MFS Adelaide Fire Station

Preliminary Human Health and Ecological Risk Assessment

South Australian Metropolitan Fire Service

30 October 2023

→ **The Power of Commitment**

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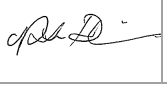
S4	0	N Peachey S Holloman	K Dodd B Petticrew		N Robinson		30/10/23

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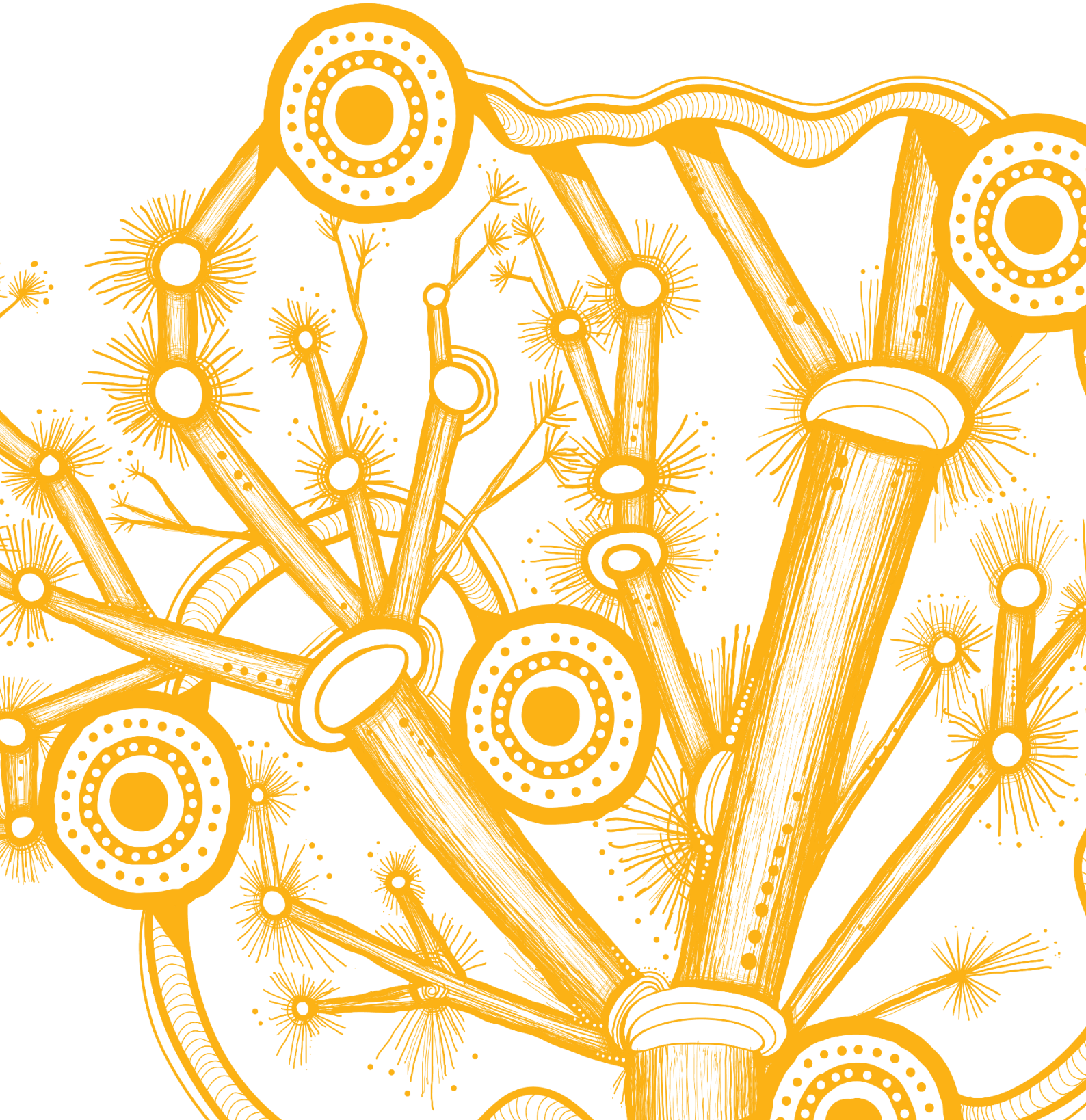
Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



Executive Summary

GHD Pty Ltd (GHD) was commissioned by the South Australia Metropolitan Fire Service (MFS) to undertake a preliminary Human Health and Ecological Risk Assessment (HHERA) for identified contamination from perfluoroalkyl and polyfluoroalkyl substances (PFAS) for the Adelaide Fire Station, located at 99 Wakefield Street, Adelaide, South Australia hereafter referred to as 'the site'.

The works also included a supplementary assessment of surface water and stormwater receptors, specifically the River Torrens (Karrawirra Parri), hereafter referred to as River Torrens, and a stormwater retention basin located in G S Kingston Park (Wirrarninthi). G S Kingston Park is referred to as Park 23 by the City of Adelaide and hereafter in the Report. A site location plan is presented in Figure 1. The surface water and stormwater are hereafter referred to as 'the Investigation Area' and are illustrated in Figures 2, 3, and 6 (Appendix A), respectively.

Objectives and scope of works

The scope of work comprised i) a program of off-site surface water sampling (9 primary samples) within the Park 23 retention basin and River Torrens, and ii) stormwater sampling (3 primary samples within the Wakefield Street stormwater drains (west of the site).

The focus of the report is the PFAS contamination associated with the historical use of AFFF at the site.

The objectives of this report are as follows:

1. To delineate the nature and extent of PFAS site contamination from the site to identified surface and storm water system receptors, specifically the River Torrens and Park 23 stormwater retention basin.
2. To assess the potential risks to human health and the environment associated with on-site PFAS contamination.

Outcomes

Following completion of off-site characterisation and the HHERA. The following findings were made in relation to the project's objectives.

Objective 1 – The nature and extent of PFAS impact in off-site stormwater and surface water

– Stormwater samples (**SW_DISCHARGE 1** to **SW_DISCHARGE 3**) reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criteria. The PFOS concentrations (between 0.0011 µg/L to 0.39 µg/L) measured in all stormwater locations were above the ecological assessment criterion for 99% species protection but below the 95% species protection value. Stormwater samples collected during this investigation within Wakefield Street and Grote Street are considered representative of the site's surface water run-off collected within on-site spoon drains.

– Stormwater samples (**PL_SW01** and **PL_SW02**) collected within Park 23 reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criterion (2 µg/L). The PFOS concentrations (0.062 µg/L to 0.15 µg/L) measured in Park 23 locations, respectively, were above the ecological assessment criterion for 99% species protection but below the 95% species protection value.

– Surface water samples collected from within the River Torrens reported PFOS, PFHxS and PFOA below the adopted human-health assessment criteria. The PFOS concentrations measured in all surface water locations (**RT_SW01** to **RT_SW07**) were above the ecological assessment criterion for 99% species protection. An increase in PFOS concentrations were reported in samples collected within urban sections of the river; up-stream (**RT_SW04** 0.0032 µg/L), cross-stream (**RT_SW05** 0.0037 µg/L), and downstream (**RT_SW06** 0.0029 µg/L and **RT_SW07** 0.0032 µg/L) of the site. Notably, within an order of magnitude of upstream samples (**RT_SW01** to **RT_SW03**) that ranged between 0.001 to 0.011 µg/L.

The assessment of the stormwater and surface water datasets in the context of the CSM demonstrated that:

– The current stormwater dataset representative of general surface water run-off indicates that human-health and ecological risks in off-site receiving environments are low and acceptable.
– The current surface water dataset indicates that PFAS concentrations identified in the River Torrens are ambient concentrations likely associated with other sources in an urban setting and not attributed to the site.

Objective 2 – Assess PFAS contamination exposure risks to human health, water, and the environment.

A preliminary (screening level) HHERA was completed and considered the following potential exposure scenarios:

– Recreational users of the receiving environments, River Torrens, and Park 23.
– Ecological receptors in nearest surface water receiving body, River Torrens.

The risk characterisation under the two scenarios assessed are low and acceptable, with the maximum PFOS, PFHxS and PFOA concentrations lower than the adopted human-health criterion.

The following data gap remains following the completion of this off-site stormwater assessment:

– Potential PFAS impacts in the receiving environment, Park 23, during a high rainfall event, with subsequent overflow from the on-site water dam, is unknown.

Recommendations

The following recommendations are made based on the information detailed within this report:

– Management of the stored water within the site's water dam (retention pit). The water dam contains surface water runoff from the site and likely contributes to the concentrations before being released to the stormwater system during overflow events. It is recommended that the water dam be removed, including disposal of any PFAS impacted water by a suitably licenced contractor.
– An SMP is recommended to manage the existing PFAS impacted soils and stored water within the water dam.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

Table of Abbreviations

Abbreviation	Full Form
ADWG	Australian Drinking Water Guidelines
AFFF	Aqueous Film-Forming Foam
AHD	Australian Height Datum
ANZG	Australian and New Zealand Governments
ASC	Assessment of Site Contamination
ATSDR	Agency for Toxic Substances and Disease Registry
BoM	Bureau of Meteorology
CBD	Central Business District
CC	Capital City
COC	Chain of Custody
COPC	Chemicals of Potential Concern
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DSI	Detailed Site Investigation
DWLBC	Department of Water, Land and Biodiversity Conservation
EC	Electrical Conductivity
EFSA	European Food Safety Authority
Eh	Redox Potential
FOSA	Perfluoralkyl Sulfonamide
GAR	South Australian *Guidelines for the Assessment and Remediation of Site Contamination 2019*
GHD	GHD Pty Ltd
HEPA	Heads of Environment Protection Authorities Australia
HHERA	Human Health and Ecological Risk Assessment
HHRA	Human Health Risk Assessment
JSEA	Job Safety and Environment Analysis
LOR	Limit of Reporting
MAR	Managed Aquifer Recharge
m bgl	Metres Below Ground Level
MFS	South Australian Metropolitan Fire Service
mg/L	Milligrams / Litre
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEMP	PFAS National Environmental Management Plan Version 2.0 - January 2020
NEPC	National Environmental Protection Council
NEPM	National Environment Protection Measure

Abbreviation	Full Form
NHMRC	National Health and Medical Research Council
NOEC	No Observed Effect Concentration
NRMCC	Natural resource Management Ministerial Council
PCA	Perfluoroalkyl Carboxylic Acids
PFAS	Per- and Poly-Fluoroalkyl Substances
PFBA	Perfluorobutanoic Acid
PFBS	Perfluorobutanesulfonic Acid
PFDA	Perfluorodecanoic Acid
PFDS	Perfluorodecanesulfonic Acid
PFHpS	Perfluoroheptane Sulfonic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexane Sulfonate
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PFPeA	Perfluoropentanoic Acid
PFPeS	Perfluoropentane Sulfonic Acid
PFPrS	Perfluoropropanesulfonic Acid
PFUnDA	Perfluoroundecanoic Acid
PSA	Perfluoralkly Sulfonic Acids
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance and Quality Control
ROA	Remediation Options Assessment
RPD	Relative Percentage Difference
SA EPA	South Australian Environment Protection Authority
SAPOL	South Australian Police
SAPPA	South Australia Property and Planning Atlas
SAQP	Sampling and Analysis Quality Plan
SARIG	South Australian Resources Information Gateway
SPR	Source-Pathway-Receptor
SRN	Sample receipts
SSD	Species Sensitivity Distribution
TDS	Total Dissolved Solids
WoE	Weight of Evidence
WQEPP	South Australian *Environmental Protection (Water Quality) Policy* 2015
µg/L	Micrograms / litre
µS/cm	Microsiemens / centimetre

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Appendices

1. Introduction

GHD Pty Ltd (GHD) was commissioned by the South Australia Metropolitan Fire Service (MFS) to undertake a preliminary Human Health and Ecological Risk Assessment (HHERA) for identified contamination from perfluoroalkyl and polyfluoroalkyl substances (PFAS) for the Adelaide Fire Station, located at 99 Wakefield Street, Adelaide, South Australia and is described by the Certificate of Title references CT 6181/979, CT 5943/887, CT 5782/242, CT 5943/888, CT 5346/689, CT 5761/799 and CT 5761/798 (hereafter referred to as 'the site'). The works also included a supplementary assessment of surface water and stormwater receptors, specifically the River Torrens (Karrawirra Parri), hereafter referred to as River Torrens, and a stormwater retention basin located in G S Kingston Park (Wirrarninthi). G S Kingston Park is referred to as Park 23 by the City of Adelaide and hereafter in the Report. A site location plan is presented in Figure 1. The surface water and stormwater are hereafter referred to as 'the Investigation Area' and are illustrated in Figures 2, 3, and 6 (Appendix A), respectively.

1.1 Background

The site is an operational fire station. GHD understands that MFS historically used aqueous film-forming foams (AFFF) containing per- and poly-fluoroalkyl substances (PFAS) as part of training activities undertaken at the site. The use of AFFF containing PFAS ceased in 2016.

MFS has previously engaged GHD to undertake various site investigations (GHD (2017a, 2017b, 2017c, 2021, and 2022)) to determine the nature and extent of PFAS contamination in soil, groundwater, and surface water both on- and off-site. These investigations identified PFAS impacts in on-site soil, groundwater, stormwater, and sediment were either below the nominated assessment criteria and/or were inaccessible to site users. Furthermore, GHD (2022) reported that PFAS impacts in off-site groundwater were not expected to impact human-health, with concentrations below the adopted human-health criterion and the absence of extraction bores downgradient of the site.

GHD (2022) identified a data gap pertaining to PFAS migration offsite, via both surface water flow and groundwater migration but that the migration pathways were not well understood.

Notification of site contamination of underground water was submitted 9 December 2022, to the South Australia Environmental Protection Authority (SA EPA), in accordance with Section 83A of the *Environment Protection Act 1993*.

The SA EPA subsequently reviewed the available reports and issued a letter (reference EPA GENI 62088) concluding the site is a Level 2 regulatory priority in accordance with the SA EPA *Site Contamination Regulatory Framework 2022*. The SA EPA recommended to undertake a '*A detailed site investigation and remediation options assessment (ROA), to achieve the goals of:*

– *Delineating the nature and extent of site contamination; and*
– *Assessing the potential risks to human health, water, and the environment'.*

A meeting was held with the EPA 2 March 2023 to discuss findings of the various assessments undertaken at the site and it was agreed that further work was required to:

– Address data gaps associated with the surface water migration pathway.
– Understand the health and environmental risks associated with the identified PFAS impacts.

This report seeks to address these recommendations.

This report is subject to, and must be read in conjunction with, the limitations in Section 1.6.

