFCAs) - Trace			
Perfluorododecanoic acid (PFDoDA)(trace) ^{N11}	0.001	ug/L	< 0.001
Perfluorotetradecanoic acid (PFTeDA)(trace) ^{N11}	0.001	ug/L	< 0.001
13C4-PFBA (surr.)	1	%	52
13C5-PFPeA (surr.)	1	%	61
13C5-PFHxA (surr.)	1	%	68
13C4-PFHpA (surr.)	1	%	75
13C8-PFOA (surr.)	1	%	80
13C5-PFNA (surr.)	1	%	127
13C6-PFDA (surr.)	1	%	90
13C2-PFUnDA (surr.)	1	%	86
13C2-PFDoDA (surr.)	1	%	71
13C2-PFTeDA (surr.)	1	%	48
Perfluoroalkyl sulfonic acids (PFSA)s- Trace			
Perfluorobutanesulfonic acid (PFBS)(trace) ^{N11}	0.001	ug/L	0.018
Perfluorononanesulfonic acid (PFNS)(trace) ^{N15}	0.001	ug/L	< 0.001
Perfluoropropanesulfonic acid (PFPrS)(trace) ^{N15}	0.001	ug/L	0.008
Perfluoropentanesulfonic acid (PFPeS)(trace) ^{N15}	0.001	ug/L	0.034
Perfluorohexanesulfonic acid (PFHxS)(trace) ^{N11}	0.001	ug/L	0.39
Perfluoroheptanesulfonic acid (PFHpS)(trace) ^{N15}	0.001	ug/L	0.006
Perfluorooctanesulfonic acid (PFOS)(trace) ^{N11}	0.001	ug/L	0.075
Perfluorodecanesulfonic acid (PFDS)(trace) ^{N15}	0.001	ug/L	< 0.001
13C3-PFBS (surr.)	1	%	74
18O2-PFHxS (surr.)	1	%	36
13C8-PFOS (surr.)	1	%	61
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace) ^{N11}	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace) ^{N11}	0.005	ug/L	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace) ^{N11}	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace) ^{N15}	0.001	ug/L	< 0.001
13C2-4:2 FTSA (surr.)	1	%	76
13C2-6:2 FTSA (surr.)	1	%	136
13C2-8:2 FTSA (surr.)	1	%	91

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
Perfluoroalkyl sulfonamido substances- Trace	Brisbane	Jul 09, 2019	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Brisbane	Jul 09, 2019	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSA)- Trace	Brisbane	Jul 09, 2019	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Brisbane	Jul 09, 2019	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

Company Name: GHD Pty Ltd QLD
Address: 145 Ann Street
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QLD 4000

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Order No.:
Report #: 664834
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Brisbane Laboratory - NATA Site # 20794						X
Perth Laboratory - NATA Site # 23736						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	QA02_190702	Not Provided		Water	B19-JI11870	X
Test Counts						1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)(trace)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)	ug/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)(trace)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTTrDA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSA)s- Trace							
Perfluorobutanesulfonic acid (PFBS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)(trace)	%	109			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	%	97			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	%	87			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	%	110			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	%	141			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	%	144			50-150	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)			%	124			50-150	Pass	
LCS - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace									
Perfluorobutanoic acid (PFBA)(trace)			%	112			50-150	Pass	
Perfluoropentanoic acid (PFPeA)(trace)			%	72			50-150	Pass	
Perfluorohexanoic acid (PFHxA)(trace)			%	130			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)			%	123			50-150	Pass	
Perfluorooctanoic acid (PFOA)(trace)			%	111			50-150	Pass	
Perfluorononanoic acid (PFNA)(trace)			%	99			50-150	Pass	
Perfluorodecanoic acid (PFDA)(trace)			%	115			50-150	Pass	
Perfluorotridecanoic acid (PFTTrDA)(trace)			%	79			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)			%	116			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)			%	100			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)			%	89			50-150	Pass	
LCS - % Recovery									
Perfluoroalkyl sulfonic acids (PFSA)s- Trace									
Perfluorobutanesulfonic acid (PFBS)(trace)			%	100			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)			%	74			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)			%	116			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)			%	115			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)			%	93			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)			%	98			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)			%	113			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)			%	73			50-150	Pass	
LCS - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace									
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)			%	119			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)			%	116			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)			%	117			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)			%	148			50-150	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances- Trace				Result 1					
Perfluorooctane sulfonamide (FOSA)(trace)	M19-JI06030	NCP	%	112			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	M19-JI06030	NCP	%	105			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	M19-JI06030	NCP	%	95			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	M19-JI06030	NCP	%	123			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	M19-JI06030	NCP	%	144			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	M19-JI06030	NCP	%	134			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)	M19-JI06030	NCP	%	119			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1					
Perfluorobutanoic acid (PFBA)(trace)	M19-JI06030	NCP	%	115			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropentanoic acid (PFPeA)(trace)	M19-JI06030	NCP	%	74			50-150	Pass	
Perfluorohexanoic acid (PFHxA)(trace)	M19-JI06030	NCP	%	133			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)	M19-JI06030	NCP	%	129			50-150	Pass	
Perfluorooctanoic acid (PFOA)(trace)	M19-JI06030	NCP	%	109			50-150	Pass	
Perfluorononanoic acid (PFNA)(trace)	M19-JI06030	NCP	%	95			50-150	Pass	
Perfluorodecanoic acid (PFDA)(trace)	M19-JI06030	NCP	%	116			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)(trace)	M19-JI06030	NCP	%	94			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)	M19-JI06030	NCP	%	126			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)	M19-JI06030	NCP	%	108			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)	M19-JI06030	NCP	%	79			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSA)s- Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)(trace)	M19-JI06030	NCP	%	94			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)	M19-JI06030	NCP	%	70			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)	M19-JI06030	NCP	%	138			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)	M19-JI06030	NCP	%	129			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)	M19-JI06030	NCP	%	93			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)	M19-JI06030	NCP	%	80			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)	M19-JI06030	NCP	%	113			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)	M19-JI06030	NCP	%	60			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)s- Trace				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	M19-JI06030	NCP	%	120			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	M19-JI06030	NCP	%	124			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	M19-JI06030	NCP	%	134			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	M19-JI06030	NCP	%	143			50-150	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD			
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)(trace)	M19-JI06027	NCP	ug/L	0.004	0.004	2.0	30%	Pass	
Perfluoroheptanoic acid (PFHpA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanoic acid (PFNA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSA)s- Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)(trace)	M19-JI06027	NCP	ug/L	0.004	0.004	17	30%	Pass	
Perfluorononanesulfonic acid (PFNS)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)(trace)	M19-JI06027	NCP	ug/L	0.002	0.002	10	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)(trace)	M19-JI06027	NCP	ug/L	0.005	0.004	23	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)(trace)	M19-JI06027	NCP	ug/L	0.027	0.026	7.0	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)(trace)	M19-JI06027	NCP	ug/L	0.005	0.005	3.0	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)(trace)	M19-JI06027	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)(trace)	M19-JI06027	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

Authorised By

Ryan Gilbert	Analytical Services Manager
Bryan Wilson	Senior Analyst-PFAS (QLD)



Glenn Jackson General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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CHAIN OF CUSTODY

ALS Laboratory, please tick →

CLIENT: Air Services Australia

OFFICE: Mackay, Queensland

PROJECT: Mackay Airport Post-PSI Target Sampling

ORDER NUMBER: 4132561

PURCHASE ORDER NO.: 4132561

PROJECT MANAGER: Daniel Todd

SAMPLER: Jackson Skopp

COC Emailed to ALS? (YES / NO)

Email Reports to (will default to PM if no other addresses are listed): daniel.todd@gnd.com; jackson.skopp@gnd.com

Email Invoice to (will default to PM if no other addresses are listed): daniel.todd@gnd.com; jackson.skopp@gnd.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:

(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.: EN/005/18

COUNTRY OF ORIGIN: Australia

CONTACT PH: 073316 3333 or 0400 662 677

SAMPLER MOBILE: 0491 120 596

EDD FORMAT (or default): Esdat

Standard TAT (List due date):

☒ Non Standard or urgent TAT (List due date):

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

RECEIVED BY: N. Sutton

DATE/TIME: 27/6/19

2:30

RELINQUISHED BY: J. Skopp

DATE/TIME: 27/6/19

1425

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No

Freeze / frozen ice bricks present upon receipt? Yes No

Random Sample Temperature on Receipt: 1.3 °C

Other comment:

RECEIVED BY: N. Sutton

DATE/TIME: 27/6/19

4:00pm

RELINQUISHED BY: N. Sutton

DATE/TIME: 28/06/2019

08:30AM

LAB ID	SAMPLE DETAILS		CONTAINER INFORMATION		ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price)		Additional Information	
	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	When Metals are required, specify Total (unfiltered bottle required) or Disolved (field filtered bottle required)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
1	SW06_190625	25/06/2019 0:00	W	P	2	PFAS low level and branched chain	Environmental Division Sydney	
2	SS06_190625	25/06/2019 0:00	S	AG	2	Major Anions and Cations	Work Order Reference ES1920340	
3	SW05_190626	26/06/2019	W	P	2			
4	SS05_190626	26/06/2019	S	AG	2			
5	SW07_190626	26/06/2019	W	P	2			
6	SS07_190626	26/06/2019	S	AG	2			
7	Biota1_BAR1	26/06/2019	B	B	1			
8	Biota1_BAR2	26/06/2019	B	B	1			
9	Biota1_BAR3	26/06/2019	B	B	1			
10	Biota1_BAR4	26/06/2019	B	B	1			
11	Biota1_MULL1	26/06/2019	B	B	1			
12	Biota1_BBRIM1	26/06/2019	B	B	1			
13	Biota1_BRIM1	26/06/2019	B	B	1			
					TOTAL	19		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Disulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved; Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Plastic; SP = Sulfuric Preserved Plastic; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : ES1920340

Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Contact	: Customer Services ES
Address	: GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: daniel.todd@ghd.com	E-mail	: ALSEnviro.Sydney@ALSGlobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Mackay Airport Post-PSI Target Sampling	Page	: 1 of 4
Order number	: 4132561	Quote number	: ES2017AIRSER0001 (EN/054A/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Jackson Skopp		

Dates

Date Samples Received	: 28-Jun-2019 08:30	Issue Date	: 01-Jul-2019
Client Requested Due Date	: 05-Jul-2019	Scheduled Reporting Date	: 05-Jul-2019

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 1.3°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 18 / 18