1.2 Purpose and objectives

The overarching purpose of this Report is to assist MFS to address PFAS contamination present in association with historical use of AFFF at the site. More specifically, the objective of this further investigation and preliminary (screening level) human health and ecological risk assessment (HHERA) is to address the SA EPA's recommendations to assess the following:

– The nature and extent of off-site PFAS contamination to identified surface and stormwater system receptors, specifically the River Torrens and Park 23 stormwater retention basin.
– Preliminary risk assessment of whether known PFAS concentrations in soil, surface water, groundwater, and sediment have the potential to cause an adverse effect on human health and the environment.

1.3 Overview of PFAS

PFAS are a large family of manufactured chemicals that have been used in Australia and around the world in a variety of commercial processes, household products and specialty applications. The physical and chemical properties of PFAS impart oil and water repellence, temperature resistance and friction reduction, making them useful to consumers and industry.

Firefighting foams containing perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) as active ingredients were once used extensively worldwide and within Australia, including at fire training facilities. Perfluorohexane sulfonate (PFHxS) was also commonly found in firefighting foam as an impurity of its manufacturing process.

Scientists have identified many individual PFAS compounds, but the individual PFAS that generally account for the majority of the PFAS mass in environmental samples include the following:

– Perfluoroalkyl sulfonates (PFSA), of which PFOS and PFHxS are the most well-studied.
– Perfluoroalkyl carboxylates (PFCA), of which PFOA is the most well-studied.
– Fluorotelomers (FtS), including 8:2 FtS and 6:2 FtS.
– Perfluoroalkyl sulfonamides.

The guidelines produced by Australian health and environmental regulators, as detailed in Section 1.4, have focused on PFOS, PFHxS, and PFOA, with PFOS and PFHxS being the predominant PFAS identified within the Investigation Area. PFOS and PFHxS, as well as PFOA, are therefore the focus of this Report. The other PFAS that have been detected at relatively lower concentrations within the Investigation Area have been evaluated in Section 6.9.

1.4 Assessment framework

The Report ERA has been prepared with reference to the following legislation and guidance:

– National Environmental Protection Council (NEPC, 1999) *National Environment Protection (Assessment of Site Contamination) Amendment Measure* 1999, as amended 2013 (the “ASC NEPM”):
– Australian and New Zealand Governments (ANZG, 2018) *Australia and New Zealand Fresh Water and Marine Water Quality Guidelines*.
– Heads of EPAs Australia and New Zealand (HEPA, 2020) *PFAS National Environmental Management Plan, over 2.0 (the “PFAS NEMP”)*.
– Australian and New Zealand Governments (ANZG, 2018) *Australia and New Zealand Fresh Water and Marine Water Quality Guidelines*.
– NHMRC (2019) *Guidance on Per and Polyfluoroalkyl substances (PFAS) in Recreational Water*, National and Medical Research Council, Canberra, 2019
– NHMRC/NRMCC (2011) Australian Drinking Water Guidelines 6, Version 3.6 updated March 2021, National Water Quality Management Strategy, National Health and Medical Research Council and Natural resource Management Ministerial Council, Canberra, 2021 (ADWG)
– SA EPA (2019) Guidelines for the assessment and remediation (GAR) of site contamination, Environment Protection Agency, South Australia, revised November 2019.
– SA Government (2015) *Environment Protection (Water Quality) Policy (WQEPP)*, version 1.7.2020

Guidance provided by international agencies has been referenced where required and consistent with Australian guidance.

1.5 Scope of Work

To achieve the purpose and objectives of the surface water investigation, the following scope of works was completed:

– Collection of 7 primary surface water samples from up- and down-stream of the site within the River Torrens (Karrawarri Parri).
– Collection of 3 primary stormwater samples from stormwater drains along Wakefield and Grote Street, west of the site.
– Collection of 2 primary surface water samples from the Park 23 stormwater retention basin.

Data analysis and reporting

– Laboratory analysis of all surface water and stormwater samples for a “long” PFAS analytical suite (28 compounds), which includes PFOS, PFOA and PFHxS, the primary focus of this investigation.
– Comparison of surface water analytical results to human-health and environment screening criteria.
– Preparation of this report documenting the findings and recommendations of the investigation, and a preliminary (screening level) HHERA.

The scope of works and findings of this investigation should be read in conjunction with limitations provided in Section of this report.

1.6 Limitations

This report: has been prepared by GHD for South Australian Metropolitan Fire Service and may only be used and relied on by South Australian Metropolitan Fire Service for the purpose agreed between GHD and South Australian Metropolitan Fire Service as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than South Australian Metropolitan Fire Service 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 assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Site setting

2.1 Site Identification

This Report encompasses the site and the wider Investigation Area downgradient of the site, as summarised in Table 2.1. A site location plan is presented on Figure 1, Appendix A, and the wider investigation area is presented on Figures 2 and 3, Appendix A.

Table 2.1 Site details summary

Item	Description[1]	Wider investigation area
Site address	99 Wakefield Street, Adelaide SA 5000	Wakefield and Grote Street, Adelaide SA Park 23 River Torrens
Certificate of title	The site comprises land with the following Certificate of Title references: – CT5346/689 – CT5761/798 – CT5761/799 – CT5782/242 – CT5943/887 – CT5943/888 – CT6181/979	-
Local Government Authority	City of Adelaide Council	
Current zoning	Capital City (CC), City of Adelaide (mixed use of light industrial, commercial, and residential)	
Property owner	South Australian Metropolitan Fire Service	City of Adelaide Council
Current Site Use	Operational Fire Station	-
Area	13,601 m²	-
Site Elevation	46 m AHD	-
Site Surface	GHD (2022) observed the site to be relatively flat, with a gentle slope to the west (towards Chancery Lane). The majority of the site surface was sealed, with outdoor surfaces comprising pavers or concrete hardstand at ground surface. Small, unsealed garden bed areas exist in the central-northern, eastern, and southern site boundaries. The sealed surfaces of the site were observed to be in good condition. Some sediment collection around stormwater drainage features was evident. No hydrocarbon staining, aside from minor staining in carpark spaces, was observed.	-

[1]Information was obtained from the South Australia Property and Planning Atlas (SAPPA) database accessed 21/09/2023.

2.2 Site history and conditions

The MFS Adelaide Fire Station was constructed in 1985, with development occurring between 1968 to 1985. The current fire station replaced the old fire station built in 1882. A detailed description for the history of the site was presented in GHD (2017a). Anecdotal information provided by site personnel suggests that:

– AFFF was historically aerially dispersed within the site's training area with runoff likely discharging onto Wakefield Street during on-site firefighting training exercises and testing of delivery systems on firefighting appliances.
– Hoses and pumps were historically flushed of AFFF with water into on-site stormwater drainage following on-site training and testing activities.

2.2.1 Key site infrastructure

The site includes the following key infrastructure:

– Main building (north-eastern portion) including appliance parking and offices.
– No.2 Engine room (central portion of the site) including:
  - Washdown bay used for fire appliances.
  - A drain connected with oily waste separator (adjacent washdown bay). The separated oil and sediment are removed for off-site disposal bi-annually. Separated water connects to sewer.
  - Three underground fuel tanks (adjacent engine room).
– Special Operations building (north-western portion)
– Training Tower (south of Special Operations building)
– Comms Tech building (western portion)
– Storage shed (north of the Logistics building)
– Logistics building (southern portion)
– Surface water drains:
  - Between Main building and washdown bay (running east-west) discharging to Wakefield Street
  - Adjacent (east) Special Operations and Training Tower (running north-south), an inlet is located north of Logistics building.
– Two drain inlets between Special Operations and Training Tower receive run-off from the Training Tower discharging to Chancery Lane, west of the site.
– Basement ejector pits for subsoil and building stormwater (Basement carpark)
– Underground "water dam" that discharges/overflows to Wakefield Street.
– Underground sewer tank that received subsoil collected in the basement ejector pits.

GHD understand that the on-site underground "water dam" was historically used for training. This was ceased in 2018 and it is now used for the collection and storage of surface water run-off. The water dam was high pressure cleaned in 2017, removing 11,150L of water from the dam (based on the storage dimensions of 2m x 2m x 8m), information provided by MFS (dated 11 October 2023).

3. Environmental Setting

Table 3.1 provides a summary of information related to the environment setting of the site and wider investigation area.

Table 3.1 Summary of environmental setting

Item	Description
Geology	South Australian Resources Information Gateway (SARIG) (1:100,000 Surface Geology Map – Adelaide) (accessed 12 September 2023), details the site and surrounds as underlain by Pleistocene aged alluvial/fluvial sediments of the Keswick Clay formation (Qpas) within the St Vincent Basin. GHD understands that detailed subsurface lithology encountered within the site comprised a layer of fill material underlain by alluvial clays. Subsurface lithology encountered by GHD (2022) comprised a layer of fill in the upper 1.0 m bgl, followed by alluvial clay formations (sandy clay, and clay) to a maximum depth of 13.0 m bgl.
Hydrology	The nearest surface water bodies to the site are the River Torrens (Karrawarri Parri), located ~1.3 kilometres (km) northwest, and Park 23 stormwater retention basin, located ~1.6 km west. According to the Department of Water, Land and Biodiversity Conservation (DWLBC) Report (Gerges 2006), the site lies within 'hydrogeological zone 4', which contains up to three Quaternary and two Tertiary aquifers, and a fractured rock aquifer. Each Tertiary aquifer consists of thin layers of fine sand with low yield. The Quaternary and Tertiary aquifers are described as becoming thin, shallow, and interconnected in the vicinity of the River Torrens. The shallow fractured rock aquifer near the River Torrens contains groundwater of low salinity and significant yield. A search of the SARIG database identified shallow groundwater below the site and surrounds (ranging from 5 m below ground level (bgl) to 15 m bgl). Salinity of groundwater in the region ranges from 1,500 to 3,000 mg/L indicating fresh to brackish water with a reported yield of 0.5 L per second to 2.5 L per second. Registered groundwater bores located northwest of the site, and south of the River Torrens identified within the WaterConnect interactive database are discussed further in Section 3.1 and tabulated in Appendix I.
Local hydrogeology	Groundwater at the site lies within a sandy clay layer with standing water levels (SWL) measured between 11.69 to 13.16 m bgl on site. The aquifer is considered semi-confined by a layer of clay overlying the sandy clay aquifer. The River Torrens is down hydraulic gradient based on the groundwater flow direction to the northwest. Park 23 is cross hydraulic gradient to the site; however, it receives stormwater discharge from the site (and surrounding urban areas).
Topography and drainage	The site consists of a raised ground surface in the eastern portion, sloping towards a surface drain (running east – west), that connects to an off-site stormwater drain within Wakefield Street, north of the site. The western portion of the site has surface drains (running north – south) to an inlet that discharges to Wakefield Street. Basement ejector pits for subsoil and building stormwater are in the basement carpark. The subsoil and wastewater for the site are connected to the sewer, which leads to Wakefield Street. GHD (2017) observed two water dams on-site, located in the western portion of the site. GHD (2022) stated one of the dams is known to remain on-site, while the status of the second water dam is unknown. The water dam observed in the western portion of the site currently holds stored surface water that is known to overflow and discharge to Wakefield Street stormwater drains. The topography surrounding the site is observed as relatively flat and forms part of the Adelaide Plains between Gulf St Vincent to the west and the Mount Lofty Ranges to the east. Surrounding areas of the site have an elevation of approximately 45 to 50 m Australian Height Datum (AHD), with the land surface sloping gently to the west. The surrounding land within the Adelaide Central Business District (Adelaide CBD) is largely covered with sealed surfaces (hardstand, bitumen, etc.), with the majority of stormwater discharging to the Adelaide Parklands to the west via stormwater drainage throughout the Adelaide CBD.
Ecological constraints	The nearest groundwater dependent ecosystems (GDE) and inflow dependent systems (IDE) are the River Torrens, located approximately 1.3 kilometres (km) northwest of the site.
Note: A detailed description of the environmental setting of the site and surrounding environment is presented by GHD (2022).	

3.1 Groundwater use

A desktop review of the publicly available WaterConnect database identified 560 bores north-west of the site (within ~1.5km), based on inferred groundwater flow, and south of the River Torrens. The registered bores listed their purpose as drainage, environmental, exploration, investigation, managed aquifer recharge (MAR), monitoring, observation and unknown. No bores were identified for beneficial use (i.e., water supply). The database was subsequently filtered by land use, well type, standing water level (SWL) <50 metres (m), and total dissolved salinity (TDS) below 1,200 mg/L (highest threshold with Australian Drinking Water Guidelines (ADWG)), reducing registered bores to 52 bores (presented in Appendix I).

Of the 52 registered bores, the land use was identified as commercial, that ranged between residential apartment buildings, hospitality venues, hospitals, service stations, and a combination of office buildings, retail, and other business, carparks, and roads. Two bores, 6628-28631 and 6628-413, registered as unknown and recreational use, respectively, were considered in greater detail:

– Registered bore (6628-28631), installed in 2016, with no registered purpose, and a depth of 25 m bgl, located ~50 m cross gradient from the site. GHD (2022) stated that this bore not located within vacant land (126 Wakefield Street, Adelaide SA), likely destroyed.
– Registered bore (6628-413), installed prior to 1949, registered for recreational land use, in Elders Park adjacent the River Torrens, ~1.4 km down gradient from the site. This bore with no registered status (i.e., operational) was likely destroyed during the installation of the River Torrens Linear Park Trail.

In this context, there were no registered bores identified for beneficial use (non-potable or potable), downgradient (northwest), between the site and the southern bank of the River Torrens.

3.2 Surrounding environment

The current surrounding land use for the investigation area are summarised in Table 3.2.

Table 3.2 Summary of surrounding land use/zoning information

Direction	Land Use/Zoning
North	Land use immediately to the north of the site bounded by Wakefield Street is classified as public and commercial use with businesses including corporate offices and Torrens University. Hindmarsh Square is located approximately 500m to the north of the site. The River Torrens located approximately 1.3km to the north of the site is the nearest surface water body.
East	Commercial properties are located immediately to the east of the site. Residential properties are located approximately 875m to the east and south of Pulteney Street. Victoria Park is located 1km to the east of the site.
South	The South Australian Police (SAPOL) Headquarters[1] are located on Angus Street, immediately adjacent to the southern boundary of the site. The Calvary Adelaide Hospital[1] borders the western boundary of the SAPOL Headquarters, and SW boundary of the Adelaide MFS Fire Station. Sites further south of Angas Street are a combination of residential and commercial sites. A public park is located approximately 1 km south of the site.
West	Commercial properties are located immediately to the west of the site. St Aloysius College and Chancery Lane Montessori Preschool are located on Chancery Lane. The City Park of Victoria Square (Tarntanyanga) is located approximately 500m west of the Fire Station. The Park 23 stormwater retention basin that manages the CBD stormwater flow is located within recreational parklands approximately 1.5 km west of the site.
[1]The SAPOL Headquarters and Calvary Adelaide Hospital previously comprised a Mitsubishi Service Centre.	