General Comments

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



Sample Container(s)/Preservation Non-Compliances

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

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS : EP231X		
Biota1_BAR1	- Snap Lock Bag	- Frozen Sample
Biota1_BAR2	- Snap Lock Bag	- Frozen Sample
Biota1_BAR3	- Snap Lock Bag	- Frozen Sample
Biota1_BAR4	- Snap Lock Bag	- Frozen Sample
Biota1_MULL1	- Snap Lock Bag	- Frozen Sample
Biota1_BBRIM1	- Snap Lock Bag	- Frozen Sample
Biota1_BRIM1	- Snap Lock Bag	- Frozen Sample
PFOS - Linear/Branched Speciation : EP231-PFOS-SP		
Biota1_BAR1	- Snap Lock Bag	- Frozen Sample
Biota1_BAR2	- Snap Lock Bag	- Frozen Sample
Biota1_BAR3	- Snap Lock Bag	- Frozen Sample
Biota1_BAR4	- Snap Lock Bag	- Frozen Sample
Biota1_MULL1	- Snap Lock Bag	- Frozen Sample
Biota1_BBRIM1	- Snap Lock Bag	- Frozen Sample
Biota1_BRIM1	- Snap Lock Bag	- Frozen Sample
Total Organic Carbon : EP005		
SW06_190625	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
SW05_190626	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
SW07_190626	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
SW01_190627	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid
SW08_190627	- Clear Plastic Bottle - Natural	- Amber TOC Vial - Sulfuric Acid

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: BIOTA

Laboratory sample ID	Client sampling date / time	Client sample ID	
ES1920340-007	26-Jun-2019 00:00	Biota1_BAR1	✓
ES1920340-008	26-Jun-2019 00:00	Biota1_BAR2	✓
ES1920340-009	26-Jun-2019 00:00	Biota1_BAR3	✓
ES1920340-010	26-Jun-2019 00:00	Biota1_BAR4	✓
ES1920340-011	26-Jun-2019 00:00	Biota1_MULL1	✓
ES1920340-012	26-Jun-2019 00:00	Biota1_BBRIM1	✓
ES1920340-013	26-Jun-2019 00:00	Biota1_BRIM1	✓

BIOTA - EP231X
PFAS - Full Suite (28 analytes) - includes PFOS



Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
ES1920340-002	25-Jun-2019 00:00	SS06_190625	✓	✓	✓
ES1920340-004	26-Jun-2019 00:00	SS05_190626	✓	✓	✓
ES1920340-006	26-Jun-2019 00:00	SS07_190626	✓	✓	✓
ES1920340-015	27-Jun-2019 00:00	SS01_190627	✓	✓	✓
ES1920340-017	27-Jun-2019 00:00	SS08_190627	✓	✓	✓
ES1920340-018	27-Jun-2019 00:00	SS02_190627	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EP005 Total Organic Carbon (TOC)	WATER - EP231X-LL PFAS - Full Suite Low Level (29 analytes)	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
ES1920340-001	25-Jun-2019 00:00	SW06_190625	✓	✓	✓
ES1920340-003	26-Jun-2019 00:00	SW05_190626	✓	✓	✓
ES1920340-005	26-Jun-2019 00:00	SW07_190626	✓	✓	✓
ES1920340-014	27-Jun-2019 00:00	SW01_190627	✓	✓	✓
ES1920340-016	27-Jun-2019 00:00	SW08_190627	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

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

Method	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
Client Sample ID(s)							
EP005: Total Organic Carbon							
SW05_190626	Clear Plastic Bottle - Natural	----	27-Jun-2019	28-Jun-2019	✗	----	----
SW06_190625	Clear Plastic Bottle - Natural	----	26-Jun-2019	28-Jun-2019	✗	----	----
SW07_190626	Clear Plastic Bottle - Natural	----	27-Jun-2019	28-Jun-2019	✗	----	----

CERTIFICATE OF ANALYSIS

Work Order : **ES1920340**
Client : **AIR SERVICES AUSTRALIA**
Contact : Daniel Todd
Address : GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM
 BRISBANE QLD, AUSTRALIA 4008

Telephone : ----
Project : Mackay Airport Post-PSI Target Sampling
Order number : 4132561
C-O-C number : ----
Sampler : Jackson Skopp
Site : ----
Quote number : EN/054A/17
No. of samples received : 18
No. of samples analysed : 18

Page : 1 of 14
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 28-Jun-2019 08:30
Date Analysis Commenced : 01-Jul-2019
Issue Date : 08-Jul-2019 12:15



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
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Franco Lentini		Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP231X (Biota): ALS NATA accreditation for PFAS in Biota covers all Perfluoroalkyl Sulfonic Acids, Perfluoroalkyl Carboxylic Acids and (n:2) Fluorotelomer Sulfonic Acids in fish (whole and muscle), plants and vegetable matrices, with the exception PFBA (fish only), EtFOSA, MeFOSE, EtFOSE, MeFOSAA, EtFOSAA.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)				Client sample ID	Biota1_BAR1	Biota1_BAR2	Biota1_BAR3	Biota1_BAR4	Biota1_MULL1
Client sampling date / time					26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920340-007	ES1920340-008	ES1920340-009	ES1920340-010	ES1920340-011
					Result	Result	Result	Result	Result
Biota Sample Pre-Preparation									
Ø Sample Description	----	-	--		fish	fish	fish	fish	fish
Ø Weight of Sample Prepared	----	0.1	g		73.8	69.1	59.8	58.8	12.2
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg		<1	<1	<1	<1	<1
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg		<1	<1	<1	<1	<1
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg		<1	5	4	3	3
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg		<1	<1	<1	<1	<1
Perfluorooctane sulfonic acid (PFOS) - Linear	2795-39-3	1	µg/kg		1	16	16	12	20
Perfluorooctane sulfonic acid (PFOS) - Branched	----	1	µg/kg		1	7	7	4	7
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg		2	23	23	16	27
Perfluorodecane sulfonic acid (PFDS)	335-77-3	2	µg/kg		<2	<2	<2	<2	<2
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg		<5	<5	<5	<5	<5
Perfluoropentanoic acid (PFPeA)	2706-90-3	2	µg/kg		<2	<2	<2	<2	<2
Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg		<1	<1	<1	<1	<1
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg		<1	<1	<1	<1	<1
Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg		<1	<1	<1	<1	<1
Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg		<1	<1	<1	<1	<1
Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg		<1	<1	<1	<1	<1
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg		<1	<1	<1	<1	<1
Perfluorododecanoic acid (PFDoDA)	307-55-1	2	µg/kg		<2	<2	<2	<2	<2
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	2	µg/kg		<2	<2	<2	<2	<2
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg		<2	<2	<2	<2	<2



Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)				Client sample ID	Biota1_BAR1	Biota1_BAR2	Biota1_BAR3	Biota1_BAR4	Biota1_MULL1
Client sampling date / time					26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920340-007	ES1920340-008	ES1920340-009	ES1920340-010	ES1920340-011
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	5	µg/kg		<5	<5	<5	<5	<5
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	5	µg/kg		<5	<5	<5	<5	<5
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg		<2	<2	<2	<2	<2
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg		<2	<2	<2	<2	<2
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg		<2	<2	<2	<2	<2
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg		<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg		<1	<1	<1	<1	<1
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg		<2	<2	<2	<2	<2
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg		<2	46	51	33	32
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg		<2	19	21	14	12
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg		<2	<2	<2	<2	<2
EP231P: PFAS Sums									
^ Sum of PFAS	----	1	µg/kg		2	93	99	66	74
EP231S: PFAS Surrogate									
13C4-PFOS	----	1	%		70.5	61.0	60.0	60.5	66.0
13C8-PFOA	----	1	%		74.5	65.0	62.5	67.0	62.0



Analytical Results

Sub-Matrix: BIOTA
 (Matrix: BIOTA)

Client sample ID

Client sampling date / time				Biota1_BBRIM1	Biota1_BRIM1	----	----	----
26-Jun-2019 00:00				26-Jun-2019 00:00	26-Jun-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1920340-012	ES1920340-013	-----	-----	-----
Result				Result	Result	----	----	----

Biota Sample Pre-Preparation

Ø Sample Description	----	-	--	fish	fish	----	----	----
Ø Weight of Sample Prepared	----	0.1	g	95.5	50.8	----	----	----

EP231A: Perfluoroalkyl Sulfonic Acids

Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	<1	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	<1	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	3	3	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	<1	----	----	----
Perfluorooctane sulfonic acid (PFOS) - Linear	2795-39-3	1	µg/kg	29	23	----	----	----
Perfluorooctane sulfonic acid (PFOS) - Branched	----	1	µg/kg	6	7	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	35	30	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	2	µg/kg	<2	<2	----	----	----

EP231B: Perfluoroalkyl Carboxylic Acids

Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	<5	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	2	µg/kg	<2	<2	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	<1	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	<1	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	<1	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	<1	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	<1	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	<1	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	2	µg/kg	<2	<2	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	2	µg/kg	<2	<2	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	<2	----	----	----



Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)				Client sample ID	Biota1_BBRIM1	Biota1_BRIM1	----	----	----
Client sampling date / time					26-Jun-2019 00:00	26-Jun-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1920340-012	ES1920340-013	-----	-----	-----
					Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	5	µg/kg		<5	<5	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	5	µg/kg		<5	<5	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg		<2	<2	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg		<2	<2	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg		<2	<2	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg		<1	<1	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg		<1	<1	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg		<2	<2	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg		23	41	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg		8	16	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg		<2	<2	----	----	----
EP231P: PFAS Sums									
^ Sum of PFAS	----	1	µg/kg		69	90	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	1	%		63.0	64.0	----	----	----
13C8-PFOA	----	1	%		62.5	64.5	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06_190625	SS05_190626	SS07_190626	SS01_190627	SS08_190627
Client sampling date / time					25-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	27-Jun-2019 00:00	27-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920340-002	ES1920340-004	ES1920340-006	ES1920340-015	ES1920340-017
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		33.6	38.7	19.6	25.8	17.1
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.58	0.78	0.07	0.38	0.10
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		<0.0002	<0.0002	<0.0002	0.0005	0.0020
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		0.0023	0.0008	0.0006	0.0004	0.0170
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	0.0003
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 (PFTriDA)	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