3.3 Wider investigation area

The extent of the wider investigation area is consistent with the scope of works (described in Section 1.3), and illustrated on Figure 2, Appendix A. Notably, the current surface water and stormwater sampling events focused on locations up- and down-gradient of the site with the River Torrens, and cross gradient stormwater discharge outlets within Wakefield and Grote Streets (west of the site) that receives surface water via a stormwater drainage system from the site, and directed to Park 23 (illustrated on Figure 1, Appendix A). A photolog is presented in Appendix H.

The off-site locations: River Torrens and Park 23, in the wider investigation area are described in the following sections.

3.3.1 River Torrens

The River Torrens is ~85 km in length, flowing from the Mount Lofty Ranges near Mount Pleasant, fed by numerous ephemeral creeks, and emptying into the Gulf St Vincent between Henley Beach South and West Beach. Upstream, there are three reservoirs within the Adelaide Hills (Hope Valley, Millbrook, and Kangaroo Creek) which capture water from the river and supply 60% of Adelaide's water needs. Due to variability in Adelaide's climate, the River Torrens has variable flow rates.

Torrens Lake was constructed in 1881 within the River Torrens that flows through the CBD. Construction included landscaping and high modification of the riverbank and surrounds, and the development of a weir. Torrens Lake is located ~1.3 km downgradient, northwest of the site (illustrated on Figure 2, Appendix A). It is documented that in Spring and Summer, the natural flow of the river is limited within Torrens Lake, and often polluted with algal blooms and significant levels of E. coli bacteria[1]. On this basis, recreational use of Torrens Lake is limited to boating activities.

The River Torrens catchment is located within the central part of Adelaide, flowing through urban areas, fed by stormwater runoff, that affects water quality, indicating a moderate to highly disturbed system. Rubbish accumulation downstream is controlled within collection racks, sediments and other pollutants are filtered through man-made wetlands.

The urban section of the River Torrens provides habitat for several flow dependent aquatic macroinvertebrates. The lower River Torrens occasionally supports a range of threatened and common species of fish (i.e., Climbing Galaxias, Short-finned Eel, and Lamprey).[2] A study (EPA SA, 2011) of the River Torrens, Bonython Park (downstream of Lake Torrens) reported major changes in the river's ecosystem structure, with considerable evidence of human disturbance that included gross nutrient enrichment and degraded riparian vegetation.

3.3.2 Park 23 stormwater retention basin

Park 23 is a 57.4-hectare (Ha) parcel of land bound by West Terrace to the east, Sir Donald Bradman Drive to the north, Anzac Highway to the south, and railway lines to the west. A significant proportion of the site encompasses the West Terrace Cemetery. Historically, Park 23 comprised a rubbish tip and quarry[3].

In the early 1990s, three retention basins were designed and constructed to manage stormwater flow through the northern portion of the park[4]. The intention being that the retention basins would improve overall water quality through sedimentation and flow through vegetation. The stormwater system within Park 23 since its inception has had further planting and is currently maintained as a wetland area for aesthetics.

The northern portion of Park 23 (~17 Ha) is ~1.5 km west, downgradient of the site (illustrated on Figure 3, Appendix A). GHD (2022) observed that stormwater from the site is discharged into the Adelaide CBD stormwater system, where it is then directed into the series of retention basins via drainage channels within Park 23. This stormwater then having flowed through Park 23 is directed into a stormwater channel, that connects with the River Torrens several kilometres away, and ultimately discharges to Gulf St Vincent.

[1] **How blue-green algae blooms are managed in Adelaide's Torrens Lake (environment.sa.gov.au)**
[2] **Torrens River, Bonython Park 2011 Aquatic Ecosystem Condition Report | EPA**
[3] **45-04 Quarry, Rubbish dump, Works depot | Adelaide City Explorer**
[4] **Water Sensitive SAPark 23, Western Parklands detention basins, Adelaide - Water Sensitive SA**

Park 23 is made up of play spaces, sports fields, gardens, and wetlands. An environmental trail loops around the northern portion of the park. For an unknown time during 2022, the Department of Human Services ran a temporary pop-up medical hub to support remote communities. A transient community remains within the northern portion of the park, GHD field staff observed the washing of dishes in one of the retention basins.

3.4 Climate

The impact of rainfall is an important factor that can affect discharges from the site into the receiving environment, Park 23.

Climate conditions

Adelaide has a warm temperate climate (low diurnal temperature range near coast to high diurnal range inland) ranging from mild winters with low humidity, and hot to very hot summers with moderate humidity. Higher rainfall is recorded between May to September. Plate 3.1 (in text) shows mean monthly rainfalls recorded at Adelaide (West Terrace / Ngayirdapira) weather station (023000) between 1839 and the present day with most precipitation falling between June and August.

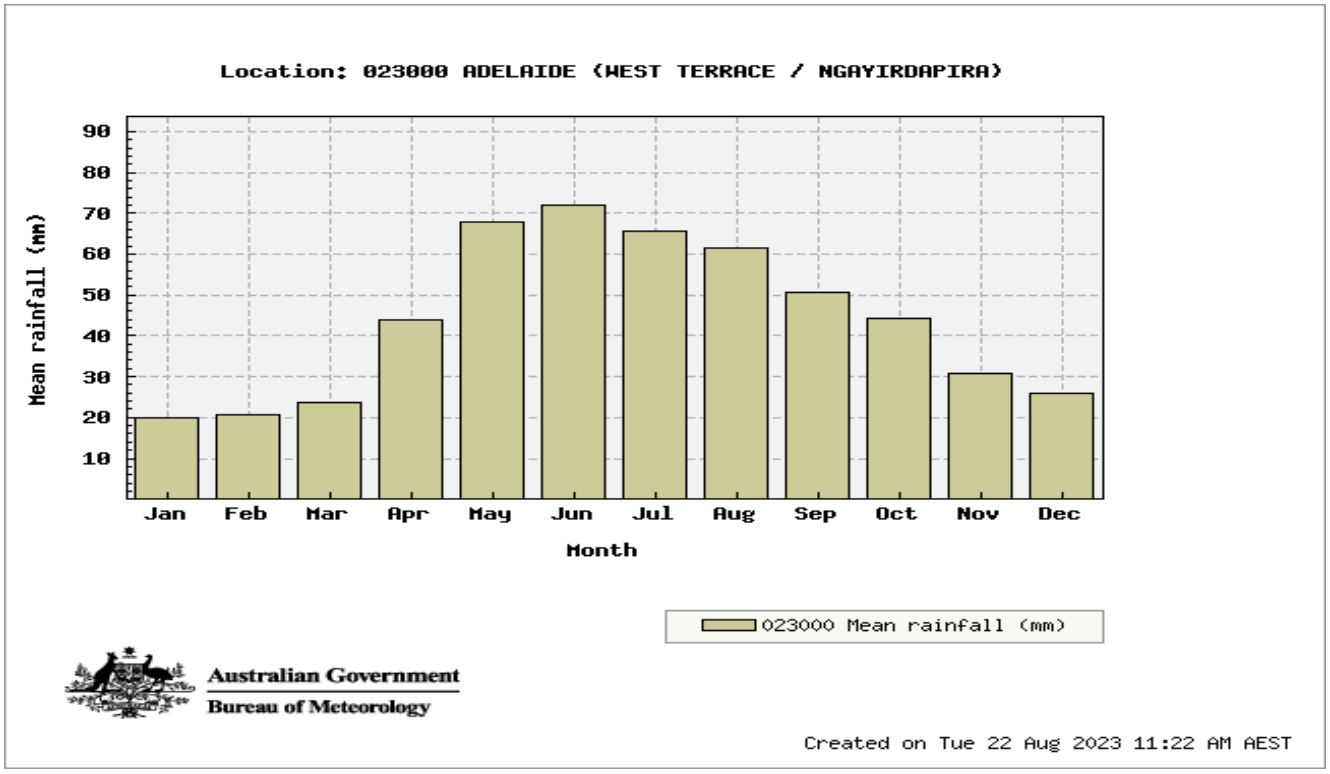

Plate 3.1 ***Mean monthly rainfalls recorded at Adelaide (West Terrace / Ngayirdapira) weather station [023000] between 1839 and present day, accessed from www.bom.gov.au on 22 August 2023.***

Climate conditions at the time of monitoring events

Surface and storm water sampling was completed during a period of rainfall, reflected on Plate 3.2 to Plate 3.4 (in text), recorded at Adelaide (West Terrace / Ngayirdapira) [023000].

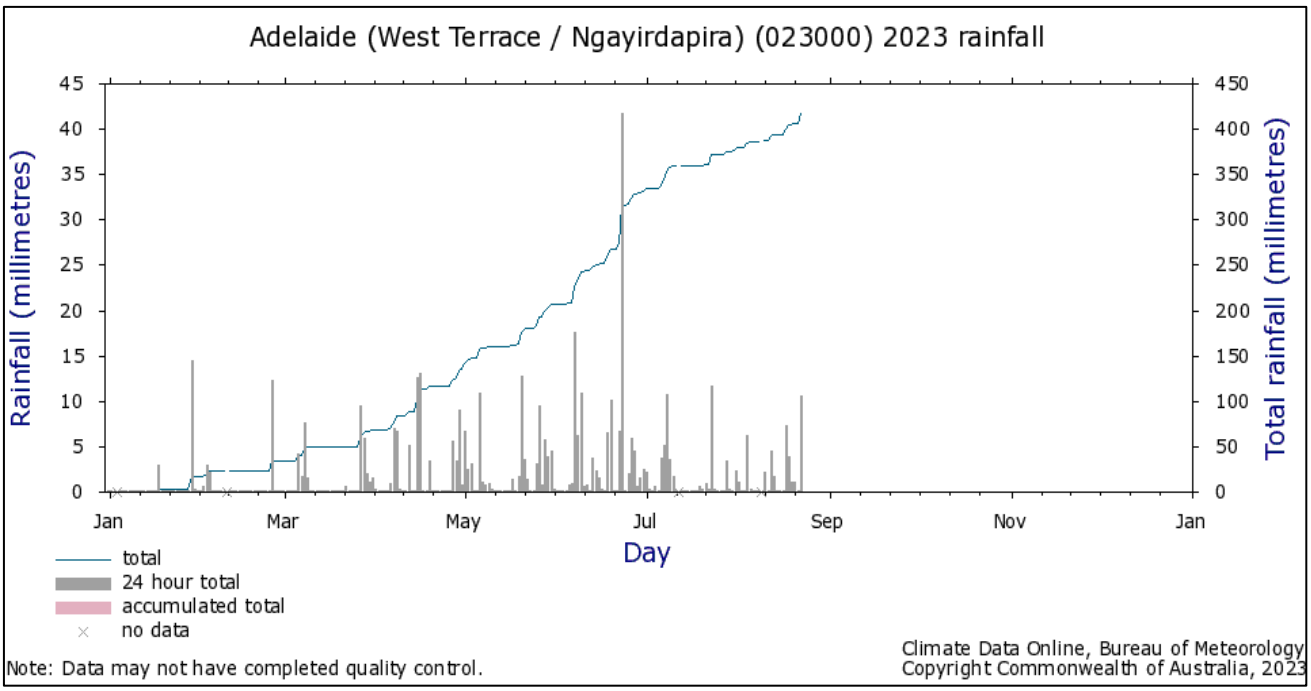

Plate 3.2 ***Daily rainfall graph obtained from www.bom.gov.au reported at weather station [023000]***

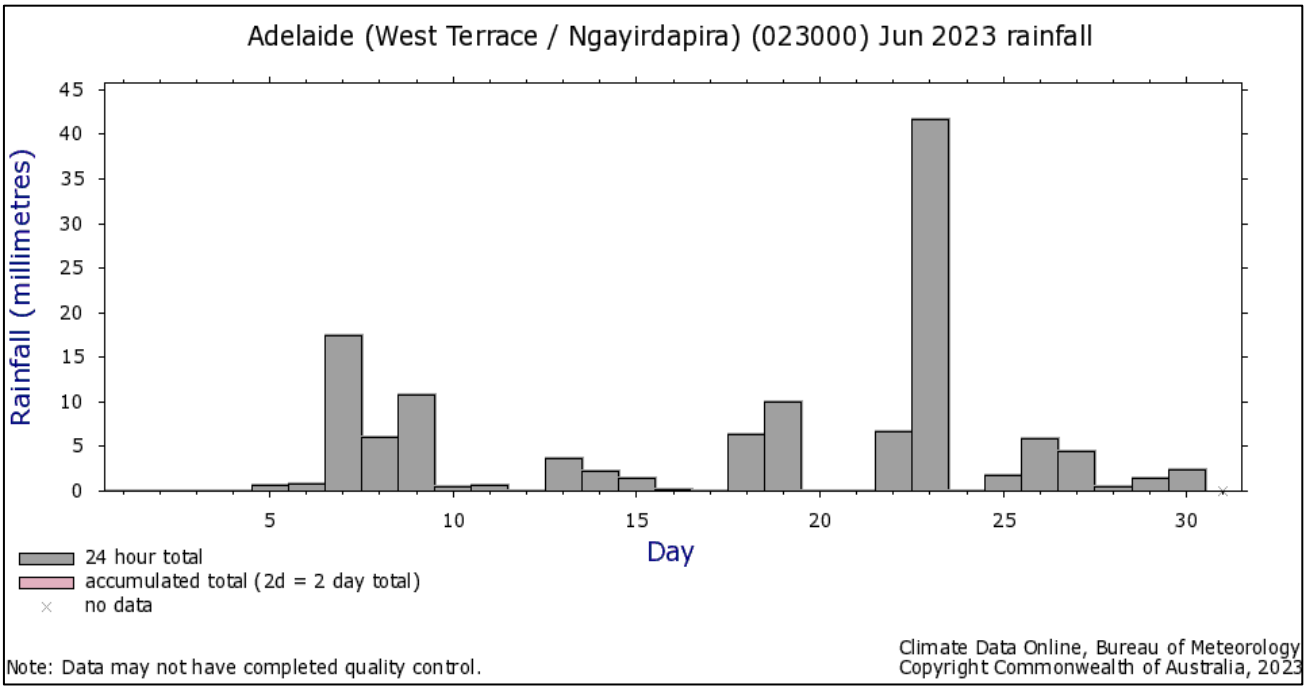

Plate 3.3 ***Daily rainfall graph for the 9th of June 2023 obtained from www.bom.gov.au reported at weather station [023000]***