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06_190625	SS05_190626	SS07_190626	SS01_190627	SS08_190627
Client sampling date / time					25-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	27-Jun-2019 00:00	27-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920340-002	ES1920340-004	ES1920340-006	ES1920340-015	ES1920340-017
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
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		0.0023	0.0008	0.0006	0.0009	0.0193
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		0.0023	0.0008	0.0006	0.0009	0.0190
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		0.0023	0.0008	0.0006	0.0009	0.0193
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		74.5	78.0	75.5	96.0	76.5
13C8-PFOA	----	0.0002	%		86.0	90.0	93.0	98.0	81.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID		SS02_190627	----	----	----	----
Client sampling date / time			27-Jun-2019 00:00		----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1920340-018	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%	18.8	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%	0.34	----	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0007	----	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS02_190627	----	----	----	----
Client sampling date / time				27-Jun-2019 00:00	----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1920340-018	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg	0.0007	----	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0007	----	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0007	----	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%	89.5	----	----	----	----	----
13C8-PFOA	----	0.0002	%	95.5	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW06_190625	SW05_190626	SW07_190626	SW01_190627	SW08_190627
Client sampling date / time					25-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	27-Jun-2019 00:00	27-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		ES1920340-001	ES1920340-003	ES1920340-005	ES1920340-014	ES1920340-016
				Result	Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO ₃	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO ₃	3812-32-6	1	mg/L	<1	<1	<1	<1	57	<1
Bicarbonate Alkalinity as CaCO ₃	71-52-3	1	mg/L	152	200	121	99	182	182
Total Alkalinity as CaCO ₃	----	1	mg/L	152	200	121	156	182	182
ED041G: Sulfate (Turbidimetric) as SO₄ 2- by DA									
Sulfate as SO ₄ - Turbidimetric	14808-79-8	1	mg/L	1550	699	2600	42	99	99
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	11200	6020	17700	197	786	786
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	274	140	393	13	30	30
Magnesium	7439-95-4	1	mg/L	820	370	1290	17	56	56
Sodium	7440-23-5	1	mg/L	6680	3210	10800	178	507	507
Potassium	7440-09-7	1	mg/L	236	113	390	4	15	15
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L	351	188	556	9.55	27.9	27.9
∅ Total Cations	----	0.01	meq/L	378	180	606	9.89	28.5	28.5
∅ Ionic Balance	----	0.01	%	3.64	2.28	4.28	1.77	1.19	1.19
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	4	3	2	8	4	4
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	<0.002	0.012	0.258	0.258
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.004	0.002	0.005	0.026	0.405	0.405
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.032	0.021	0.044	0.213	2.64	2.64
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.002	0.006	0.318	0.318
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.360	0.085	0.052	0.047	7.20	7.20
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<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	0.06	0.06



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				SW06_190625	SW05_190626	SW07_190626	SW01_190627	SW08_190627
Client sampling date / time				25-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	27-Jun-2019 00:00	27-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	ES1920340-001	ES1920340-003	ES1920340-005	ES1920340-014	ES1920340-016
				Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	0.128
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.008	0.005	0.010	0.002	0.766
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	0.075
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	0.199
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	0.027
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<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	<0.002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L	<0.002	<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	<0.005
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<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	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<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	<0.005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<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	<0.005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<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	<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	<0.005



Analytical Results

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

Client sample ID

				SW06_190625	SW05_190626	SW07_190626	SW01_190627	SW08_190627
Client sampling date / time				25-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	27-Jun-2019 00:00	27-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	ES1920340-001	ES1920340-003	ES1920340-005	ES1920340-014	ES1920340-016
				Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued								
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<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	<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	<0.005
EP231P: PFAS Sums								
Sum of PFAS	----	0.002	µg/L	0.404	0.113	0.113	0.306	12.1
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	0.392	0.106	0.096	0.260	9.84
Sum of PFAS (WA DER List)	----	0.002	µg/L	0.400	0.111	0.106	0.274	11.3
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	80.3	80.9	85.7	67.9	75.0
13C8-PFOA	----	0.002	%	90.7	88.1	87.7	77.0	94.1



Surrogate Control Limits

Sub-Matrix: BIOTA		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	50	130
13C8-PFOA	----	50	130

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

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

QUALITY CONTROL REPORT

Work Order	: ES1920340	Page	: 1 of 14
Client	: AIR SERVICES AUSTRALIA	Laboratory	: Environmental Division Sydney
Contact	: Daniel Todd	Contact	: Customer Services ES
Address	: GATE 12A BAECKEA LOCK BAG 747 EAGLE FARM BRISBANE QLD, AUSTRALIA 4008	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Mackay Airport Post-PSI Target Sampling	Date Samples Received	: 28-Jun-2019
Order number	: 4132561	Date Analysis Commenced	: 01-Jul-2019
C-O-C number	: ----	Issue Date	: 08-Jul-2019
Sampler	: Jackson Skopp		
Site	: ----		
Quote number	: EN/054A/17		
No. of samples received	: 18		
No. of samples analysed	: 18		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Franco Lentini		Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Peter Wu		Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: BIOTA

Sub-Matrix: BIOTA				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: 2441854)									
ES1920340-007	Biota1_BAR1	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	2	2	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	1	µg/kg	<2	<2	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2441854)									
ES1920340-007	Biota1_BAR1	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	<5	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2441854)									
ES1920340-007	Biota1_BAR1	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	1	µg/kg	<5	<5	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	<1	0.00	No Limit



Sub-Matrix: BIOTA				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: 2441854) - continued									
ES1920340-007	Biota1_BAR1	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	2	µg/kg	<5	<5	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg	<2	<2	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2441854)									
ES1920340-007	Biota1_BAR1	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg	<2	<2	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2441854)									
ES1920340-007	Biota1_BAR1	EP231X: Sum of PFAS	----	1	µg/kg	2	2	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 (%)
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2440391)									
ES1920292-012	Anonymous	EA055: Moisture Content	----	0.1	%	13.2	13.0	1.60	0% - 50%
ES1920351-001	Anonymous	EA055: Moisture Content	----	0.1	%	8.6	8.8	2.09	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2447092)									
ES1920340-002	SS06_190625	EP003: Total Organic Carbon	----	0.02	%	0.58	0.62	7.33	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2441716)									
ES1920329-001	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	0.0008	0.0008	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2441716)									
ES1920329-001	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



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: 2441716) - continued									
ES1920329-001	Anonymous	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
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2441716)									
ES1920329-001	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
		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: 2441716)									
ES1920329-001	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
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 (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 2438807)									
ES1920340-005	SW07_190626	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	121	122	0.935	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	121	122	0.935	0% - 20%
ES1920331-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	60	59	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	60	59	0.00	0% - 20%

Page : 5 of 14
 Work Order : ES1920340
 Client : AIR SERVICES AUSTRALIA
 Project : Mackay Airport Post-PSI Target Sampling



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 (%)
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2441053)									
ES1920327-008	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	877	845	3.79	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2441052)									
ES1920327-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	108	109	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2442449)									
ES1920344-006	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	7	6	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	5	5	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	22	22	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.00	No Limit
ES1920315-013	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	178	178	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	219	220	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	708	715	1.03	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	32	32	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2444618)									
ES1920277-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	19	20	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	12	12	0.00	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	34	35	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit
ES1920366-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	17	17	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	8	8	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	99	96	2.69	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.00	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 2440644)									
ES1920148-002	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	2	1	0.00	No Limit
ES1920340-003	SW05_190626	EP005: Total Organic Carbon	----	1	mg/L	3	5	47.2	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2439624)									
EM1910098-002	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.005	0.004	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.005	0.004	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.055	0.051	8.14	0% - 20%
		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	0.014	0.013	8.70	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: 2439624)									
EM1910098-002	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.012	0.011	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.015	0.013	15.3	No Limit



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2439624) - continued									
EM1910098-002	Anonymous	EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.004	0.003	37.8	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.004	0.003	26.3	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: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	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: 2439624)									
EM1910098-002	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: 2439624)									
EM1910098-002	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



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: BIOTA

Sub-Matrix: BIOTA				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2441854)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	5 µg/kg	69.2	50	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	5 µg/kg	68.4	50	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	5 µg/kg	70.0	50	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	5 µg/kg	65.2	50	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	<1	5 µg/kg	71.2	50	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	1	µg/kg	<1	5 µg/kg	74.8	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2441854)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	25 µg/kg	66.6	50	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	1	µg/kg	<1	5 µg/kg	74.8	50	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	5 µg/kg	94.8	50	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	5 µg/kg	70.8	50	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	5 µg/kg	69.6	50	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	5 µg/kg	72.0	50	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	5 µg/kg	68.8	50	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	5 µg/kg	74.0	50	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	1	µg/kg	<1	5 µg/kg	94.0	50	130
EP231X: Perfluorotridecanoic acid (PFTriDA)	72629-94-8	1	µg/kg	<1	5 µg/kg	94.0	50	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	12.5 µg/kg	73.0	50	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2441854)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	1	µg/kg	<1	5 µg/kg	68.0	50	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	2	µg/kg	<2	12.5 µg/kg	74.6	50	130
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg	<2	12.5 µg/kg	68.8	50	130
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg	<2	12.5 µg/kg	71.5	50	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg	<2	12.5 µg/kg	67.2	50	130
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	5 µg/kg	70.8	50	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	5 µg/kg	74.0	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2441854)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg	<2	5 µg/kg	66.0	50	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg	<2	5 µg/kg	73.6	50	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg	<2	5 µg/kg	70.0	50	130



Sub-Matrix: BIOTA

Sub-Matrix: BIOTA				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2441854) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg	<2	5 µg/kg	78.4	50	130
EP231P: PFAS Sums (QCLot: 2441854)								
EP231X: Sum of PFAS	----	1	µg/kg	<1	----	----	----	----

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2447092)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.44 %	101	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2441716)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.4	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.8	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.2	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	66.8	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2441716)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	66.9	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.2	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.6	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.8	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.5	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2441716)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.7	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.5	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	66.2	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	67.0	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.0	61	130



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2441716) - continued								
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2441716)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	74.4	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	64.0	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	69.6	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	78.0	60	130
Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
ED037P: Alkalinity by PC Titrator (QCLot: 2438807)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	87.7	81	111
				----	50 mg/L	93.9	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2441053)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	96.7	82	122
ED045G: Chloride by Discrete Analyser (QCLot: 2441052)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	111	81	127
				<1	1000 mg/L	96.0	81	127
ED093F: Dissolved Major Cations (QCLot: 2442449)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	96.7	80	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	100	90	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	82	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	98.1	85	113
ED093F: Dissolved Major Cations (QCLot: 2444618)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	93.5	80	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	90	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	99.4	82	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	98.6	85	113
EP005: Total Organic Carbon (TOC) (QCLot: 2440644)								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	100	72	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2439624)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.05 µg/L	78.0	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.05 µg/L	85.6	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.05 µg/L	79.6	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.05 µg/L	82.6	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.05 µg/L	74.8	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.05 µg/L	57.0	40	130

Matrix Spike (MS) Report

Sub-Matrix: **BIOTA**

Sub-Matrix: BIOTA				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2441854)							



Sub-Matrix: BIOTA

Sub-Matrix: BIOTA				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2441854) - continued							
ES1920340-008	Biota1_BAR2	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	5 µg/kg	61.2	30	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	5 µg/kg	60.8	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	5 µg/kg	68.4	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	5 µg/kg	61.6	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	5 µg/kg	# Not Determined	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	5 µg/kg	64.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2441854)							
ES1920340-008	Biota1_BAR2	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	25 µg/kg	62.2	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	5 µg/kg	62.0	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	5 µg/kg	66.8	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	5 µg/kg	62.4	30	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	5 µg/kg	64.8	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	5 µg/kg	54.8	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	5 µg/kg	58.0	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	5 µg/kg	75.2	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	5 µg/kg	76.0	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	5 µg/kg	80.8	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	12.5 µg/kg	70.6	50	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2441854)							
ES1920340-008	Biota1_BAR2	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	5 µg/kg	64.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	12.5 µg/kg	67.8	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	12.5 µg/kg	50.2	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	12.5 µg/kg	64.6	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	12.5 µg/kg	73.6	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	5 µg/kg	67.2	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	5 µg/kg	69.6	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2441854)							
ES1920340-008	Biota1_BAR2	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	5 µg/kg	59.2	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	5 µg/kg	# Not Determined	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	5 µg/kg	103	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	5 µg/kg	86.0	50	130