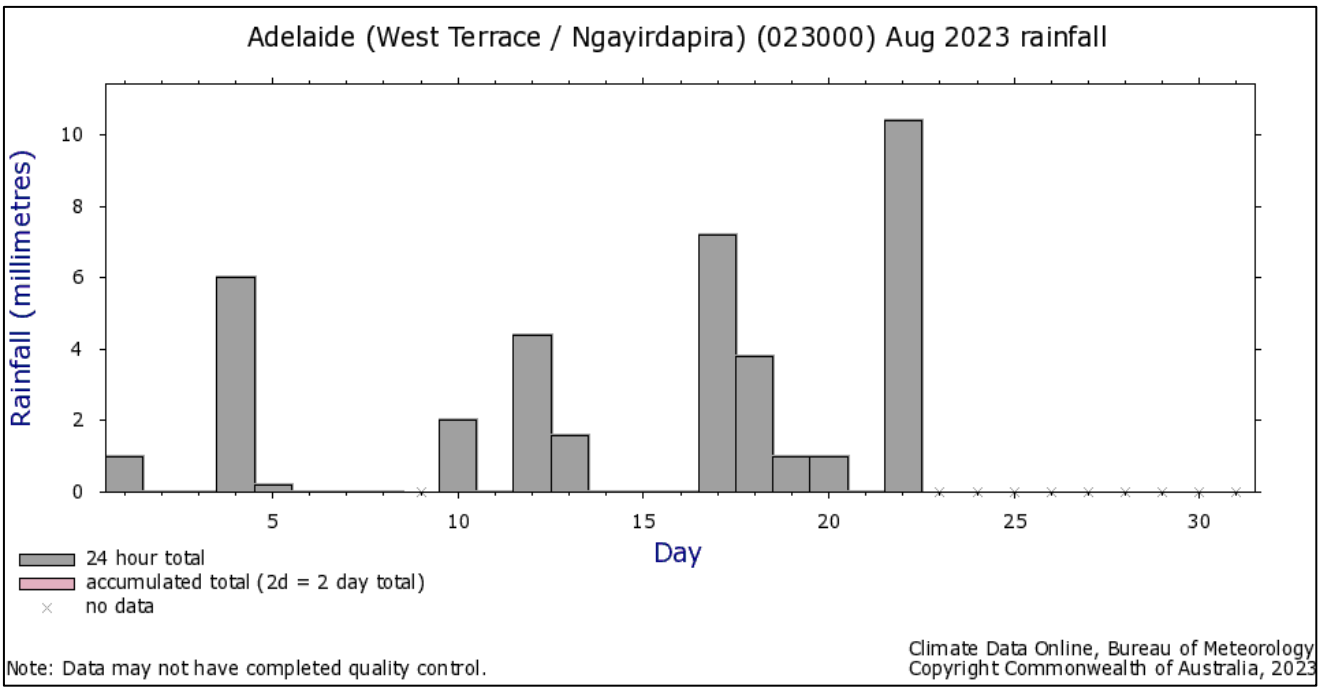

Plate 3.4 ***Daily rainfall graph for the 4th of August 2023 obtained from www.bom.gov.au reported at weather station [023000]***

4. Investigation methodology

The following section details the sampling and analysis program developed to address the objectives and the scope of works for the investigation. A team of suitably qualified GHD environmental scientist conducted the field program on 9 June 2023 and 4 August 2023. Sampling locations are presented on Figures 2 to 4, Appendix A.

4.1 Data quality objectives

The quantity, nature and quality of the data collected in any environmental investigation are determined by establishing data quality objectives (DQOs). Consideration of the DQOs must be given to ensure sufficient data are gathered to characterise potential contamination and considerations at the site and to enable the preparation of a CSM. The DQOs for this investigation have been developed in accordance with Schedule B(2) of the NEPM ASC, presented in Appendix B.

4.2 Investigation rationale

4.2.1 Key data gaps identified by GHD (2022)

Table 4.1 Data gaps identified by GHD (2022)

Data gaps	Comments
Extent of the presence of PFAS in groundwater off-site has not been delineated which has the potential to impact downgradient groundwater users and ecological receptors including nearby surface water bodies (site sourced or ambient).	Potentially complete SPR linkages identified for groundwater. GHD (2022) identified PFAS impacted groundwater migrating off-site (presented in Figure 8, Appendix A). A data gap exists regarding migration and discharge of PFAS impacted groundwater to surface water exposing aquatic ecosystems of the River Torrens.
PFAS concentrations in on-site surface water were reported above human-health and ecological criteria. The potential for PFAS contamination to be transported off-site via stormwater discharge impacting Park 23 has not been investigated.	A potentially complete SPR linkage was identified with discharge and migration of stormwater from site to the receiving environment within Park 23.

4.2.2 Sampling plan

A sampling plan was developed for this investigation to close the data gaps presented by GHD (2022). The sampling plan was designed to target off-site surface water identified as having the potential for PFAS contamination, based on the following:

– Stormwater runoff from the site, and transportation via the stormwater drainage network to the Park 23 stormwater retention basin.
– Collection of surface water samples within the River Torrens (nearest surface water body) to assess whether there is a link between groundwater impacts beneath the site and the River Torrens.

Investigation rationale for the selection of the surface water and stormwater sampling points are shown in Table 4.2.

Table 4.2 Investigation location rationale

Sample ID	Location	Media	Rationale
PL_SW01	Park 23 (stormwater retention basin)	Surface water	To characterise the nature of potential surface water impacts in Park 23 based on migration of stormwater discharge from the site.
PL_SW02			
RT_SW01	River Torrens (upstream)		To characterise the nature of surface water within River Torrens upstream of the site. Sampling locations as follows: – West of Kangaroo Creek Reservoir (~1.4km). – West of Kangaroo Creek Reservoir (~4km). – Edge of residential suburbs, west of Kangaroo Creek Reservoir (~5.5km). – Adelaide (suburb of Paradise) approximately 8km upstream of site.
RT_SW02			
RT_SW03			
RT_SW04			
RT_SW05	River Torrens (north)		To characterise the nature of surface water within River Torrens cross-gradient of the site (~1.3 km).
RT_SW06	Lake Torrens (downstream)		To characterise the nature of surface water within River Torrens downstream of the site.
RT_SW07	River Torrens (downstream)		
SW_Discharge 1	Wakefield Street (adjacent fire station)	Stormwater	To characterise the nature of potential surface water impacts within the CBD stormwater system (Wakefield and Grote Streets) migrating to Park 23.
SW_Discharge 2	Wakefield Street (west of fire station)		
SW_Discharge 3	Grote Street (west of the fires station)		

4.3 Field methodology

The surface and storm water sampling methodologies are summarised in Table 4.3. Field notes are presented in Appendix F. A photolog is presented in Appendix H.

The stormwater sampling program was an opportunistic event, undertaken shortly after a substantial rainfall event (6 mm rainfall)) as shown in Plate 3.4. It was considered necessary that the stormwater be collected during after a recent rainfall event to reflect PFAS contamination moving offsite. Immediately prior to sampling, the MFS personnel also hosed down the training area so that the samples collected in the stormwater system were from active runoff and not a stagnant source.

Water was observed to be flowing from the site through a spoon drain and discharging onto Wakefield Street at a high rate (SW_DISCHARGE 1). The water was allowed to flow until the sediment load had cleared and then a sample was collected. Another sample was collected approximately 100 m west of the site, from a storm drain (S _DISCHARGE 2) that was noted as flowing very slowly but assumed to be direct runoff from the release of water at the site. A third sample was collected from a storm drain approximately 800 m west of the site on Grote Street (extension of Wakefield Street). This sample was stagnant and considered representative of recent storm runoff from the recent rainfall event.

Table 4.3 Sampling field methodology

Activity	Details
General	Site and task specific Job Safety and Environmental Assessments (JSEAs) were designed and implemented for each field mobilisation, which included identifying site-specific hazards.
Field equipment	All field equipment was calibrated prior to undertaking field work. Calibration certificates are presented in Appendix F.
Surface water sampling	Surface water sampling was undertaken from the River Torrens. Grab samples were collected directly into laboratory supplied 500ml sample bottles appropriate for PFAS analysis. Each sample bottle was appropriately labelled with a unique GHD job number, sample identification and sampling date. Water quality parameters (pH, dissolved oxygen, electrical conductivity, reduction/oxidation (redox) potential and temperature) were measured using a YSI Quatro Pro Plus multi parameter water quality meter and recorded using sampling record sheets. The surface water was visually assessed for turbidity and any evidence of contamination and recorded in field sheets (provided in Appendix F).
Stormwater sampling	Stormwater sampling was undertaken as grab samples from water within the stormwater drain and collected directly into laboratory supplied 500ml sample bottles appropriate for PFAS analysis. Each sample bottle was appropriately labelled with job number, sample ID and sampling date. Sample methodology in the off-site stormwater system as follows: – Stormwater samples SW_DISCHARGE 1 and SW_DISCHARGE 2 were collected from a trickle of running water originating from surface water runoff generated from training hoses running on-site. – Stormwater sample SW_DISCHARGE 3 was collected from stagnant water within the stormwater drain ~800m west of the site.
Sample preservation and transport	Samples were stored on ice in an insulated cooler and kept chilled for the duration of sampling and transport to the laboratory. All samples were transported to the laboratory by GHD field staff under chain of custody (COC) documentation provided in Appendix G.
Decontamination	All non-disposable equipment (water quality meter) was washed with a PFAS and phosphate-free detergent between each sample location. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination.

Further care and mitigation practice was implemented during sampling to minimise the potential for cross contamination during sample collection and transport, in accordance with HEPA (2020).

5. Investigation results

Surface water and stormwater samples were submitted to NATA accredited laboratories for analysis. Sample results were compared to the assessment criteria (Section 6.6.1) presented in Table C1, Appendix C. Laboratory reports, chain of custody (COC), and sample receipts (SRN) are provided in Appendix G. Sample locations and exceedance of the adopted assessment criteria is presented on Figures 4, 5 and 7, Appendix A.

5.1 Quality assurance and quality control (QAQC)

The GHD field team collected surface water and stormwater samples in accordance with methods described in Schedule B(2) of the ASC NEPM.

The review of the QA/QC program (presented in Appendix E) indicates that, with the exception of the non-conformances summarised in Appendix E, the vast majority of the GHD and laboratories QA/QC parameters were within the specified requirements. Therefore, the analytical data is considered valid and of acceptable quality for the purposes of this investigation.

5.2 Water quality

Water quality parameters comprising pH, dissolved oxygen (DO), electrical conductivity (EC), redox potential (Eh), and temperature are presented in Table 5.1. Field sheets are provided in Appendix F.

Table 5.1 Summary of water quality parameters (June 2023 and August 2023)

Investigation location	Sample ID	Date	pH (Field)	DO (mg/L)	EC (µS/cm)	Field Eh (mV)	Temp (°C)	Comments
River Torrens (upstream)	RT_SW01	June 2023	8.22	9.05	449.4	81	11.9	Pale yellow Low turbidity No sheen / odour
	RT_SW02		8.1	10.73	351.5	80.9	12.2	Brown High turbidity No sheen / odour
	RT_SW03		7.89	8.25	530	94	12.8	Yellow Moderate turbidity No sheen / odour
	RT_SW04		7.9	5.73	586.2	97.7	14.1	Colourless Low turbidity No sheen / odour
River Torrens (north)	RT_SW05		7.78	4.3	296.6	105.5	13.9	Colourless Moderate turbidity No sheen / odour
Lake Torrens (downstream)	RT_SW06		7.75	5.73	294.8	111.7	14.2	
River Torrens	RT_SW07		7.85	7.95	320.7	117	14.6	

Investigation location	Sample ID	Date	pH (Field)	DO (mg/L)	EC (µS/cm)	Field Eh (mV)	Temp (°C)	Comments
(downstream)								
Park 23 (stormwater retention basin)	PL_SW01	August 2023	8.02	5.42	1069	122	17.5	Colourless Low turbidity No sheen / odour
	PL_SW02		7.57	2.42	3799	108	16.6	Pale yellow Low turbidity No sheen / odour

5.3 Surface water analytical results

All surface water samples collected from within the River Torrens reported PFOS, PFHxS and PFOA below the adopted human-health assessment criteria. The PFOS concentrations measured in all surface water locations (**RT_SW01** to **RT_SW07**) were above the ecological assessment criterion for 99% species protection (HEPA, 2020). An increase in PFOS concentrations were reported in samples collected within urban sections of the river; up-stream (**RT_SW04** 0.0032 µg/L), cross-stream (**RT_SW05** 0.0037 µg/L), and downstream (**RT_SW06** 0.0029 µg/L and **RT_SW07** 0.0032 µg/L) of the site. Notably, within an order of magnitude of upstream samples (**RT_SW01** to **RT_SW03**) that ranged between 0.001 to 0.011 µg/L.

PFHxS, that does not have an assigned ecological criterion, reported concentrations greater than the laboratory limits of reporting (LOR) in all surface water samples (except for upstream sample **RT_SW01**) ranging between 0.001 µg/L to 0.002 µg/L.

Overall, the concentrations of PFAS measured in surface water up- and down-stream of the site within the River Torrens indicate that groundwater impacts beneath the site are not demonstrably influencing the PFAS concentrations in surface water quality within river. The concentrations measured in the River Torrens are suggestive of various sources other than the fire station that contribute to the PFAS concentrations. It is noted that the catchment is heavily modified and PFAS is ubiquitous in urban settings.

5.4 Stormwater analytical results

5.4.1 Stormwater drainage system (Wakefield and Grote Streets)

All stormwater samples reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criteria. The PFOS concentrations (between 0.0011 µg/L to 0.39 µg/L) measured in all stormwater locations (**SW_DISCHARGE 1** to **SW_DISCHARGE 3**) were above the ecological assessment criterion for 99% species protection but below the 95% species protection value (HEPA, 2020).

The following PFAS analytes, which do not have an assigned ecological criterion, reported concentrations within one order of magnitude above the LOR within stormwater samples:

- **SW_DISCHARGE 1** reported concentrations in PFPrS, PFBS, PFPeS, PFHxS, PFHpS, PFDS, PFBA, PFPeA, PFHxA, PFOA, PFDA, PFUnDA, and FOSA.
- **SW_DISCHARGE 2** reported concentrations in PFHxA.
- **SW_DISCHARGE 3** reported concentrations in PFPeA, PFHxA, PFHpA, and PFOA.

SW_DISCHARGE 1 (adjacent the site) reported 0.39 µg/L, the highest level of concentration that reduced by an order of magnitude to 0.011 µg/L in stormwater sample **SW_DISCHARGE_2** (Wakefield Street) that indicates dilution is occurring within ~100 m from the site. Comparatively, GHD (2022) reported PFOS concentrations within on-site drainage samples between 0.15 µg/L (**SW16**) and 5.0 µg/L (**SW01**) (presented in Table C4, Appendix C)

5.4.2 Park 23 stormwater retention basin

All stormwater samples collected within Park 23 reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criterion (2 µg/L). The PFOS concentrations (0.062 µg/L to 0.15 µg/L) measured in Park 23 locations **PL_SW01** and **PL_SW02**, respectively, were above the ecological assessment criterion for 99% species protection but below the 95% species protection value (HEPA, 2020). The PFOS concentration accounted for 30% of total PFAS concentration in both samples.

The following PFAS analytes, which do not have an assigned ecological criterion, reported concentrations within one order of magnitude above the LOR within Park 23 stormwater samples:

– **PL_SW01** reported concentrations in PFPrS, PFBS, PFPeS, PFHxS, PFHpS, PFPeA, PFHxA, and PFOA.
– **PL_SW02** reported concentrations in PFPrS, PFBS, PFPeS, PFHxS, PFHpS), PFBA, PFPeA, PFHxA, PFOA, PFNA, and PFDA.

6. Preliminary (screening level) human-health and ecological risk assessment

6.1 Introduction

The objectives of this preliminary (screening level) human-health and ecological risk assessment (HHERA) are to assess the following:

– The nature and extent of off-site PFAS contamination to identified surface water and stormwater system receptors, specifically the River Torrens via groundwater and Park 23 stormwater retention basin via surface water.
– Whether known PFAS concentrations in soil, surface water, groundwater, and sediment have the potential to cause an adverse effect on human-health and the environment.

As outlined in Section 1.1, the PFAS concentrations measured in on-site soil, sediment, surface water, and groundwater do not present a human-health and /or ecological risk in its current layout. Similarly, PFAS concentrations measured in off-site groundwater do not pose a risk to human-health for abstraction of groundwater for beneficial use (i.e., potable, and non-potable) based on the absence of groundwater extraction for beneficial use downgradient of the site (Section 3.1) and therefore is not considered in this HHERA.

The key steps in the HHERA process are outlined in Plate 6.1 overleaf and can be summarised as follows:

– ***Issues identification:*** establishes the objectives of the HHERA, evaluates the available data and establishes a preliminary CSM.
– ***Receptor identification:*** identifies the human and ecological species that may be at risk and evaluates the level of acceptable risk in the context of ecological values that need to be protected.
– ***Toxicity assessment:*** establishes the relationships between chemical exposure and potential health and ecological effects.
– ***Exposure assessment:*** produces estimates of the chemical exposure that may be experienced by the identified human and ecological receptors of the site and surrounding area.
– ***Risk characterisation:*** combines the results of the toxicity assessment and exposure assessment, to provide estimates of the potential health and ecological risks to relevant receptors.
– ***Uncertainty and sensitivity assessment*****:** evaluates the uncertainty associated with the HHERA and sensitivity of the assessment outcomes to the various assumptions and inputs.

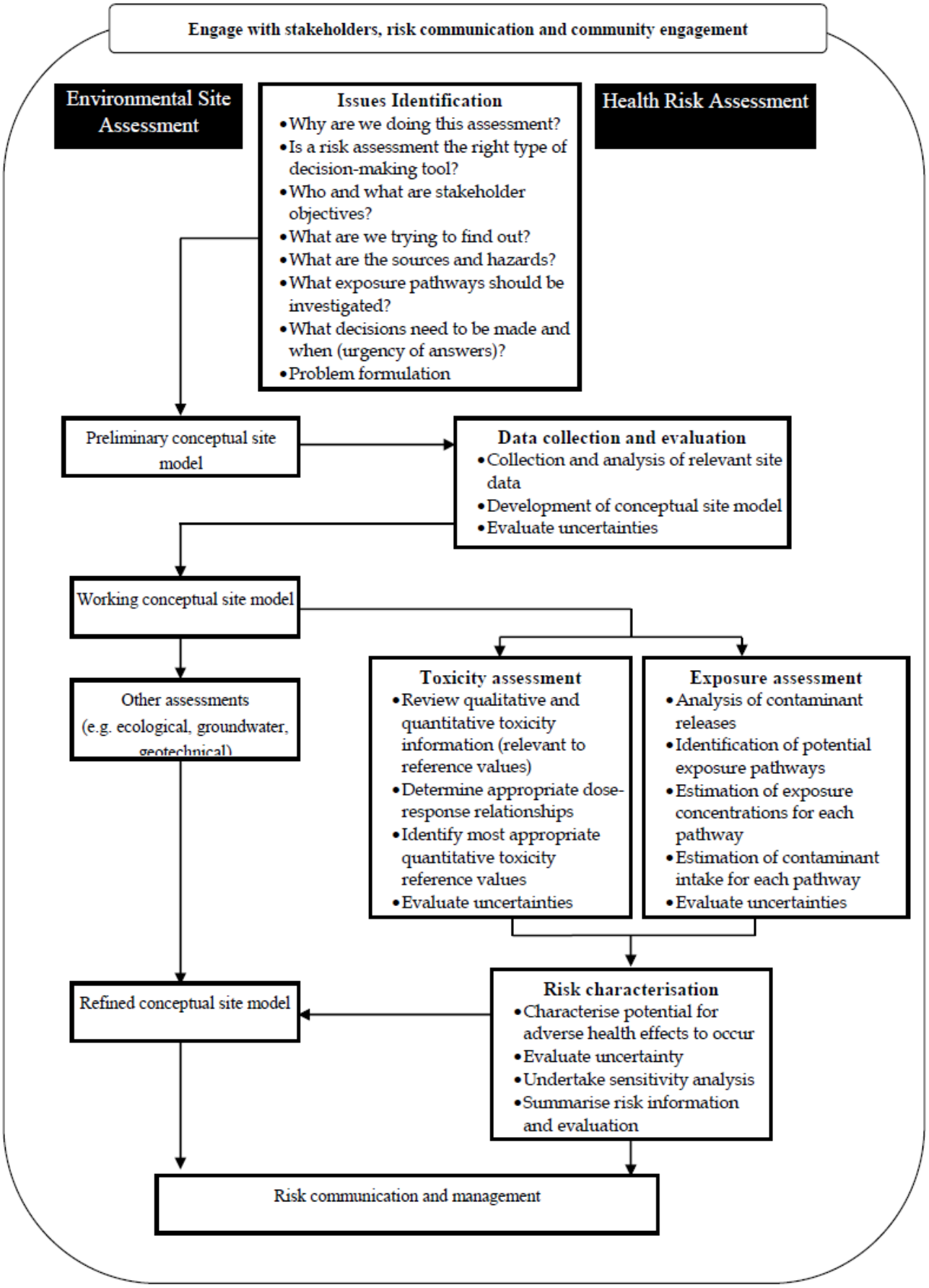

Plate 6.1 *ASC NEPM Health Risk Assessment Methodology (ASC NEPM, 2013)*

The HHERA considers the results of the current investigation and historical results reported in the following documents:

– GHD, 2017a, South Australian Metropolitan Fire Service, Preliminary Site Investigation, 99 Wakefield Street Adelaide, Investigation of PFAS, January 2017
– GHD, 2017b, South Australian Metropolitan Fire Service, PFAS Investigation, June 2017
– GHD, 2017c, PFAS Investigation – Additional Testing, Wakefield Street Fire Station, December 2017
– GHD, 2021, Adelaide Fire Station Groundwater PFAS Assessment, South Australian Metropolitan Fire Service, October 2021
– GHD, 2022, Adelaide Fire Station, Detailed Site Investigation, December 2022

6.2 Preliminary conceptual site model

Fundamental to any contamination investigation is the development of a Conceptual Site Model (CSM), which is a description of the plausible mechanisms ('pathways'), by which people and ecology ('receptors') may be exposed to chemicals in the environment ('sources'). Potential risks to human health or the environment cannot occur unless there is a Source-Pathway-Receptor (SPR linkage). Conversely, complete SPR linkages do not by default indicate a risk and the site investigation process is used to evaluate the extent of potential risks.

The following preliminary CSM was developed based on the information collected in the previous investigation (GHD, 2022).

6.3 Potential contamination sources

6.3.1 On-site

The primary source is the operational fire station ('the site'). GHD (2017a) reported aqueous film-forming foam (AFFF) containing the surfactant PFOS was used historically on-site until 2007, inside the wash down bay, and at the training tower. AFFF (containing PFAS) ceased use on-site in 2016.

The data set collected during previous investigations (discussed further in Section 6.6.2), indicates that secondary sources of PFAS are present on-site, based on widespread impact within on-site shallow soils (0.1 to 0.4 m bgl), particularly, adjacent surface water inlets, sediment and surface water within on-site stormwater drainage (i.e., surface drains, water dam (with unsealed concrete walls), and within underlying groundwater.

Further investigation (GHD, 2017b; 2017c) of surface water within the on-site water dam (in the western portion of the site), identified surface water samples collected prior to flushing and pressure cleaning reported concentrations for the sum of PFOS+PFHxS that exceeded human-health (recreational) and ecological (95% species protection level) criteria, and post cleaning, surface water samples exceeded ecological (95% species protection level) criteria. GHD understands that overflow from the on-site water dam still discharges to stormwater in Chancery Lane, that ultimately connects with stormwater drainage in Wakefield Street (Figure 1, Appendix A).

6.3.2 External

Other potential sources of PFAS contamination external to the site, may additionally influence water quality within the receiving environments: River Torrens and Park 23, based on the surrounding urban land use of the wider investigation area.

6.4 Contaminants of potential concern

Based on identified contamination sources for the site the primary contaminant of concern (COPC) considered is PFAS. PFAS are surfactant chemicals used in AFFF to facilitate the spread of foam and provide resistance to thermal decay of the product.

Of the PFAS compounds included in the standard analytical suite, PFOS, PFHxS, and PFOA are typically the dominant compounds detected in environmental samples. Many other PFAS compounds also breakdown to PFOS, PFHxS, and PFOA. Consequently, the guidelines produced by Australian health and environmental regulators have focused on these three primary compounds, and they have been the focus of the scientific research undertaken (ATSDR, 2021; EFSA, 2020).

Given the regulatory and scientific focus on PFOS, PFHxS, and PFOA, these compounds are the primary chemicals of potential concern (COPC) in this assessment. Other PFAS compounds are discussed further in Section 6.9.

6.5 Potential receptors and exposure pathways

6.5.1 Receptors and exposure pathways

The primary receptors of concern for surface water and groundwater impacts identified within the site and immediate surrounds include the following:

– Recreational users of the receiving environments, River Torrens, and Park 23.
– Ecological receptors in nearest surface water receiving body, River Torrens.

For PFAS, direct contact pathways are the predominant exposure (HEPA, 2020). In this context, the relevant exposure pathways for the PFAS impacts identified comprise the following:

– Direct contact with surface water (dermal contact or incidental ingestion).
– Indirect exposure given the ability for PFOS and PFOA to bio accumulate, that can increase at each stage of the food chain, affecting higher order species.

6.6 Nature and extent of contamination

6.6.1 Assessment criteria

Ecological values

To assess contamination in an aquatic environment it is necessary to define the level of protection afforded to a water body, which in turn informs the acceptable water quality for a waterway. The level of protection considers the ecosystem condition, community values, and associated management goals.

ANZG (2018) recognises three categories for ecosystem condition, including:

– High conservation or ecological value systems (99% species protection) i.e., unmodified, or highly valued ecosystems.
– Slightly to moderately disturbed systems (95% species protection) i.e., aquatic biodiversity may be impacted by human activity.
– Highly disturbed systems (80-90% species protection) i.e., degraded ecosystems of lower ecological value.

The River Torrens, down-gradient of the site, is located within the Adelaide CBD, within an urban setting, that is highly modified from the natural environment and receives stormwater discharge from the surrounding area. For the purposes of this investigation, it is considered a slightly to moderately disturbed system, and it is unknown whether there is any hydraulic connection with groundwater.

Park 23, downgradient of the site, comprises a series of retention basins, constructed to manage stormwater flow through the park, a disturbed urban setting. These retention basins were not intended to support aquatic organisms. Notwithstanding this the ecological screening levels for 95% and 99% species protection levels have been applied to this assessment of surface water (retention basins) within Park 23, as the receiving environment for surface water from the site as a conservative approach.

PFAS, the key contaminants of this assessment, are referred to as bio accumulative chemicals. As such, the 99% species protection level is generally recommended for Tier 1 screening levels as the default guideline values

(DGVs) does not account for the bioaccumulation of PFOS in aquatic food chains. However, PFAS are ubiquitous, and in urban / industrial areas are present at ambient levels. Given the presence of ambient concentrations of PFAS within the River Torrens catchment, the PFAS dataset has additionally considered the 95% species protection levels (i.e., 0.13 µg/L for PFOS and 220 µg/L for PFOA), and a comparison of the PFAS concentrations measured downstream of the site, relative to those upstream.

Table 6.1 summarises the ecological screening levels adopted for this surface water assessment.

Table 6.1 Summary of ecological screening levels for PFAS in surface water

Exposure Scenario		PFOS	PFHxS	PFOS+PFHxS	PFOA	Source
Ecological						
Aquatic and semi-aquatic organisms within Park 23 stormwater system and River Torrens.	Direct and indirect food chain exposure	0.13	-	-	220	PFAS NEMP Freshwater 95% species protection
		0.00023	-	-	19	PFAS NEMP Freshwater 99% species protection[1]
[1]The Park 23 stormwater system and River Torrens are considered highly disturbed systems within an urban setting, however, the NEMP 2.0 (HEPA, 2020) states that the 99% species protection should be used to assess bioaccumulation exposure pathways.						

Human-health values

The NEMP 2.0 (HEPA, 2020) recreational guidelines were adopted in consideration that the primary human receptors for discharges from the site to receiving environments, Park 23, and River Torrens, are recreational users. The River Torrens is restricted for recreational activities swimming and fishing given the water quality associated with E-coli bacteria and algal blooms, however, it is used for boating activities. Park 23 comprises walking tracks, gardens, and man-made wetlands associated with the stormwater retention basins. A transient community use Park 23 for temporary accommodation (i.e., camping) to access a pop-up medical hub (discussed in Section 3.3.2).

PFAS can be bio accumulative and Tier 1 screening criteria specific to the consumption of aquatic biota are not available for these chemicals. Given the restriction for fishing in the CBD, specifically in Lake Torrens (downgradient of the site), human consumption of aquatic biota has not been considered.

Table 6.2 summarises the health-based screening levels adopted in this surface water assessment.

Table 6.2 Summary of human health screening levels for PFAS in surface water and groundwater

Exposure Scenario		PFOS	PFHxS	PFOS+PFHxS	PFOA	Source
Human Health						
River Torrens	Recreational water use	2	2	2	10	NHMRC (2019) Recreation and aesthetics

6.6.2 Previous investigation findings

Five environmental investigations have been undertaken by GHD at the site since 2017. The outcomes of these investigations are summarised below in Table 6.3.