Sub-Matrix: **SOIL**

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
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2441716)							
ES1920329-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	73.2	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	76.4	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	70.4	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	74.0	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	62.4	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	70.0	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2441716)							
ES1920329-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	69.4	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	79.2	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	84.8	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	84.8	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	85.6	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	77.2	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	82.4	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	76.8	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	80.8	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	80.0	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	60.1	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2441716)							
ES1920329-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	72.8	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	66.8	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	70.5	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	66.5	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	63.5	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	68.4	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	78.8	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2441716)							
ES1920329-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	78.0	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	70.4	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	82.8	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	96.0	50	130

Sub-Matrix: **WATER**

Matrix Spike (MS) Report		
Spike	SpikeRecovery(%)	Recovery Limits (%)



Sub-Matrix: **WATER**

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
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2441053)							
ES1920327-008	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2441052)							
ES1920327-005	Anonymous	ED045G: Chloride	16887-00-6	250 mg/L	114	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 2440644)							
ES1920148-008	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	101	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2439624)							
ES1920340-005	SW07_190626	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	77.4	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	81.4	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	88.6	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	75.4	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	92.8	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	60.8	30	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2439624)							
ES1920340-005	SW07_190626	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	76.1	30	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	84.2	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	86.8	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	81.8	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	76.0	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	79.6	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	67.0	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	75.6	30	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	78.0	30	130
		EP231X-LL: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.05 µg/L	70.0	30	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	87.3	30	130
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.05 µg/L	98.6	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2439624)							
ES1920340-005	SW07_190626	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	59.6	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	59.9	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	64.5	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	63.6	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	70.3	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	84.6	30	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2439624) - continued							
ES1920340-005	SW07_190626	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	89.0	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2439624)							
ES1920340-005	SW07_190626	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	96.2	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	90.4	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	95.4	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	94.0	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **ES1920340**

Page : 1 of 11

Client : **AIR SERVICES AUSTRALIA**
Contact : Daniel Todd
Project : Mackay Airport Post-PSI Target Sampling
Site : ----
Sampler : Jackson Skopp
Order number : 4132561

Laboratory : Environmental Division Sydney
Telephone : +61-2-8784 8555
Date Samples Received : 28-Jun-2019
Issue Date : 08-Jul-2019
No. of samples received : 18
No. of samples analysed : 18

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- 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: **BIOTA**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES1920340--008	Biota1_BAR2	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	ES1920340--008	Biota1_BAR2	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	ES1920327--008	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
ED093F: Dissolved Major Cations						
Clear Plastic Bottle - Natural SW06_190625	----	----	----	03-Jul-2019	02-Jul-2019	1
Clear Plastic Bottle - Natural SW05_190626, SW07_190626	----	----	----	04-Jul-2019	03-Jul-2019	1
EP005: Total Organic Carbon (TOC)						
Clear Plastic Bottle - Natural SW06_190625	----	----	----	02-Jul-2019	26-Jun-2019	6
Clear Plastic Bottle - Natural SW05_190626, SW07_190626	----	----	----	02-Jul-2019	27-Jun-2019	5
Clear Plastic Bottle - Natural SW01_190627, SW08_190627	----	----	----	02-Jul-2019	28-Jun-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.

Page : 3 of 11
 Work Order : ES1920340
 Client : AIR SERVICES AUSTRALIA
 Project : Mackay Airport Post-PSI Target Sampling



Matrix: **BIOTA** Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
Biota Sample Pre-Preparation								
Snap Lock Bag (Biota-PP) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	03-Jul-2019	----	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Snap Lock Bag (EP231-PFOS-SP) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	04-Jul-2019	23-Dec-2019	✓	04-Jul-2019	13-Aug-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
Snap Lock Bag (EP231X) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	04-Jul-2019	23-Dec-2019	✓	04-Jul-2019	13-Aug-2019	✓
EP231C: Perfluoroalkyl Sulfonamides								
Snap Lock Bag (EP231X) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	04-Jul-2019	23-Dec-2019	✓	04-Jul-2019	13-Aug-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
Snap Lock Bag (EP231X) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	04-Jul-2019	23-Dec-2019	✓	04-Jul-2019	13-Aug-2019	✓
EP231P: PFAS Sums								
Snap Lock Bag (EP231X) Biota1_BAR1, Biota1_BAR3, Biota1_MULL1, Biota1_BRIM1	Biota1_BAR2, Biota1_BAR4, Biota1_BBRIM1,	26-Jun-2019	04-Jul-2019	23-Dec-2019	✓	04-Jul-2019	13-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



Matrix: **SOIL**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) SS06_190625		25-Jun-2019	----	----	----	02-Jul-2019	09-Jul-2019	✓
Soil Glass Jar - Unpreserved (EA055) SS05_190626,	SS07_190626	26-Jun-2019	----	----	----	02-Jul-2019	10-Jul-2019	✓
Soil Glass Jar - Unpreserved (EA055) SS01_190627, SS02_190627	SS08_190627,	27-Jun-2019	----	----	----	02-Jul-2019	11-Jul-2019	✓
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003) SS06_190625		25-Jun-2019	05-Jul-2019	23-Jul-2019	✓	05-Jul-2019	23-Jul-2019	✓
Pulp Bag (EP003) SS05_190626,	SS07_190626	26-Jun-2019	05-Jul-2019	24-Jul-2019	✓	05-Jul-2019	24-Jul-2019	✓
Pulp Bag (EP003) SS01_190627, SS02_190627	SS08_190627,	27-Jun-2019	05-Jul-2019	25-Jul-2019	✓	05-Jul-2019	25-Jul-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X) SS06_190625		25-Jun-2019	03-Jul-2019	22-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS05_190626,	SS07_190626	26-Jun-2019	03-Jul-2019	23-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS01_190627, SS02_190627	SS08_190627,	27-Jun-2019	03-Jul-2019	24-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X) SS06_190625		25-Jun-2019	03-Jul-2019	22-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS05_190626,	SS07_190626	26-Jun-2019	03-Jul-2019	23-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS01_190627, SS02_190627	SS08_190627,	27-Jun-2019	03-Jul-2019	24-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X) SS06_190625		25-Jun-2019	03-Jul-2019	22-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS05_190626,	SS07_190626	26-Jun-2019	03-Jul-2019	23-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓
HDPE Soil Jar (EP231X) SS01_190627, SS02_190627	SS08_190627,	27-Jun-2019	03-Jul-2019	24-Dec-2019	✓	04-Jul-2019	12-Aug-2019	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) SS06_190625	25-Jun-2019	03-Jul-2019	22-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔
HDPE Soil Jar (EP231X) SS05_190626, SS07_190626	26-Jun-2019	03-Jul-2019	23-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔
HDPE Soil Jar (EP231X) SS01_190627, SS02_190627, SS08_190627,	27-Jun-2019	03-Jul-2019	24-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) SS06_190625	25-Jun-2019	03-Jul-2019	22-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔
HDPE Soil Jar (EP231X) SS05_190626, SS07_190626	26-Jun-2019	03-Jul-2019	23-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔
HDPE Soil Jar (EP231X) SS01_190627, SS02_190627, SS08_190627,	27-Jun-2019	03-Jul-2019	24-Dec-2019	✔	04-Jul-2019	12-Aug-2019	✔

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) SW06_190625	25-Jun-2019	----	----	----	01-Jul-2019	09-Jul-2019	✓
Clear Plastic Bottle - Natural (ED037-P) SW05_190626, SW07_190626	26-Jun-2019	----	----	----	01-Jul-2019	10-Jul-2019	✓
Clear Plastic Bottle - Natural (ED037-P) SW01_190627, SW08_190627	27-Jun-2019	----	----	----	01-Jul-2019	11-Jul-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) SW06_190625	25-Jun-2019	----	----	----	02-Jul-2019	23-Jul-2019	✓
Clear Plastic Bottle - Natural (ED041G) SW05_190626, SW07_190626	26-Jun-2019	----	----	----	02-Jul-2019	24-Jul-2019	✓
Clear Plastic Bottle - Natural (ED041G) SW01_190627, SW08_190627	27-Jun-2019	----	----	----	02-Jul-2019	25-Jul-2019	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) SW06_190625	25-Jun-2019	----	----	----	02-Jul-2019	23-Jul-2019	✓
Clear Plastic Bottle - Natural (ED045G) SW05_190626, SW07_190626	26-Jun-2019	----	----	----	02-Jul-2019	24-Jul-2019	✓
Clear Plastic Bottle - Natural (ED045G) SW01_190627, SW08_190627	27-Jun-2019	----	----	----	02-Jul-2019	25-Jul-2019	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F) SW06_190625	25-Jun-2019	----	----	----	03-Jul-2019	02-Jul-2019	✘
Clear Plastic Bottle - Natural (ED093F) SW05_190626, SW07_190626	26-Jun-2019	----	----	----	04-Jul-2019	03-Jul-2019	✘
Clear Plastic Bottle - Natural (ED093F) SW01_190627, SW08_190627	27-Jun-2019	----	----	----	03-Jul-2019	04-Jul-2019	✔
EP005: Total Organic Carbon (TOC)							
Clear Plastic Bottle - Natural (EP005) SW06_190625	25-Jun-2019	----	----	----	02-Jul-2019	26-Jun-2019	✘
Clear Plastic Bottle - Natural (EP005) SW05_190626, SW07_190626	26-Jun-2019	----	----	----	02-Jul-2019	27-Jun-2019	✘
Clear Plastic Bottle - Natural (EP005) SW01_190627, SW08_190627	27-Jun-2019	----	----	----	02-Jul-2019	28-Jun-2019	✘
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) SW06_190625	25-Jun-2019	02-Jul-2019	22-Dec-2019	✔	03-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW05_190626, SW07_190626	26-Jun-2019	02-Jul-2019	23-Dec-2019	✔	03-Jul-2019	23-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW01_190627, SW08_190627	27-Jun-2019	02-Jul-2019	24-Dec-2019	✔	03-Jul-2019	24-Dec-2019	✔
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) SW06_190625	25-Jun-2019	02-Jul-2019	22-Dec-2019	✔	03-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW05_190626, SW07_190626	26-Jun-2019	02-Jul-2019	23-Dec-2019	✔	03-Jul-2019	23-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW01_190627, SW08_190627	27-Jun-2019	02-Jul-2019	24-Dec-2019	✔	03-Jul-2019	24-Dec-2019	✔
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) SW06_190625	25-Jun-2019	02-Jul-2019	22-Dec-2019	✔	03-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW05_190626, SW07_190626	26-Jun-2019	02-Jul-2019	23-Dec-2019	✔	03-Jul-2019	23-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW01_190627, SW08_190627	27-Jun-2019	02-Jul-2019	24-Dec-2019	✔	03-Jul-2019	24-Dec-2019	✔
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) SW06_190625	25-Jun-2019	02-Jul-2019	22-Dec-2019	✔	03-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW05_190626, SW07_190626	26-Jun-2019	02-Jul-2019	23-Dec-2019	✔	03-Jul-2019	23-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW01_190627, SW08_190627	27-Jun-2019	02-Jul-2019	24-Dec-2019	✔	03-Jul-2019	24-Dec-2019	✔