Table 6.3 Summary of previous investigations

Report	Scope of work	Findings
GHD, 2017a, South Australian Metropolitan Fire Service, Preliminary Site Investigation, 99 Wakefield Street Adelaide, Investigation of PFAS, January 2017	GHD (2017a) were engaged by the South Australian Metropolitan Fire Service (SA MFS) to prepare a Preliminary Site Investigation (PSI). The PSI targeted soil, sediment, and surface water on-site: Three shallow bores (BH1 – BH3) below the paved surface. Two drain sediment samples: drain inlet adjacent BH2 (SED1) and washdown bay drain (SED2). Two stormwater samples from surface water inlet east of the chemical storage shed (SW01) and washdown bay drain (SW02).	GHD (2017a) reported PFAS impacts within all soil, sediment and surface water samples that included the washdown bay and associated drainage, the training tower in the north-west corner of the site and the chemical storage shed located in the southern portion of the site. – Shallow soil (0.1 – 0.4 m bgl) results reported elevated PFAS concentrations located in sample (BH2) adjacent to the surface water inlet (runoff) from the training tower. – Soi leachate sample (BH1_0.08-0.18) (east of the chemical storage shed) reported a leachable concentration for PFOS (1.98 µg/L) exceeding ecological criterion (0.13 µg/L) and (2.16 µg/L) exceeding human-health recreational criterion. – Surface water samples SW01 and SW02 exceeded the adopted human-health and ecological criteria (NEMP 2.0). It was concluded that these on-site impacts were not delineated.
GHD, 2017b, South Australian Metropolitan Fire Service, PFAS Investigation, June 2017	GHD (2017b) were engaged by the SA MFS to complete further investigation that targeted soil, sediment and surface water sampling on-site: Two drain sediment samples: drain inlet (SED1) and washdown bay drain (SED2). Two surface water samples from the water storage dam: surface sample (DAM_S) and bottom of the dam (DAM_B).	GHD (2017b) reported PFAS impacts within sediment and surface water samples as follows: – Drain sediment samples (SED1 and SED2) exceeded the adopted ecological (indirect exposure) criterion. – The surface water samples (DAM_S and DAM_B) exceeded human-health recreational criterion and ecological freshwater 95% protection level for sum of PFOS+PFHxS. It was concluded that these on-site impacts were not delineated.
GHD, 2017c, PFAS Investigation – Additional Testing, Wakefield Street Fire Station, December 2017	GHD (2017c) were engaged by the SA MFS to undertake additional sediment and surface water samples (including TOP Assay (TOPA)) from the on-site dam to assess whether pressure cleaning of the dam had impacted PFAS concentrations: One sediment sample (DRAIN_S) collected from the on-site drain south of the 'Training Tower'. Surface water samples (DAM_S and DAM_B) collected in September and October.	GHD (2017c) reported PFAS impacts within the onsite water dam exceeding ecological criterion were attributed to unsealed concrete walls of the dam potentially acting as a secondary source of PFAS. – The sediment sample (DRAIN_S) reported below the adopted human-health and ecological criteria. – The dam water samples (DAM_S and DAM_B) exceeded the ecological criterion freshwater 95% protection level. – TOPA results indicated an increasing trend for sum of PFOS+PFHxS in surface water sample DAM_S, and a decreasing trend in deeper water sample DAM_B. It was concluded that the water dam was no longer acceptable for use for training and aerosolising water on-site. However, the water dam was to continue use as an on-site stormwater retention pit.
GHD, 2021, Adelaide Fire Station Groundwater PFAS Assessment, South Australian Metropolitan Fire Service, October 2021	GHD (2021) were engaged by the SA MFS to assess the potential PFAS contamination on-site and investigate the nature, and extent of impacts in	GHD (2021) reported the following:

Report	Scope of work	Findings
	groundwater, if present, in six existing on-site monitoring wells (GW101 to GW106).	– The active source of PFAS (AFFF) is no longer used on-site, however a secondary source likely remains within impacted soil, surface water, and groundwater. – Soil dry weight and leachate results reported elevated PFAS concentrations exceeding the adopted ecological and human-health criteria, identifying an ongoing secondary source. – Inferred groundwater flows in a north-westerly direction towards the River Torrens. Groundwater was recorded between 11.528 to 13.168 metres below top of casing (m bTOC). – Extraction bores in the vicinity of the site unlikely used for domestic and/or irrigation given the CBD location, a reticulated water supply. There were 56 bores identified within a 2 km radius of the site with total dissolved solids (TDS) below 1,200 mg/L (considered potable), therefore beneficial use for irrigation of parklands cannot be precluded. – Elevated PFOS and sum of PFHxS+PFOS concentrations exceeded human-health recreational criterion in four on-site wells (GW101, GW103, GW104, and GW106). GW101 reported the highest PFAS concentrations located adjacent the washdown bay associated with historical AFFF training activity. The report concluded that delineation was not achieved, and further investigation was required to assess the nearest surface water bodies; the River Torrens and the Park 23 (retention basins) based on exceedance of the ecological criterion in on-site surface water and groundwater.
GHD, 2022, Adelaide Fire Station, Detailed Site Investigation 2022, December 2022	GHD (2022) were engaged by the SA MFS to complete a Detailed Site Investigation (DSI) to assess the following: The nature and extent of PFAS site contamination in soil and groundwater, both on- and off-site. Potential risks to human-health and the environment associated with identified on-site PFAS contamination for continued industrial land use. Preliminary assessment of potential risks to human-health and the environment potentially migrating off-site in groundwater. The investigation targeted the following: – Sediment and stormwater on-site. – Soil sampling of fifteen shallow soil bores in on- and off-site locations. – Installation of one on-site, and five off-site groundwater wells, and groundwater sampling	GHD (2022) reported the following: – All soil results reported below the human-health criterion for a commercial /industrial setting, furthermore, impacted soils were observed to overlain with hardstand limiting direct contact. – Soil samples reported exceedance of adopted indirect ecological exposure criterion (0.14 mg/kg) for PFOS in ten on-site soil bores. Notably beneath hardstand. – Soil leachability results identified that shallow on-site soils potentially a secondary source impacting groundwater. The potential infiltration of PFAS through surface materials (hardstand) and potential flux to groundwater is unknown. – On-site groundwater wells reported exceedance of human-health and ecological. TDS concentrations >1200 mg/L identifies that groundwater is not potable. Extraction bores for beneficial use were reportedly absent downgradient to the northwest. – On-site surface water sampling identified exceedances of human-health recreational and ecological criteria. – All sediment samples were below the adopted human-health criteria (HIL D).

Report	Scope of work	Findings
	of twelve (existing and newly installed) monitoring wells.	– Off-site groundwater monitoring wells **MW03** and **MW05**, located 70 m and 50 m, respectively. PFAS concentrations demonstrated attenuation with PFHxS and sum of PFHxS+PFOS concentrations several orders of magnitude lower than groundwater reported beneath the site. – All off-site groundwater samples reported PFAS below the human-health recreational criterion in groundwater. – Off-site downgradient well **MW03** reported an exceedance with an order of magnitude of the ecological criterion for Freshwater (95% protection level). It was concluded that the off-site impacts that exceeded ecological criteria were not delineated.

6.6.3 Source-pathway-receptor linkages

The CSM presented in GHD (2022) has been revised based on information gained from this investigation (Section 5). The revised CSM describes potential risks for exposure through source-pathway-receptor linkages, presented in Table 6.4 and Table 6.5.

Table 6.4 Revised conceptual site model – on-site.

Source	COPC and media	Potential receptor	Potential pathway	Risk from exposure through SPR Linkages	Recommendations
Historical AFFF use and storage on the fire station	PFAS in soil, sediment, surface water, and groundwater	On-site current and future commercial workers. Intrusive maintenance workers (IMW)	Direct contact and/or incidental ingestion.	**Low and acceptable** – The SPR linkage associated with direct contact and/or incidental ingestion is incomplete. The site in its current layout is covered in hardstand (brick paving) on this basis contaminated soil and groundwater identified beneath the site is inaccessible to current site users. Furthermore, groundwater is reportedly ~12 m bgl, inaccessible to site users and/or intrusive workers. Given the commercial/industrial use of the site the ingestion of surface water by commercial workers is unlikely. Surface water locations (**SW01**, **SW02**, and **SW06**), within surface water inlets in the vicinity of chemical storage, washdown bay, and water dam, respectively, reported historical exceedance of human-health criterion, however, the surface water drains / pits are inaccessible to site users beneath metal grates. GHD (2022) stated that **SW02** was decommissioned. Previous investigations have identified that surface water collected within site surface drains discharge to Wakefield Street and/or collected within the water dam in the western portion of the site. Historical water dam samples (**DAM_S** and **DAM_B**) reported exceedance of human-health criterion, however, the water dam (used as a stormwater retention pit) is capped with a metal cover, and lined with concrete, inaccessible to site users. The historical sediment dataset within the site drainage network reported below the adopted human-health criterion (NEMP 2.0, HIL D).	Management of the stored water within the site's water dam drainage network is required. A site management plan (SMP) is recommended to manage the stored water within the water dam. Further discussion relating to the management and implementation of an SMP is outside of the scope of this assessment.

Table 6.5 Revised conceptual site model – off-site

Source	COPC	Potential receptor	Potential pathway	Risk from exposure through SPR Linkages	Recommendations
PFAS impacted surface water run-off (overland) and stormwater discharge from the site.	PFAS	Migration via the Adelaide CBD stormwater system to Park 23 stormwater retention basins.	Recreational users	**Low and acceptable –** PFAS concentrations measured in off-site stormwater drains (**SW_DISCHARGE 1** to **SW_DISCHARGE 3)** and within Park 23 (**PL_01** and **PL_02**) reported all samples below the adopted human-health (recreational) criterion. Discussed further in Section 6.7.	Management of the stored water within the site's water dam is required, and associated overflow, discharging to off-site stormwater. A site management plan (SMP) is recommended to manage the stored water within the water dam. Further discussion relating to the management and implementation of an SMP is outside of the scope of this assessment.
			Direct and indirect ecological exposure	**Low and acceptable** – PFOS concentrations measured in off-site stormwater drains (**SW_DISCHARGE 1** to **SW_DISCHARGE 3)** and within Park 23 (**PL_01** and **PL_02**) reported all surface water samples above the adopted ecological (99% protection level) criterion adopted for bioaccumulation, and surface water samples **SW_DISCHARGE 1** and **PL_02** above the adopted ecological (95% protection level) criterion. PFOS concentrations identified within the Adelaide CBD stormwater drainage network and the Park 23 stormwater retention basins, were constructed to manage stormwater flow, and are not considered ecological receptors due to the highly disturbed system within an urbanised environment and the absence of a viable ecosystem. Discussed further in Section 6.7.	
PFAS impacted groundwater		Migration via groundwater and discharge to River Torrens.	Recreational users	**Low and acceptable** – GHD (2022) reported that PFAS concentrations measured in off-site groundwater wells were below the adopted human-health (recreational) criterion and demonstrate attenuation within ~50m distance from the site. PFOS concentrations measured within the River Torrens (**RT_SW01** to **RT_SW07**) during this assessment reported all surface water samples below the adopted human-health (recreational) criterion. Discussed further in Section 6.8.	
			Direct and indirect ecological exposure	**Low and acceptable** – PFOS concentrations measured in the River Torrens (**RT_SW01** to– **RT_SW07**) reported all surface water samples below the ecological (95% species protection). Ecological (99% species protection) criterion adopted for bioaccumulation was exceeded in all samples, however, it is noted that up- and down-stream samples were all within an order of magnitude. Therefore, PFOS concentrations measured in surface water are likely ambient concentrations associated with the river's urban setting. Discussed further in Section 6.8.	

6.7 Preliminary risk assessment for off-site stormwater

GHD (2022) stated that the site's drainage (including overland flow) discharges to Wakefield Street based on site topography observed as sloping from east to west where surface water flows in a westerly direction within the CBD stormwater system, eventually flowing through Park 23. The on-site drainage network is comprised of the following:

– A surface drain on-site flowing east – west is understood to connect to a stormwater drain in Wakefield Street adjacent the northern boundary of the site.
– The western portion of the site (east of the Special Operations and Training Tower) has surface drains flowing north - south to a surface water inlet that is understood to discharge to Wakefield Street.

A water dam (Plate 6.2) located in the western portion of the site (historically used for on-site training activities) is currently used for the retention of surface water, that discharges to off-site stormwater drains in Chancery Lane during high rainfall. The dimensions of the water dam and volume of water stored are detailed in Section 2.2.

GHD (2022) on-site surface water sampling occurred during a rainfall event representative of leaching of PFAS from hardstand brick to on-site surface water. All surface water samples were collected where water was observed to be flowing from stormwater swales, pits or drains representative of actual overland discharge. Limited sampling volumes were observed during this investigation. GHD (2022) stated that PFHxS+PFOS concentrations in sample locations **SW11** (1.6 µg/L) and **SW03** (1.9 µg/L) were most representative of stormwater leaving the site during the rain event, both reported below human-health (recreational) criterion (presented in Table C4, **Appendix C**). Previous investigations (GHD, 2017a, 2022) state that most of the on-site surface water is discharged to off-site drains in Chancery Lane and Wakefield Street.

GHD (2017c) provided a comparison of sampling collected from the water storage dam between May and October 2017. The surface water sampling undertaken in October 2017 followed the flushing and pressure cleaning of the water dam that demonstrated a decreasing trend in PFOS+PFHxS in deeper water samples (**DAM_B**) between May to October 2017, and an increasing trend in surface water samples (**DAM_S**) (presented in Tables C2 and C3, Appendix C).

GHD (2022) reported that all sediment samples within the on-site drainage network were below the adopted human-health (NEMP 2.0, HIL D) criterion (presented on Table C6, Appendix C), however, that these are likely to provide a secondary source of PFAS within off-site drainage systems.

Plate 6.2 Water dam located in the western portion of the site (GHD, 2017c).

Tier 1 screening of PFAS concentrations in on-site stormwater

Table 6.6 presents a review of the maximum concentration for PFAS identified in on-site stormwater drains, connected to the off-site stormwater drainage system, compared against Tier 1 screening criteria. Historical surface water exceedances are illustrated in Figure 9, Appendix A.

Table 6.6 ***Summary and review of historical PFAS concentrations in surface water and stormwater at the site (GHD 2017a – 2017c, 2022) – compared against Tier 1 screening criteria***

Parameter	PFOA (µg/L)	PFHxS (µg/L)	PFOS (µg/L)	PFOS+PFHxS (µg/L)
Surface water inlet (SW01)				
Maximum concentration	0.32	**2.64**	**22.8**	**25.4**
Washdown bay drain (SW02) (decommissioned)				
Maximum concentration	0.05	<0.02	**6.12**	**6.12**
Stormwater pit (SW06) – western portion of the site (adjacent water storage dam)				
Maximum concentration	0.05	0.35	1.7	**2.1**
Water storage dam (DAM_S) – Surface				
Maximum concentration	0.22	0.76	**3.07**	**3.83**
Water storage dam (DAM_B) – Bottom				
Maximum concentration.	0.22	0.78	**3.07**	**3.85**
Tier 1 screening criteria				
Health-based criteria – recreational	**10**	**2**	**2**	**2**
Ecological criteria	19[a] 220[b]	-	0.00023[a] 0.13[b]	-

Notes:
"-" Not available
[a] HEPA (2020) criterion for the protection of 99th percentile of species
[b] HEPA (2020) criterion for the protection of 95th percentile of species

A review of Table 6.6 indicates the following:

– PFOS maximum concentrations exceeded the human-health based criterion and ecological (95% and 99% species protection) criteria in all on-site stormwater drainage.

– PFOS+PFHxS (sum) and PFHxS concentrations exceeded the human-health based criterion, in on-site stormwater samples (**SW01**, **SW02** (now decommissioned), **SW06**, **DAM_S**, and **DAM_B**).

– Surface water from location **SW01** discharges to off-site stormwater in Chancery Lane, ultimately to Wakefield Street, and **SW06** discharges to off-site stormwater in Wakefield Street.

In summary, the Tier 1 screening assessment of the historical surface water dataset collected on-site compared with off-site surface water sampling undertaken during this assessment (discussed in Section 5.4) demonstrates that PFAS concentrations measured in the on-site drainage network that predominantly discharges to Chancery Lane and Wakefield Street is several orders of magnitude lower in the off-site drainage system, notably, below the adopted human-health (recreational) criterion.

Tier 1 screening of PFAS concentrations in off-site stormwater

PFAS concentrations measured in Park 23 is summarised in Table 6.7.

Table 6.7 Summary of Park 23 PFAS results

Location		PFOS	PFHxS	PFOS+PFHxS	PFOA	Total PFAS
August 2023 - concentrations expressed in µg/L						
Downgradient	SW_DISCHARGE 1	**0.39**	0.029	0.419	0.004	0.47
	SW_DISCHARGE 2	**0.0011**	<0.001	0.0011	<0.001	<0.005
	SW_DISCHARGE 3	**0.0015**	<0.001	0.0015	0.001	0.0125
	PL01 (Park 23)	**0.062**	0.035	0.097	0.01	0.206
	PL02 (Park 23)	**0.15**	0.057	0.207	0.05	0.433
Tier 1 screening criteria – concentrations expressed in µg/L						
HEPA (2020) 99% species protection		**0.00023**	**-**	**-**	**19**	**-**
HEPA (2020) 95% species protection		0.13	-	-	220	-
HEPA (2020) Recreational guidelines		2	2	2	10	-
Notes: "-" = Not available						

A review of Table 6.7 indicates the following:

- PFOS is the primary PFAS compounds identified in the stormwater drainage system and receiving environment. As stated previously, this likely reflects the high levels of persistence and mobility demonstrated by PFOS, relative to many other PFAS compounds.
- All stormwater samples collected from the stormwater drainage system and in the retention basin reported PFOS+PFHxS concentrations below the health-based recreational guidelines. Hence, the Park 23 stormwater retention basin poses; a low risk to the transient population observed camping in the vicinity of the surface water body.
- Surface water sample in Park 23 (**PL_02)** reported PFOS concentrations above the ecological guidelines, 95% species protection level (slightly disturbed system) and 99% species protection level (bioaccumulation). However, the retention basin located within man-made wetlands designed to manage the Adelaide CBDs stormwater system, is a highly disturbed system not designed to support aquatic organisms, and/or higher trophic level terrestrial species that may visit this highly urbanised environment.
- The PFOS concentrations reported within **SW_DISCHARGE 1** (drain adjacent the site), and the receiving environment within Park 23 (**PL_01** and **PL_02**) were within one order of magnitude higher. Downgradient stormwater samples (**SW_DISCHARGE 2** and **SW_DISCHARGE 3**) were notably two orders of magnitude lower than **SW_DISCHARGE 1**, suggesting that the samples collected from the receiving environment (retention basin) are influenced by other external sources of PFAS within the Adelaide CBD stormwater system (discussed further in Section 6.8.1).
- The PFAS dataset is limited in terms of temporal coverage, with only one sampling round of the off-site stormwater system undertaken.
- It is noted that off-site stormwater sampling conducted during the current assessment did not capture an overflow of the stored water within the site's water dam. GHD (2017a, 2022) stated that majority of on-site surface water volumes are discharged to Chancery Lane and Wakefield Street.

6.8 Preliminary risk assessment of surface water – River Torrens

6.8.1 Background levels

PFAS are a large family of manufactured chemicals that have been in used in Australia and around the world in a variety of commercial processes, household products, and specialty applications. The physical and chemical properties of PFAS impart oil and water repellence, temperature resistance, and friction reduction, making them useful to consumers and industry. Potential sources of PFAS to surface water are as follows:

– Building materials (i.e., additives to wood-based materials, insulation, paints, plumbing materials)
– Paper products and packaging
– Furniture
– Surfactants
– Domestic products, including cosmetics, waxes.
– Class B firefighting foams

The widespread use of PFAS and the persistence and mobility of some PFAS, have resulted in the presence of these compounds in the environment across the globe. PFAS concentrations in surface water are frequently elevated within surface water in the vicinity of known point sources of PFAS (i.e., facilities where class B firefighting foams are manufactured, stored, or used).

The draft PFAS NEMP 3.0 has identified that PFAS is widespread in freshwater, estuarine, and marine environments not subject to impacts from known PFAS point sources. The PFAS NEMP 3.0 suggests that concentrations in the environment are likely to reflect the nature (type and intensity) of ambient land use and provides an indication of the PFAS concentrations that are typical in catchments in assorted land use settings. The PFOS concentrations identified via the ambient sampling programs undertaken in Victoria and Queensland, are detailed in the draft PFAS NEMP 3.0, are summarised in Table 6.8.

Table 6.8 Summary of ambient monitoring undertaken in Victoria and Queensland (HEPA, 2022)

Catchment land use	Victorian sampling program outcomes		Queensland sampling program outcomes	
	Range of PFOS concentrations (µg/L)	Sites with PFOS detections (%)	Range of PFOS concentrations (µg/L)	Sites with PFOS detections (%)
Remote (>85%)	<0.0002 to 0.0002	20%	<0.0001 to 0.0001	11%
Agricultural (>60%)	<0.0002 to 0.009	75%	<0.0001 to 0.001	53%
Urban (>40-50%)	0.0007 to 0.081	100%	<0.0001 to 0.037	83%

The data presented in Table 6.8 demonstrates that while PFAS are man-made chemicals, due to the diversity of purposes for which it has been used, it is not typically absent in aquatic environments in urban areas. The samples collected from within the River Torrens have demonstrated relatively low PFOS concentrations (less than ≤0.003 µg/L), that align with those reported in other urban catchments. It is therefore important to consider the exceedances of the 99% species protection value (0.00023 µg/L) in this context.

Tier 1 screening of PFAS concentrations in River Torrens

PFAS concentrations measured in River Torrens is summarised in Table 6.9.

Table 6.9 Summary of River Torrens PFAS results

Location		PFOS	PFHxS	PFOS+PFHxS	PFOA	Total PFAS
June 2023 – concentrations expressed in µg/L						
Upstream	RT_SW01	**0.0010**	<0.001	0.001	<0.01	<0.005
	RT_SW02	**0.0011**	0.001	0.0021	<0.01	<0.005
	RT_SW03	**0.0010**	0.002	0.003	<0.01	<0.005
	RT_SW04	**0.0032**	0.001	0.0042	<0.01	0.0112
North of the site (cross-gradient)	RT_SW05	**0.0037**	0.002	0.0057	<0.01	0.0127
Lake Torrens (downstream)	RT_SW06	**0.0029**	0.002	0.0049	<0.01	0.0149
Downstream	RT_SW07	**0.0032**	0.002	0.0052	<0.01	0.0152
Tier 1 screening criteria – concentrations expressed in µg/L						
HEPA (2020) 99% species protection		**0.00023**	**-**	**-**	**19**	**-**
HEPA (2020) 95% species protection		*0.13*	*-*	*-*	*220*	*-*
HEPA (2020) Recreational guidelines		2	2	2	10	-
Notes: "-" = Not available						

A review of Table 6.9 indicates the following:

- PFOS is the primary PFAS identified in the receiving environment, comprising the majority of the total PFAS detected in sampling locations. This likely reflects the high levels of persistence and mobility demonstrated by PFOA, relative to other PFAS compounds.
- Overall, the concentrations of PFAS measured in surface water up- and down-stream of the site were within an order of magnitude. As such, discharges from the fire station are not demonstrably influencing the PFAS concentrations in surface water quality within river and the available data suggests that the presence of various sources other than the fire station that contribute to the PFAS concentrations. The catchment is heavily modified and PFAS is ubiquitous in urban settings.
- All surface water samples collected along the River Torrens reported PFOS+PFHxS concentrations below the health-based guidelines. Therefore, PFAS in surface water poses a low risk to people using these waterways for recreational activities. It is noted that these criteria do not incorporate the consumption of biota (e.g., fish). Noting that the nearest surface water body (River Torrens) does not allow recreational activities that includes fishing.
- All samples reported PFOS concentrations below the 95% species protection. This result provides a high level of confidence that PFOS discharges from the site are unlikely to adversely affect lower trophic level aquatic organisms within the River Torrens.
- The ecological screening criterion for PFOS for the protection of 99% species was exceeded at all sampling locations including those located upstream of the site. These criteria are applicable to the screening level assessment of the potential for effects on higher trophic level species via indirect (food chain) exposure.
- The PFAS surface water dataset is limited in terms of temporal coverage, with only one sampling round of surface water sampling in the River Torrens undertaken.

6.8.2 Ecotoxicity assessment

The water quality guidelines published by HEPA (2020) were originally derived in 2015, prior to publication of the *Warne et al., (2018) Revised method for deriving Australian and New Zealand Water Quality Guideline Values for Toxicant*. In 2023, ANZG (2023) released a draft (for consultation of revised water quality guidelines for PFOS), including the following:

– 99% species protection values: 0.0091 µg/L
– 95% species protection values: 0.48 µg/L
– 90% species protection values: 2.7 µg/L
– 80% species protection values: 17 µg/L

The higher water quality guidelines derived in 2023 reflect the inclusion of toxicity studies published in interim and the application of the *Warne et al.,* (2018) derivation approach. While these values have not been finalised, it is notable that, the total PFAS concentrations measured in the River Torrens were below the range of draft values protective of bioaccumulation in aquatic organisms.

Given that PFOS can be highly persistent, environmental exposures are potentially long term and multi-generational. A summary of a selection of NOEC reported for PFOS in multigenerational studies is provided in Table 6.10, with the species sensitivity distribution (SSD) associated with the draft guideline values illustrated in Plate 6.3. Notably, the ecotoxicity studies report no-observed effect concentration (NOEC) which are within an order of magnitude higher than the PFOS concentrations measured upstream and downstream of the site.

Table 6.10 Summary of multigeneration PFOS toxicity data for freshwater aquatic species

Taxonomic group	Species	Laboratory study end point	NOEC[a] (µg/L)	References
Mollusc	*P. pomilia*	Reproduction (F1 generation)	10,000	Funkhouser (2014)
Rotifer	*Barchionus calcyciflorus*	Population growth	250	Zhang *et al.* (2013)
Insect	*Chironomus raprius*	Development (F6)	3.5	Marzialli *et al.* (2019
Fish	*Aryzias latipes*	Reproduction (F1 generation)	10	Ji *et al.* (2008)
Fish	*Danio rerio*	Growth (F2 generation)	0.6 µg/L (LOEC)	Keiter, *et al.* (2012)
Fish	*Pimephales promelas*	Reproduction (F0)	230	Ankley *et al.* (2005)
[a]Except as indicated				

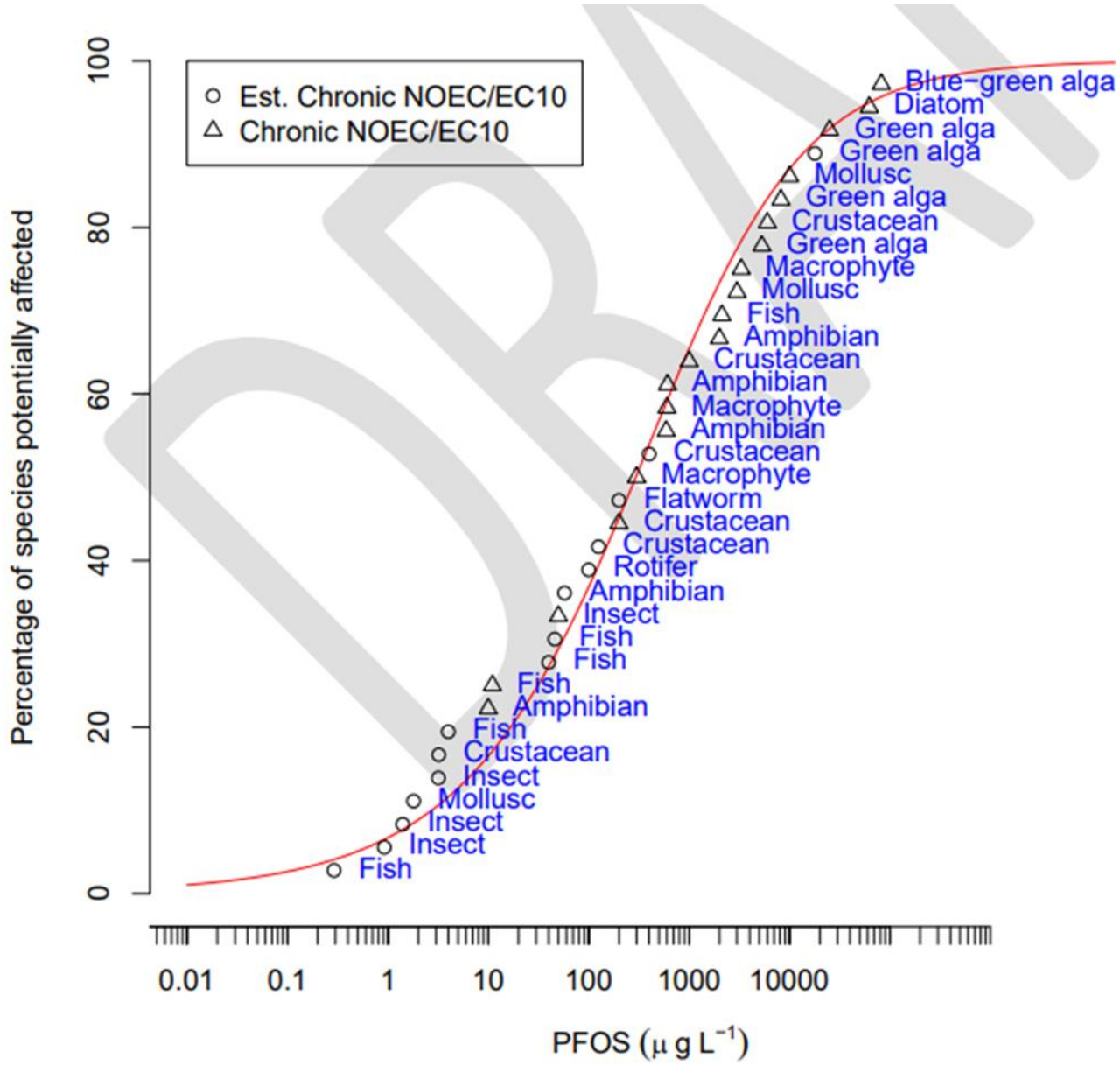

Plate 6.3 SSD curve associated with the draft toxicant guideline values for PFOS (ANZG, 2018)

6.8.3 Weight of evidence assessment

A weight of evidence (WoE) approach has been adopted in this assessment, with the lines of evidence assessed including the following:

- The range of potential sources of PFAS to the environment in urban settings. PFOS toxicity, including recent advances in the approach to deriving water guidelines.
- Published literature on the tendency for PFOS to bioaccumulate in aquatic biota.
- The nature of the receiving environment and susceptibility of the aquatic food chain to PFOS bioaccumulation and secondary poisoning.