Matrix: WATER

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) SW06_190625	25-Jun-2019	02-Jul-2019	22-Dec-2019	✔	03-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW05_190626, SW07_190626	26-Jun-2019	02-Jul-2019	23-Dec-2019	✔	03-Jul-2019	23-Dec-2019	✔
HDPE (no PTFE) (EP231X-LL) SW01_190627, SW08_190627	27-Jun-2019	02-Jul-2019	24-Dec-2019	✔	03-Jul-2019	24-Dec-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: **BIOTA** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	8	12.50	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)							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	8	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	34	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	14.29	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Control Samples (LCS) - Continued							
Chloride by Discrete Analyser	ED045G	2	8	25.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	34	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	34	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
PFOS - Linear/Branched Speciation	EP231-PFOS-SP	BIOTA	n-house: Linear PFOS is determined by quantiation of the separate linear peak using linear PFOS. Branched PFOS is determined as the difference between total PFOS (determined using a mixed linear/branched standard) and linear PFOS.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	BIOTA	In-House. A sample extract is analysed 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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.
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
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ ²⁻ by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ ²⁻ concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003



Analytical Methods	Method	Matrix	Method Descriptions
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS)	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
Prep-Preparation for Biota Analysis	* Biota-PP	BIOTA	A sample is prepared from whole or particular tissues/organs, identified, homogenised and the total weight of prepared sample recorded.
Sample Preparation for PFAS in Biota	EP231-PR	BIOTA	In-house. A sample is mixed with water and a complexing reagent and twice extracted with MTBE. Sample cleanup is employed as required.
Sample Extraction for PFAS	EP231-PR	SOIL	In house
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

Hi,

Just clarifying from my previous email that we want pre TOPA 28 suite on the soil TCLP.

Surface water for TOPA:

- 3 • SW06 (ES1920340-001)
- 4 • SW08 (ES1920340-016)

Groundwater for TOPA:

- 1 • GMW3 (EB1917295-002)
- 2 • GMW6 (EB1917295-003)

Soil TCLP – 28 PFAS plus TOPA:

- 5 • MW09_0.5 (ES1920563-008)

Environmental Division
Brisbane
Work Order Reference
EB1919297



Telephone : + 61-7-3243 7222

Kind regards,

Pascale Lin
BSc (Environmental)
Environmental Scientist – Contamination Assessment & Remediation, South Queensland

GHD

Proudly employee owned

T: 07 3316 3795 | M: +61 401 946 762 | E: Pascale.Lin@ghd.com
145 Ann Street, Brisbane Queensland 4000 Australia | <http://www.ghd.com/>

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GHD acknowledges the Traditional Owners of Country throughout Australia.
We pay respect to their continuing culture and Elders past, present and
emerging. [Click here to learn about our Reconciliation Action Plan.](#)

From: Reece Smith <Reece.Smith@ghd.com>

Sent: Wednesday, 24 July 2019 3:58 PM

To: Pascale Lin <Pascale.Lin@ghd.com>

Subject: Re: Further analysis for 4132561 Mackay Post-PSI Targeted Sampling

Hi.

Just confirm with Andrew that you also want the pre TOPA 28 suite on the soil TCLP

SOIL TCLP - 28 PFAS plus TOPA

Sent from my iPhone

On 24 Jul 2019, at 3:52 pm, Pascale Lin <Pascale.Lin@ghd.com> wrote:

Hi Andrew,

We are after some further analysis for the following samples

Surface water for **TOPA**:

- SW06 (ES1920340-001)
- SW08 (ES1920340-016)

Groundwater for **TOPA**:

- GMW3 (EB1917295-002)
- GMW6 (EB1917295-003)

Soil for **TCLP and TOPA**:

- MW09_0.5 (ES1920563-008)

Thanks

Kind regards,

Pascale Lin

BSc (Environmental)

Environmental Scientist – Contamination Assessment & Remediation, South Queensland

GHD

Proudly employee owned

T: 07 3316 3795 | M: +61 401 946 762 | E: Pascale.Lin@ghd.com

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<image002.png> <image004.png> <image006.png> <image008.png>

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<image009.jpg>

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EB1919297

Client : GHD PTY LTD Contact : MR DANIEL TODD Address : LEVEL 1/21 WOOD STREET MACKAY QLD, AUSTRALIA 4740 E-mail : daniel_todd@ghd.com Telephone : +61 03 8687 8000 Facsimile : +61 03 8687 8111 Project : 4132561 Order number : --- C-O-C number : --- Site : --- Sampler : JACKSON SKOPP	Laboratory : Environmental Division Brisbane Contact : Andrew Epps Address : 2 Byth Street Stafford QLD Australia 4053 E-mail : andrew.epps@alsglobal.com Telephone : +61 7 3552 8639 Facsimile : +61-7-3243 7218 Page : 1 of 3 Quote number : ES2018GHDSE0025 (EN/005/18) QC Level : NEPM 2013 B3 & ALS QC Standard
--	---

Dates

Date Samples Received : 24-Jul-2019 16:03	Issue Date : 26-Jul-2019
Client Requested Due Date : 02-Aug-2019	Scheduled Reporting Date : 02-Aug-2019

Delivery Details

Mode of Delivery : Samples On Hand	Security Seal : Not Available
No. of coolers/boxes : ---	Temperature : ---
Receipt Detail : REBATCH	No. of samples received / analysed : 5 / 5

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
- **26/07/2019: SRN has been resent to acknowledge PFAS analysis will be undertaken at ALS Sydney for samples #3<->5. For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- This work order has been created to rebatch samples from EB1917295, ES1920340 & ES1920563
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **PFAS analysis on ALS samples #3,4&5 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).
- **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.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EB1919297-001 : [02-Jul-2019] : GMW3_190702 - EB1917295_002
EB1919297-002 : [02-Jul-2019] : GMW6_190702 - EB1917295_003
EB1919297-003 : [25-Jun-2019] : SW06_190625 - ES1920340_001
EB1919297-004 : [27-Jun-2019] : SW08_190627 - ES1920340_016
EB1919297-005 : [25-Jul-2019] : MW09_0.5 - ES1920563_008

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 - EP231X (TOP) PFAS - Total Oxidisable Precursor (TOP) Assay	SOIL - EP231X PFAS - Full Suite (28 analytes)	SOIL - TCLP TCLP Leach
EB1919297-005	25-Jul-2019 00:00	MW09_0.5 ES1920563_...	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EP231X (TOP) PFAS - Total Oxidisable Precursor (TOP) Assay
EB1919297-001	02-Jul-2019 00:00	GMW3_190702 EB19172...	✓
EB1919297-002	02-Jul-2019 00:00	GMW6_190702 EB19172...	✓
EB1919297-003	25-Jun-2019 00:00	SW06_190625 ES19203...	✓
EB1919297-004	27-Jun-2019 00:00	SW08_190627 ES19203...	✓

Proactive Holding Time Report

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

ACCOUNTS PAYABLE (Hobart)

- Email accountspayableAU@ghd.com

Email accountspayableAU@ghd.com

- [illegible]

[illegible][illegible]

CERTIFICATE OF ANALYSIS

Work Order : **EB1919297**
Client : **GHD PTY LTD**
Contact : **MR DANIEL TODD**
Address : **LEVEL 1/21 WOOD STREET**
MACKAY QLD, AUSTRALIA 4740
Telephone : **+61 03 8687 8000**
Project : **4132561**
Order number :
C-O-C number : **----**
Sampler : **JACKSON SKOPP**
Site :
Quote number : **EN/005/18**
No. of samples received : **5**
No. of samples analysed : **5**

Page : 1 of 10
Laboratory : Environmental Division Brisbane
Contact : Andrew Epps
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61 7 3552 8639
Date Samples Received : 24-Jul-2019 16:03
Date Analysis Commenced : 29-Jul-2019
Issue Date : 05-Aug-2019 15:13



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

- EP231X (TOP): Samples were diluted due to matrix interference. LOR adjusted accordingly.
- EP231X (TOP): Sample EB1919297_003 required dilution prior to extraction due to high conductivity. LOR values have been adjusted accordingly.
- **PFAS analysis on ALS samples #3,4&5 will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**



Analytical Results

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

Client sample ID

				MW09_0.5	----	----	----	----
				ES1920563_008				
Client sampling date / time				25-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1919297-005	-----	-----	-----	-----
Result					----	----	----	----
EN33: TCLP Leach								
Initial pH	----	0.1	pH Unit	5.9	----	----	----	----
After HCl pH	----	0.1	pH Unit	1.3	----	----	----	----
Extraction Fluid Number	----	1	-	1	----	----	----	----
Final pH	----	0.1	pH Unit	4.7	----	----	----	----



Analytical Results

Sub-Matrix: TCLP LEACHATE
 (Matrix: WATER)

Client sample ID

				MW09_0.5 ES1920563_008	----	----	----	----
Client sampling date / time				25-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1919297-005	-----	-----	-----	-----
Result				----	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.11	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.08	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.48	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.03	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.31	----	----	----	----
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	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.06	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.12	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.02	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTTrDA)	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: TCLP LEACHATE
 (Matrix: WATER)

Client sample ID

				MW09_0.5 ES1920563_008	----	----	----	----
Client sampling date / time				25-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1919297-005	-----	-----	-----	-----
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	2.21	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	1.79	----	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	2.21	----	----	----	----
^ Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	1.40	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.09	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.05	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.34	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.03	----	----	----	----



Analytical Results

Sub-Matrix: TCLP LEACHATE
 (Matrix: WATER)

Client sample ID

				MW09_0.5 ES1920563_008	----	----	----	----
Client sampling date / time				25-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1919297-005	-----	-----	-----	-----
Result				----	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.45	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.10	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.02	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----
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	----	----	----	----



Analytical Results

Sub-Matrix: TCLP LEACHATE
 (Matrix: WATER)

Client sample ID

				MW09_0.5 ES1920563_008	----	----	----	----
Client sampling date / time				25-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1919297-005	-----	-----	-----	-----
Result				----	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	2.10	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	1.79	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	2.02	----	----	----	----
EP231_TOP_S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	98.0	----	----	----	----
13C8-PFOA	----	0.02	%	81.0	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	113	----	----	----	----
13C8-PFOA	----	0.02	%	91.4	----	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				GMW3_190702 EB1917295_002	GMW6_190702 EB1917295_003	SW06_190625 ES1920340_001	SW08_190627 ES1920340_016	----
Client sampling date / time				02-Jul-2019 00:00	02-Jul-2019 00:00	25-Jun-2019 00:00	27-Jun-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1919297-001	EB1919297-002	EB1919297-003	EB1919297-004	-----
				Result	Result	Result	Result	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	1.76	5.88	<0.05	0.24	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	1.51	6.00	<0.05	0.30	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	13.0	57.3	<0.05	2.97	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.56	3.18	<0.05	0.20	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	26.7	92.4	0.20	6.92	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	2.2	7.0	<0.1	0.4	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	2.63	7.00	<0.05	0.41	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	17.5	37.2	<0.05	3.05	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.65	1.40	<0.05	0.10	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.75	3.08	<0.05	0.20	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.10	0.32	<0.05	0.02	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.25	<0.50	<0.12	<0.05	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.25	<0.50	<0.12	<0.05	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.25	<0.50	<0.12	<0.05	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				GMW3_190702 EB1917295_002	GMW6_190702 EB1917295_003	SW06_190625 ES1920340_001	SW08_190627 ES1920340_016	----
Client sampling date / time				02-Jul-2019 00:00	02-Jul-2019 00:00	25-Jun-2019 00:00	27-Jun-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1919297-001	EB1919297-002	EB1919297-003	EB1919297-004	-----
				Result	Result	Result	Result	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.25	<0.50	<0.12	<0.05	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.25	<0.50	<0.12	<0.05	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.10	<0.20	<0.05	<0.02	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.10	<0.20	<0.05	<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	<0.10	<0.20	<0.05	<0.05	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.10	<0.20	<0.05	<0.05	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.10	<0.20	<0.05	<0.05	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.10	<0.20	<0.05	<0.05	----
EP231_TOP_P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	67.3	221	0.20	14.8	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	39.7	150	0.20	9.89	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	67.3	221	0.20	14.8	----
^ Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	43.2	141	0.13	9.51	----
EP231_TOP_S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	93.0	88.5	104	116	----
13C8-PFOA	----	0.02	%	116	106	110	111	----



Surrogate Control Limits

Sub-Matrix: TCLP LEACHATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

QUALITY CONTROL REPORT

Work Order	: EB1919297	Page	: 1 of 13
Client	: GHD PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR DANIEL TODD	Contact	: Andrew Epps
Address	: LEVEL 1/21 WOOD STREET MACKAY QLD, AUSTRALIA 4740	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 8687 8000	Telephone	: +61 7 3552 8639
Project	: 4132561	Date Samples Received	: 24-Jul-2019
Order number	:	Date Analysis Commenced	: 29-Jul-2019
C-O-C number	: ----	Issue Date	: 05-Aug-2019
Sampler	: JACKSON SKOPP		
Site	:		
Quote number	: EN/005/18		
No. of samples received	: 5		
No. of samples analysed	: 5		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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: 2488358)									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	26.7	25.0	6.42	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	1.76	1.33	27.8	0% - 50%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	1.51	1.16	26.2	0% - 50%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	13.0	10.8	18.3	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.56	0.52	7.41	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.10	<0.10	0.00	No Limit
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2494404)									
EB1919297-004	SW08_190627 ES1920340_016	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	6.92	6.57	5.23	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.24	0.24	0.00	0% - 50%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.30	0.30	0.00	0% - 50%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	2.97	2.96	0.404	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.20	0.18	10.3	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2503088)									
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.31	1.27	2.94	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.11	0.09	19.8	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.08	0.07	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.48	0.45	6.30	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
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2488358)									



Sub-Matrix: **WATER**

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: 2488358) - continued									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.75	0.65	14.3	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	2.63	2.18	18.7	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	17.5	14.8	16.4	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.65	0.56	14.9	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	2.2	2.0	7.66	0% - 20%
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2494404)									
EB1919297-004	SW08_190627 ES1920340_016	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.20	0.19	0.00	0% - 50%
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.41	0.42	2.42	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	3.05	3.02	0.856	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.10	0.10	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 (PFTTrDA)	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	0.4	0.4	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2503088)									
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.02	0.02	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.06	0.06	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.12	0.14	10.1	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 (PFTTrDA)	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: 2488358)									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.10	<0.10	0.00	No Limit



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2488358) - continued									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.25	<0.25	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.25	<0.25	0.00	No Limit
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2494404)									
EB1919297-004	SW08_190627 ES1920340_016	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_C: Perfluoroalkyl Sulfonamides (QC Lot: 2503088)									
EB1919297-005	MW09_0.5 ES1920563_008	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



Sub-Matrix: **WATER**

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: 2488358)									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.10	<0.10	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.10	<0.10	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2494404)									
EB1919297-004	SW08_190627 ES1920340_016	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_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2503088)									
EB1919297-005	MW09_0.5 ES1920563_008	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: 2488358)									
EB1919297-001	GMW3_190702 EB1917295_002	EP231X: Sum of PFAS	----	0.01	µg/L	67.3	59.0	13.1	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	39.7	35.8	10.3	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	67.3	59.0	13.1	0% - 20%
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	43.2	37.9	13.0	0% - 20%
EP231_TOP_P: PFAS Sums (QC Lot: 2494404)									
EB1919297-004	SW08_190627 ES1920340_016	EP231X: Sum of PFAS	----	0.01	µg/L	14.8	14.4	2.81	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	9.89	9.53	3.71	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	14.8	14.4	2.81	0% - 20%

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 Work Order : EB1919297
 Client : GHD PTY LTD
 Project : 4132561



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2503093) - continued									
EB1919297-005	MW09_0.5 ES1920563_008	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
EP231P: PFAS Sums (QC Lot: 2503093)									
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Sum of PFAS	----	0.01	µg/L	2.10	2.11	0.475	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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EN33: TCLP Leach (QCLot: 2498611)								
EN33a: Initial pH	----	0.1	pH Unit	1.0	----	----	----	----
EN33a: After HCl pH	----	0.1	pH Unit	1.0	----	----	----	----
EN33a: Final pH	----	0.1	pH Unit	1.0	----	----	----	----

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2488358)								
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	81.9	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	66.9	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2494404)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	1 µg/L	72.5	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	1 µg/L	75.8	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2503088)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	1 µg/L	71.6	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	1 µg/L	61.3	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2488358)								
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	78.4	50	150
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2488358) - continued								
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_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2494404)								
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	82.5	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_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2503088)								
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	77.0	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: 2488358)								
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	----	----	----	----



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2488358) - continued								
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2494404)								
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_C: Perfluoroalkyl Sulfonamides (QCLot: 2503088)								
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: 2488358)								
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	0.00	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2494404)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.05 µg/L	6.00	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2503088)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.05 µg/L	0.00	0	200



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2503088) - continued								
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2488358)								
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	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2494404)								
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	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2503088)								
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	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2503093)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	75.8	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	85.6	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	74.4	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	91.4	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	90.4	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	82.2	70	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2503093)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	86.2	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	88.6	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	88.6	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	94.4	70	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	85.2	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	90.2	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	92.2	70	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	85.4	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	87.2	70	130



Sub-Matrix: **WATER**

Method: Compound				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
CAS Number	LOR	Unit	Result					
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2503093) - continued								
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	91.8	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	90.6	70	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2503093)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	92.4	70	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	101	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	86.4	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	1.25 µg/L	102	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	103	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	86.0	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	110	70	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2503093)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	82.6	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	93.4	70	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	86.2	70	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	90.6	70	130

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: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2503093)							
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	75.6	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	81.8	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	73.4	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	85.2	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	78.6	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	86.6	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2503093)							
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	90.6	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	87.8	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	85.0	50	130



Sub-Matrix: **WATER**

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: 2503093) - continued							
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	88.8	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.5 µg/L	82.6	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	86.0	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	89.6	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	80.8	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	90.4	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	88.2	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	80.2	50	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2503093)							
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	88.4	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	95.0	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	83.2	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	1.25 µg/L	91.8	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	96.7	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	78.6	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	97.8	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2503093)							
EB1919297-005	MW09_0.5 ES1920563_008	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	78.4	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	85.4	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	91.0	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	88.6	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB1919297**

Page : 1 of 6

Client : **GHD PTY LTD**
Contact : **MR DANIEL TODD**
Project : **4132561**
Site :
Sampler : **JACKSON SKOPP**
Order number :

Laboratory : Environmental Division Brisbane
Telephone : +61 7 3552 8639
Date Samples Received : 24-Jul-2019
Issue Date : 05-Aug-2019
No. of samples received : 5
No. of samples analysed : 5

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: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN33: TCLP Leach							
Non-Volatile Leach: 180 day HT (e.g. PFAS, metals ex.Hg) (EN33a) MW09_0.5 - ES1920563_008	25-Jul-2019	31-Jul-2019	21-Jan-2020	✔	----	----	----

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP)) GMW3_190702 - EB1917295_002, GMW6_190702 - EB1917295_003	02-Jul-2019	29-Jul-2019	29-Dec-2019	✔	29-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW06_190625 - ES1920340_001	25-Jun-2019	30-Jul-2019	22-Dec-2019	✔	30-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW08_190627 - ES1920340_016	27-Jun-2019	30-Jul-2019	24-Dec-2019	✔	30-Jul-2019	24-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) MW09_0.5 - ES1920563_008	31-Jul-2019	05-Aug-2019	27-Jan-2020	✔	05-Aug-2019	27-Jan-2020	✔
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X (TOP)) GMW3_190702 - EB1917295_002, GMW6_190702 - EB1917295_003	02-Jul-2019	29-Jul-2019	29-Dec-2019	✔	29-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW06_190625 - ES1920340_001	25-Jun-2019	30-Jul-2019	22-Dec-2019	✔	30-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW08_190627 - ES1920340_016	27-Jun-2019	30-Jul-2019	24-Dec-2019	✔	30-Jul-2019	24-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) MW09_0.5 - ES1920563_008	31-Jul-2019	05-Aug-2019	27-Jan-2020	✔	05-Aug-2019	27-Jan-2020	✔
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X (TOP)) GMW3_190702 - EB1917295_002, GMW6_190702 - EB1917295_003	02-Jul-2019	29-Jul-2019	29-Dec-2019	✔	29-Jul-2019	29-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW06_190625 - ES1920340_001	25-Jun-2019	30-Jul-2019	22-Dec-2019	✔	30-Jul-2019	22-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) SW08_190627 - ES1920340_016	27-Jun-2019	30-Jul-2019	24-Dec-2019	✔	30-Jul-2019	24-Dec-2019	✔
HDPE (no PTFE) (EP231X (TOP)) MW09_0.5 - ES1920563_008	31-Jul-2019	05-Aug-2019	27-Jan-2020	✔	05-Aug-2019	27-Jan-2020	✔



Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X (TOP)) GMW3_190702 - EB1917295_002, GMW6_190702 - EB1917295_003	02-Jul-2019	29-Jul-2019	29-Dec-2019	✓	29-Jul-2019	29-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) SW06_190625 - ES1920340_001	25-Jun-2019	30-Jul-2019	22-Dec-2019	✓	30-Jul-2019	22-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) SW08_190627 - ES1920340_016	27-Jun-2019	30-Jul-2019	24-Dec-2019	✓	30-Jul-2019	24-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) MW09_0.5 - ES1920563_008	31-Jul-2019	05-Aug-2019	27-Jan-2020	✓	05-Aug-2019	27-Jan-2020	✓	
EP231_TOP_P: PFAS Sums								
HDPE (no PTFE) (EP231X (TOP)) GMW3_190702 - EB1917295_002, GMW6_190702 - EB1917295_003	02-Jul-2019	29-Jul-2019	29-Dec-2019	✓	29-Jul-2019	29-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) SW06_190625 - ES1920340_001	25-Jun-2019	30-Jul-2019	22-Dec-2019	✓	30-Jul-2019	22-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) SW08_190627 - ES1920340_016	27-Jun-2019	30-Jul-2019	24-Dec-2019	✓	30-Jul-2019	24-Dec-2019	✓	
HDPE (no PTFE) (EP231X (TOP)) MW09_0.5 - ES1920563_008	31-Jul-2019	05-Aug-2019	27-Jan-2020	✓	05-Aug-2019	27-Jan-2020	✓	
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X) MW09_0.5 - ES1920563_008	31-Jul-2019	02-Aug-2019	27-Jan-2020	✓	02-Aug-2019	27-Jan-2020	✓	
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X) MW09_0.5 - ES1920563_008	31-Jul-2019	02-Aug-2019	27-Jan-2020	✓	02-Aug-2019	27-Jan-2020	✓	
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X) MW09_0.5 - ES1920563_008	31-Jul-2019	02-Aug-2019	27-Jan-2020	✓	02-Aug-2019	27-Jan-2020	✓	
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X) MW09_0.5 - ES1920563_008	31-Jul-2019	02-Aug-2019	27-Jan-2020	✓	02-Aug-2019	27-Jan-2020	✓	
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X) MW09_0.5 - ES1920563_008	31-Jul-2019	02-Aug-2019	27-Jan-2020	✓	02-Aug-2019	27-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	Method	Count		Rate (%)			Quality Control Specification
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB)							
TCLP for Non & Semivolatile Analytes	EN33a	1	7	14.29	9.09	✔	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	2	50.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	2	50.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	2	50.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. 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. 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
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.
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
TCLP for Non & Semivolatile Analytes	EN33a	SOIL	In house QWI-EN/33 referenced to USEPA SW846-1311: The TCLP procedure is designed to determine the mobility of both organic and inorganic analytes present in wastes. The standard TCLP leach is for non-volatile and Semivolatile test parameters.
Preparation for PFAS in water.	EP231-PR	SOIL	Method presumes direct injection without workup. Preparation includes addition of internal standard and surrogate, and filtration prior to analysis.
Total Oxidisable Precursor Digest for PFAS	* ORG70-W	SOIL	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.

Page : 6 of 6
Work Order : EB1919297
Client : GHD PTY LTD
Project : 4132561



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.

Appendix I – Soil Disposal Dockets



8578154

Service
Dkt #

23911

NQ Resource Recovery Pty Ltd ABN 74 057 294 265

TOWNSVILLE (Regional Office): Ph: 4774 7333 Fax: 4774 7099 • PO Box 7948, Garbutt, Q 4814

CAIRNS: Ph: 4019 6600 Fax: 4033 6745 • PO Box 225, Stratford, Q 4870

MT ISA: Ph: 4774 7333 Fax: 4774 7099 • PO Box 7948, Garbutt, Q 4814

MACKAY: Ph: 4829 3100 Fax: 4952 4511 • PO Box 5264 MC, Mackay, Q 4741

DATE:

7 / 8 / 20 11

CLIENT ORDER#:

876748

ACCOUNT #:

CLIENT:

Mackay Airport Fire Service

POSTAL ADDRESS:

Milton St

COLLECTION / DELIVERY
SERVICE ADDRESS:

Mackay QLD 4740

QUANTITY

☐ Oil Collection☐ Oily Water Collection☐ Sludge Collection☐ Greasetrap Collection☐ Septic Collection☐ Dirty Water Collection☐ Fuel Delivery
Type of Fuel☐ collect 1x 240 w/B half full (cont soil)

Time IN

Time OUT

TRAVEL Time

☐ Truck Hire Time☐ Call Out Rate (

) @

/hour

Driver

Customer's Signature

Unit #

Please Print Name

600511011216

Waste Transport Certificate



Q 01660661

Part 1

This section is to be completed by the Generator or Storer of waste, must be one site/location per certificate

[illegible]

Part 2

To be completed
by the Waste
Transporter

I acknowledge the receipt of the waste described in part 1.

Discrepancy: ☐ Waste Type ☐ Volume received ☐ Other _____

If applicable I am acting as an agent for:

Name ☒ Generator ☐ Receiver

Phone No. _____

()

Signature _____

Date / /

Part 3

To be completed by the
Facility Receiving Waste

Name of Receiving Facility MARR																													
Address 3 CREECHTOWNS RD PARKET QLD																													
ABN/ACN 74057294265										Disposal/Treatment Code D15					Physical Nature S					Waste Code No 3120					Postcode 4740				
Environmental Authority No. EPPR00977913										Amount of Waste 120					☒ Litres ☐ Cubic Metres ☐ Kilograms														
If applicable I am acting as an agent ☐ for the Generator I acknowledge the receipt of the waste described in part 1. (Name and Position)																													
Signature 										Phone No. (07) 48293100																			
Date 07/08/2019																													

WHITE COPY
PINK COPY
GREEN COPY
YELLOW COPY
BLUE COPY

- TO BE FORWARDED TO DES BY THE RECEIVER (PARTS 1, 2 & 3 COMPLETED)
- TO BE FORWARDED TO DES BY THE GENERATOR (PARTS 1 & 2 COMPLETED)
- TO BE RETAINED BY THE GENERATOR (PART 1 & 2 COMPLETED)
- TO BE RETAINED BY THE RECEIVER (PARTS 1, 2 & 3 COMPLETED)
- TO BE RETAINED BY THE WASTE TRANSPORTER (PARTS 1 & 2 COMPLETED)

Pollution Hotline No. 1300 130 372

Appendix J – Water Use Survey



3 July 2019

Address

Our ref:

Dear resident

Groundwater survey

Airservices Australia (Airservices) is undertaking a groundwater survey of properties adjacent to the southern and eastern boundaries of Mackay Airport. Airservices has engaged environmental consultants GHD Pty Ltd (GHD) to conduct this groundwater survey.

Airservices is a government owned organisation providing the aviation industry with navigation, and aviation rescue fire fighting services.

Airservices is currently conducting investigations at Mackay Airport relating to Airservices historical use of PFAS containing fire fighting foam on the airport. PFAS stands for 'per- and poly- fluoroalkyl substance'. PFASs are ingredients found in some common domestic products such as paints, dishwasher rinse aids, and textile treatments (water proofing, stain prevention) along with certain types of fire fighting foam called AFFF (aqueous film forming foams) that were used previously by Airservices in firefighting activities. Since 2010, fire fighting foams carried by Airservices at Mackay Airport do not contain PFAS.

The purpose of this survey is to assess the use of groundwater extraction bores on land adjacent to the eastern and southern boundaries of Mackay Airport. The information obtained through this survey will be used by Airservices and Queensland government agencies to determine the extent of bore use in the area, what the bores are used for, and whether further environmental investigations need to be undertaken in the area.

Members of our project team will be door-knocking landowners and residents from 3 July 2019 between 8 am – 5 pm. If you are unavailable during these times, but would like to complete the survey, simply visit <https://www.surveymonkey.com/r/ASAmackay> to complete the survey online by 19 July 2019. The survey should take no longer than 10 minutes to complete.

Airservices works cooperatively with a range of government agencies in relation to its monitoring programs. Details of the groundwater survey may be shared with Airservices' technical advisors, Commonwealth and State regulatory authorities, as well as Mackay Airport, to determine whether further environmental investigations are required.

In the event that Airservices decides to undertake further environmental investigations, the information obtained from the survey would be used to inform that investigation.

It is anticipated information on results will be available in the third quarter of 2019. Airservices will publish the consolidated results on the Airservices website.

For privacy reasons, Airservices will not publish your name or address.

Should you desire further information about the groundwater survey, you can contact the project team on 1800 815 725.

Alternatively, additional information about Airservices and the survey are attached to this letter. Further information can be found at the Airservices Australia website:

<http://www.airservicesaustralia.com/environment/national-pfas-management-program/>

Sincerely
GHD Pty Ltd

Melanie Layton

Stakeholder Engagement Manager



Fact Sheet

Water Use Survey

Q. Who is Airservices Australia?

Airservices Australia provide air traffic control and aviation rescue and firefighting.

Q. Has PFAS been detected at Mackay Airport?

Investigations at Mackay Airport identified the presence of PFAS on airport from the past use of fire fighting foams in close proximity to where fire fighting activities were carried out at the airport.

Q. What is PFAS?

PFAS stands for 'per- and poly- fluoroalkyl substance'. PFASs are ingredients that can be found in some common domestic products such as paints, dishwasher rinse aids, and textile treatments (water proofing, stain prevention) and in certain types of the fire fighting foams called AFFF (aqueous film forming foams).

Q. Does Airservices still use PFAS at the Airport?

Airservices does not use fire fighting foam containing PFAS at Mackay Airport, or any civilian airport in Australia. Airservices stopped using fire fighting foam containing PFAS at the airport in 2010.

Q. What is the purpose of the survey?

The purpose of this survey is to assess the use of groundwater extraction bores on land adjacent to the eastern and southern boundaries of Mackay Airport.

Q. What will the information from the survey be used for?

The information obtained through this survey will be used by Airservices and Queensland government agencies to determine the extent of bore use in the area, what the bores are used for, and whether additional environmental investigations need to be undertaken in the area.

Q. Who will participate in the survey?

Bore owners who live within a targeted area up to 200 metres from the eastern and southern boundaries of the airport will be invited to participate in the survey.

Q. How long does the survey take?

The survey takes about 10 minutes.

Q. Am I allowed to refuse the survey?

The survey is not mandatory. If you do not have a water bore or do not want to complete the survey, please advise the project team.

Q. Can I complete the survey at another time?

The survey can be completed online at a time that is convenient to you. Simply visit <https://www.surveymonkey.com/r/ASAmackay> and follow the prompts. The online survey must be completed by 19 July 2019.

Q. Will I be advised of the survey results?

The survey results go into a consolidated report that will be uploaded to the Airservices website. It is anticipated results will be available in the third quarter of 2019.

Q. Will my personal details be made public?

For privacy reasons, Airservices will not publish your name or address.

Q. Will further investigations be required?

At this stage, it is not known if further investigations are required. Details of the groundwater survey will be shared with Airservices' technical advisors, Commonwealth and QLD regulatory authorities.

Q. Will I be kept informed?

Airservices will keep you informed and will work closely with stakeholders and neighbours should additional investigations be required. Information is anticipated to be available in the third quarter of 2019.

Q. Where can I get more information?

To speak with a member of the project team, please call 1800 815 725.

Water Use Survey - Mackay Airport

The purpose of this survey is to obtain information from you about your water use. Information collected will help us determine the extent of bore use in the area and how bores are being used. In the event that Airservices decides to undertake further environmental investigations in the area, the information obtained from this survey would be used to inform that investigation.

This information is being collected by GHD on behalf of Airservices Australia.

Airservices is a government owned organisation that provides the aviation industry with telecommunications, aeronautical data, navigation services and aviation rescue fire fighting services.

Airservices does not use fire fighting foam containing per- and poly- fluoroalkyl substances (PFAS) at Mackay Airport, and stopped using fire fighting foam containing PFAS in 2010. With the co-operation of Mackay Airport, Airservices undertook a preliminary site investigation at the fire fighting sites which identified PFAS within soil and groundwater. Airservices continues to regularly monitor soil and groundwater samples at the airport where fire fighting foam containing PFAS was used in the past.

The requested information will help inform Airservices' investigation of groundwater use adjacent to the southern and eastern boundaries of Mackay Airport.

The collection of this information is voluntary.

The information you provide may be shared with Airservices technical advisors, the Commonwealth Government, and relevant QLD government agencies, organisations, and entities directly involved in groundwater regulation. Such organisations may include, but are not limited to: North Queensland Airports (NQA) and the Queensland Department of Environment and Science (DES).

Airservices' Privacy Policy is available at <http://www.airservicesaustralia.com/terms-copyright-privacy/>. Airservices' Privacy Policy contains information on how an individual may apply for access to their personal information and how an individual may apply to have their personal information amended. If you have any privacy or security concerns, please contact Airservices online at: <http://www.airservicesaustralia.com/contact-us-2/test-contact-form/> or by email legal@airservicesaustralia.com.

Please note, only residents in the investigation area south and east of the Airport are being surveyed.

* 1. About you (*mandatory fields)

Name*

Address*

City/Town*

Email Address

Phone Number

Feedback from the survey cannot be considered unless a name and address has been provided.

* 2. What land use categories below, best describe how the property / land is currently used? (please tick all boxes applicable to the property).

- | | |
|---|--|
| ☐ Private residential | ☐ Commercial horticultural farm, including ornamental / landscaping plants / stock feed |
| ☐ Private residential, including fruit and / or vegetable garden | ☐ Commercial poultry / egg farm |
| ☐ Private residential, including chickens / other poultry / eggs | ☐ Commercial aquaculture farm |
| ☐ Hobby farm, including livestock / horses | ☐ Commercial livestock / horse breeding |
| ☐ Hobby farm, including chickens / other poultry / eggs | ☐ Other industrial / commercial business |
| ☐ Hobby farm, including fruit trees / vines, and / or vegetables | ☐ Sporting facility |
| ☐ Hobby farm, aquaculture | ☐ Government facility |
| ☐ Commercial horticultural farm, including edible produce | |
| ☐ Other (please provide more detail) | |

3. How is water supplied to the building(s) on your property? (tick all that apply)

- ☐ Mains connection
- ☐ Tank / rainwater
- ☐ Bore water

4. How is water supplied to your property for outdoor (non-household) use? (tick all that apply)

- | | |
|---|---|
| ☐ Mains connection | ☐ Recycled water |
| ☐ Tank / rainwater | ☐ Surface water (dam, creek, pond etc) |
| ☐ Bore water | |

BORE WATER STORAGE AND USE

5. Do you have a groundwater extraction bore(s) at your property?

- ☐ Yes
- ☐ No

6. How many active bores do you have on your property (in working condition)?

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3 or more

7. What is your bore water used for on your property? *(check all that apply)*

- | | |
|--|---|
| ☐ Connected to house- drinking water | ☐ Top up swimming pool/ spa/ wading pool |
| ☐ Connected -to house- household purposes (cooking, washing up, bathing, laundry, toilet) | ☐ Irrigate crops for livestock consumption |
| ☐ Not connected to house- outdoor use (lawn, wash cars, paths, machinery) | ☐ Irrigate crops for human consumption |
| ☐ Not connected to house- food crops (fruit crops, vegetables, vines) | ☐ Water for livestock |
| ☐ Other (please specify) | |

8. Do you have rainwater tanks to supply water at your property?

- ☐ Yes
- ☐ No

9. Have your household rainwater tanks contained bore water, either currently or historically?

- ☐ Yes - my household rainwater tanks are currently mixed with bore water
- ☐ Yes - in the past
- ☐ No - bore water has not been used in rainwater tanks

SURFACE WATER

10. Is there any surface water on your property? *(check all that apply)*

- | | |
|---|--|
| ☐ None (Go to end of survey) | ☐ Pond |
| ☐ Dam | ☐ Wetland |
| ☐ Creek | ☐ Surface drain |
| ☐ Other (please specify) | |

11. How often do you use surface water on your property for the activities listed below?(please tick all that apply)

	Daily	Weekly	Monthly	Quarterly	Annual	Seldom
Drinking	☐	☐	☐	☐	☐	☐
Cooking	☐	☐	☐	☐	☐	☐
Indoor domestic use- showering, washing dishes, laundry, toilet	☐	☐	☐	☐	☐	☐
Outdoor domestic use- swimming pool, sprinkler play, washing vehicles	☐	☐	☐	☐	☐	☐
Fruit/ vegetable garden	☐	☐	☐	☐	☐	☐
Lawn watering	☐	☐	☐	☐	☐	☐
Livestock- drinking or irrigation of feed	☐	☐	☐	☐	☐	☐
Poultry- drinking or irrigation of feed	☐	☐	☐	☐	☐	☐
Irrigation of commercial horticulture/ crops	☐	☐	☐	☐	☐	☐
Dust suppression (commercial sites)	☐	☐	☐	☐	☐	☐
Aquaculture	☐	☐	☐	☐	☐	☐

Other (please specify)

12. Does flood water collect on the property during times of heavy rainfall or king tides?

☐ Yes

☐ No

13. Is the property frequently inundated by a nearby waterway / water source (e.g. river, creek, drain, dam, lake) during times of heavy rainfall or kind tide?

☐ Yes

☐ No

Please provide details, including the name of the creek, pond or dam, if applicable

20 November 2019

Address
Mackay QLD 4740

Dear resident

Groundwater survey

Airservices Australia (Airservices) recently carried out a groundwater survey of properties adjacent to the southern and eastern boundaries of Mackay Airport. Airservices engaged environmental consultants GHD Pty Ltd (GHD) to conduct this groundwater survey.

Airservices Australia is a government-owned organisation that was established in 1995 to provide air navigation and aviation rescue fire fighting services (ARFFS). Airservices has provided these life-saving rescue and fire fighting services at Mackay Airport since 1995.

Airservices has been conducting investigations at Mackay Airport relating to the historical use of PFAS containing firefighting foam on the airport by Airservices. This is a common environmental issue associated with this type of land use. Per-and polyfluoralkyl substances (PFAS) are ingredients in many domestic products such as paints, dishwasher rinse aids, textile treatments (e.g. water proofing, stain prevention), and paper coatings along with certain types of firefighting foam called Aqueous Film Forming Foams (AFFFs). These firefighting foams were previously used by Airservices in firefighting activities. Airservices stopped using firefighting foams containing PFAS at Mackay Airport, in 2010.

Key results of the investigation and water use survey

Initial preliminary on-site investigations at Mackay Airport detected PFAS on airport, in close proximity to the leased sites where Airservices carried out its fire service activities prior to 2010, when it transitioned to a PFAS-free foam, and at other locations not associated with Airservices' activities.

As a precautionary approach, Airservices conducted further targeted offsite sampling on public land adjacent to the eastern airport boundary, including at Shellgrit Creek.

In addition, a survey of groundwater use was conducted on neighbouring properties to the south and east of the airport to determine the use of water adjacent to the southern and eastern boundaries of the airport should further environmental investigations need to be undertaken in the area.

Independent environmental consultancy GHD Pty Ltd undertook the off-airport investigation, on behalf of Airservices, between June and August 2019. Sampling of fish in Shellgrit Creek detected PFAS in fish above human health guidelines. The source of this PFAS is unknown because there have been a

number of other historical users of PFAS products at the airport. Airservices notified the Mackay Airport and the Queensland state regulator, so that appropriate action can be taken.

The water use survey of residents indicated there are no known properties to the south and east of the airport boundaries using groundwater bores for drinking water or irrigation.

Next steps

Airservices will be publishing the investigation report on its website once it is finalised. The water survey results will be published as a consolidated report, and for privacy reasons Airservices will not publish names or addresses.

Airservices will be undertaking a Detailed Site Investigation (DSI) at Mackay Airport beginning 2020 to further understand the extent of PFAS contamination and to inform potential, future management action. Airservices will update the community as the investigation progresses.

Airservices has engaged extensively with the airport and the regulator as part of our investigation of PFAS at Mackay Airport and will continue to do so.

More information

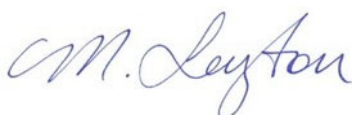
For more information about Airservices' National PFAS Management Program:

- Contact the Airservices project team by email on: pfascomms@airservicesaustralia.com
- Visit the Airservices website: <http://www.airservicesaustralia.com/environment/national-pfas-management-program/>

Other information about PFAS is available from the following websites:

- The Commonwealth Department of Health website: <http://www.health.gov.au/internet/main/publishing.nsf/content/ohp-pfas.htm> and the Commonwealth PFAS website: <http://www.pfas.gov.au/> as well as the
- Department of Environment and Science QLD – PFAS Contamination: <https://www.des.qld.gov.au/>

Kind regards
GHD Pty Ltd



Melanie Layton
Community Relations Manager

GHD
Level 9
145 Ann Street
T: 61 7 3316 3000 F: 61 7 3316 3333 E: bnemail@ghd.com

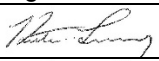
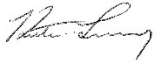
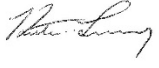
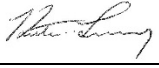
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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
RevA	J.Skopp	K Locsey		D.Todd		
RevB	J.Skopp	K Locsey		D.Todd		21/8/2019
RevC	J.Skopp	K Locsey		D.Todd		4/9/2019
Rev0	J.Skopp	K.Locsey		D.Todd		4/11/2019

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