The surface water dataset demonstrates that PFAS is present within the River Torrens, but to date, the contribution of the site to these impacts is not readily distinguishable from the contribution of other sourced within the broader catchment. Based on these results, the risk assessment has focused on the PFAS impacts present at the broader catchment scale.

Overall, the available evidence does not suggest the PFOS concentrations measured within the River Torrens are likely to result in adverse effects on human users of the area or the aquatic environment. Key lines of evidence supporting this conclusion are as follows:

– PFAS are ubiquitous in urban settings, due to diversity of purposes for which it has been used and the PFOS concentrations measured in River Torrens that align with those reported by HEPA (2022) in other urban catchments (up to 0.013 µg/L).
– The PFOS concentrations measured in the River Torrens were below the adopted ecological water guidelines (95% species protection level) and were a similar order of magnitude between up- and down-stream surface water samples. These results therefore provide a line of evidence that suggest PFOS discharges from the site are unlikely to adversely affect the aquatic environment.
– At the PFAS concentrations measured in the River Torrens, a preliminary (desktop) bioaccumulation assessment suggests a high level of locally caught fish consumption would be required to results in levels of PFAS intake that are above the FSANZ (2017) total dietary intake (TDI), recognising that fishing is restricted in the urban section of the river hydraulically downgradient of the site.

6.9 Uncertainty analysis

The uncertainty analysis identifies the assumptions and data gaps associated with the HHERA. The main areas of uncertainty identified for this assessment include:

– Characterization uncertainty: including temporal variability in stormwater and surface water impacts.
– Stormwater sampling within off-site stormwater drains (SW_DISCHARGE 1 to SW_DISCHARGE 3) is not representative of an overflow of the on-site water dam.
– Scenario uncertainty: including the use of surface water within Park 23 (i.e., time spent at the park) is unknown.
– The presence of PFAS other than PFOS, PFHxS, and PFOA in the environment.

The stormwater samples (**SW_DISCHARGE 1**, **PL_01**, and **PL02**) in the drain adjacent the site and in Park 23 identified other PFAS compounds other than PFOS, PFHxS, and PFOA. The concentrations of other compounds are detailed below:

– SW_DISCHARGE 1 – PFOS, PFHxS, and PFOA concentrations (0.423 µg/L) 90% of the total PFAS concentration 0.47 µg/L).
– PL_01 - PFOS, PFHxS, and PFOA concentrations (0.108 µg/L) 50% of the total PFAS concentration (0.206 µg/L).
– PL_02 - PFOS, PFHxS, and PFOA concentrations (0.256 µg/L) 60% of the total PFAS concentration (0.433 µg/L).

The uncertainty for the presence of other PFAS compounds will not change the outcome of the assessment given relatively low concentrations were identified in sample (SW_DISCHARGE 1) adjacent stormwater drain to the site. The other PFAS compounds reported in samples in Park 23 (**PL_01** and **PL_02**) increase in concentrations, suggestive of other PFAS sources within the stormwater drainage network, rather than emanating from the site.

The approaches used to reduce the uncertainty associated with this HHERA have been to use site-specific data wherever possible, and to adopt conservative assumptions from reputable Australian and international agencies, in the absence of site-specific data. Conservative assumptions applied to this assessment include:

– The use of screening criteria intended to be well below the threshold for adverse health and environmental effects (based on no observed-adverse-affect-levels, with several safety factors applied to account for issues such as variability in populations).
– The use of screening criteria designed for the assessment of more intensive patterns of water use and more ecological diverse ecosystems than the River Torrens and Park 23.

6.10 Closure of data gaps presented by GHD (2022)

GHD (2022) identified key data gaps associated with characterising the contamination status of the site, which were addressed by this investigation. A summary of these data gaps is provided in Table 6.11.

Table 6.11 Review of data gaps provided by GHD (2022)

Data gaps by GHD (2022)	Comments based on the revised dataset (current investigation)
Extent of the presence of PFAS in groundwater off-site has not been delineated which has the potential to impact recreational users and ecological receptors of River Torrens the nearest surface water body (site sourced or ambient).	The connectivity between PFAS concentrations measured in groundwater downgradient of the site and the River Torrens is unknown. Surface water sampling completed during this investigation in the River Torrens reported PFOS concentrations below the human-health (recreational) and ecological (95% species protection) criteria in up- and down-stream surface water samples, within an order of magnitude. In this context, concentrations of PFAS are likely ambient concentrations present within the River Torrens associated with the urban environment and not related to the site.
GHD (2022) reported on-site surface water PFAS concentrations above human-health and ecological criteria with the potential for PFAS contamination to be transported off-site via stormwater discharge impacting Park 23.	Stormwater samples collected during this investigation with the CBD stormwater system (**SW_DISCHARGE 1** to **SW_DISCHARGE 3**), and Park 23 (**PL_01** and **PL_02**), reported PFOS concentrations below the human-health (recreational) and ecological (95% species protection) criteria. Ecological (99% species protection) criterion, adopted for the bioaccumulation of PFOS in aquatic food chains, were exceeded in all samples. Based on the current assessment general surface water run-off from the site is low risk. Given there are likely multiple sources of PFAS within the Adelaide CBD stormwater system, and coupled with the man-made design of Park 23, not intended to support aquatic organisms, the exceedance of ecological 99% species protection criterion does not pose an ecological risk. Nonetheless, PFAS concentrations within the stormwater drain (**SW_DISCHARGE 1**), adjacent the site, identifies that PFAS impacts are migrating off-site and appropriate measures need to be implemented (i.e., re-engineering of the site's drainage network). A data gap still remains in relation to overflow from the water dam that occurs during high rainfall events potential impacting the receiving environment of Park 23. This stored water within the water dam requires management incorporating off-site disposal.

7. Conclusions

7.1 Context

GHD completed an opportunistic surface water sampling event offsite in June 2023 at locations which had been identified as potential surface and storm water receptors, namely the River Torrens and the Adelaide Parklands Park 23 stormwater retention basin.

The scope of work comprised i) a program of off-site surface water sampling (9 primary samples) within the Park 23 retention basin and River Torrens, and ii) stormwater sampling (3 primary samples within the Wakefield Street stormwater drains (west of the site).

The focus of the report is the PFAS contamination associated with the historical use of AFFF at the site. The objectives of this report are as follows:

– To delineate the nature and extent of PFAS site contamination from the site to identified surface and storm water system receptors, specifically the River Torrens and Park 23 stormwater retention basin.
– To assess the potential risks to human health and the environment associated with on-site PFAS contamination.

7.2 Outcomes

The key findings of this report are summarised herein.

7.2.1 Objective 1 – The nature and extent of PFAS impact in off-site stormwater and surface water

– Stormwater samples (**SW_DISCHARGE 1** to **SW_DISCHARGE 3**) reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criteria. The PFOS concentrations (between 0.0011 µg/L to 0.39 µg/L) measured in all stormwater locations were above the ecological assessment criterion for 99% species protection but below the 95% species protection value. Stormwater samples collected during this investigation within Wakefield Street and Grote Street are considered representative of the site's surface water run-off collected within on-site spoon drains.
– Stormwater samples (**PL_01** and **PL_02**) collected within Park 23 reported PFOS, PFHxS and PFOA concentrations below the adopted human-health assessment criterion (2 µg/L). The PFOS concentrations (0.062 µg/L to 0.15 µg/L) measured in Park 23 locations, respectively, were above the ecological assessment criterion for 99% species protection but below the 95% species protection value.
– Surface water samples collected from within the River Torrens reported PFOS, PFHxS and PFOA below the adopted human-health assessment criteria. The PFOS concentrations measured in all surface water locations (**RT_SW01** to **RT_SW07**) were above the ecological assessment criterion for 99% species protection. An increase in PFOS concentrations were reported in samples collected within urban sections of the river; up-stream (**RT_SW04** 0.0032 µg/L), cross-stream (**RT_SW05** 0.0037 µg/L), and downstream (**RT_SW06** 0.0029 µg/L and **RT_SW07** 0.0032 µg/L) of the site. Notably, within an order of magnitude of upstream samples (**RT_SW01** to **RT_SW03**) that ranged between 0.001 to 0.011 µg/L.

The assessment of the stormwater and surface water datasets in the context of the CSM demonstrated that:

– The current stormwater dataset indicates that human-health and ecological risks in off-site receiving environments are low and acceptable.
– The current surface water dataset indicates that PFAS concentrations identified in the River Torrens are ambient concentrations likely associated with othswer sources in an urban setting and not attributed to the site.

7.2.2 Objective 2 – Assess PFAS contamination exposure risks to human health, water, and the environment.

A preliminary (screening level) HHERA was completed and considered the following potential exposure scenarios:

– Recreational users of the receiving environments, River Torrens, and Park 23.
– Ecological receptors in nearest surface water receiving body, River Torrens.

The risk characterisation under the two scenarios assessed are low and acceptable, with the maximum PFOS, PFHxS and PFOA concentrations lower than the adopted human-health criterion.

The following data gap remains following the completion of this off-site stormwater assessment:

– Potential PFAS impacts in the receiving environment, Park 23, during a high rainfall event, with subsequent overflow from the on-site water dam, is unknown.

7.3 Recommendations

The following recommendations are made based on the information detailed within this report:

– Management of the stored water within the site's water dam (retention pit). The water dam contains surface water runoff from the site and likely contributes to the concentrations before being released to the stormwater system during overflow events. It is recommended that the water dam be removed, including disposal of any PFAS impacted water by a suitably licenced contractor.
– An SMP is recommended site to manage the contaminated soils and stored water within the water dam (if not decommissioned).

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Appendix A

Figures

Data Disclaimer

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Paper Size ISO A3

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Project No. **12583428**
Revision No. **B**
Date **20/09/2023**

Site Location Plan

FIGURE 1

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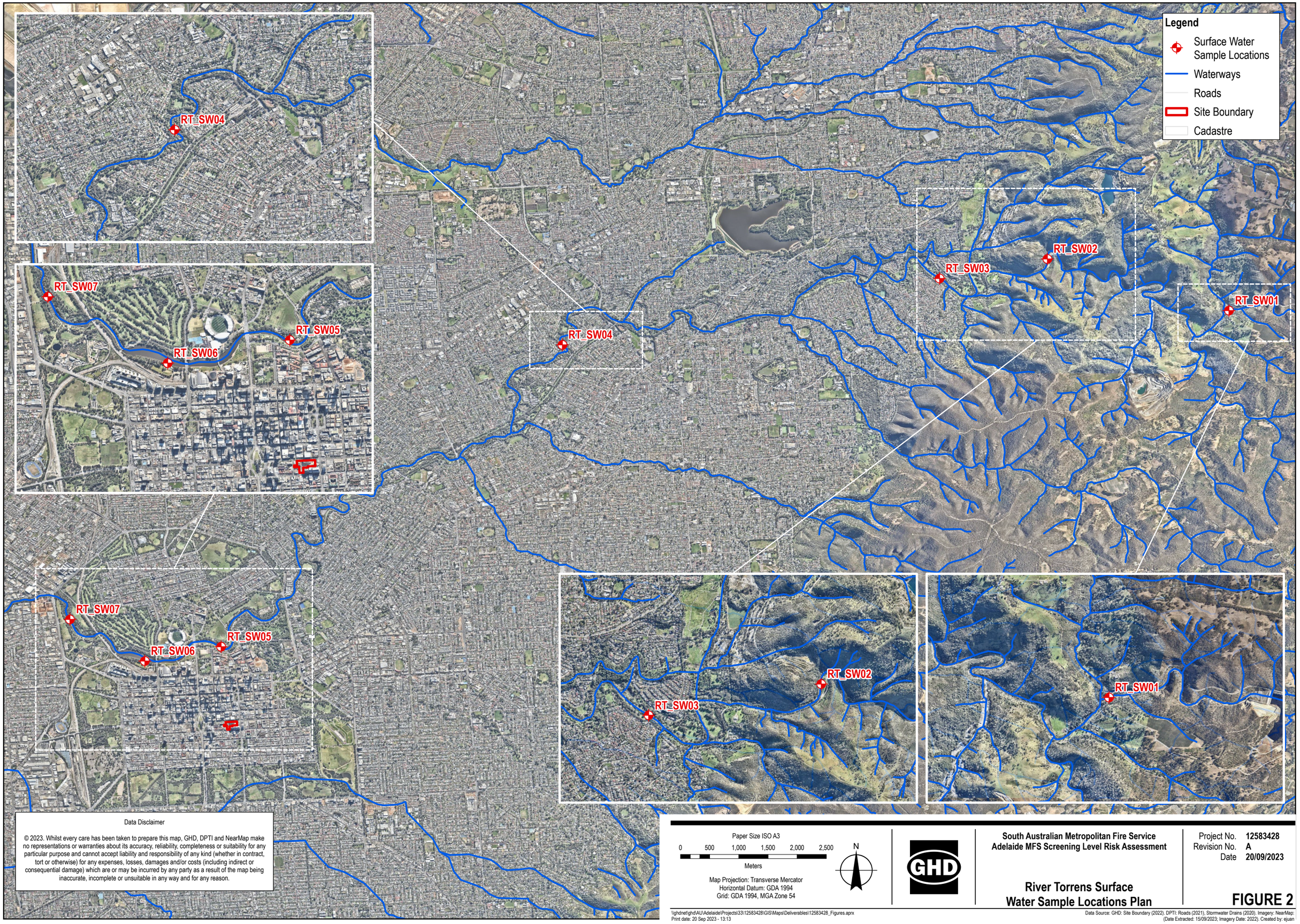
Data Source: GHD: Site Boundary (2022). DPTI: Roads (2021), Stormwater Drains (2020). Imagery: NearMap: (Date Extracted: 15/09/2023; Imagery Date: 2022). Created by: ejuan



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

River Torrens Surface Water Sample Locations Plan

Project No. **12583428**
Revision No. **A**
Date **20/09/2023**

FIGURE 2

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Park 23 Surface Water and Stormwater Sample Locations Plan

Project No. **12583428**
Revision No. **A**
Date **20/09/2023**

FIGURE 3

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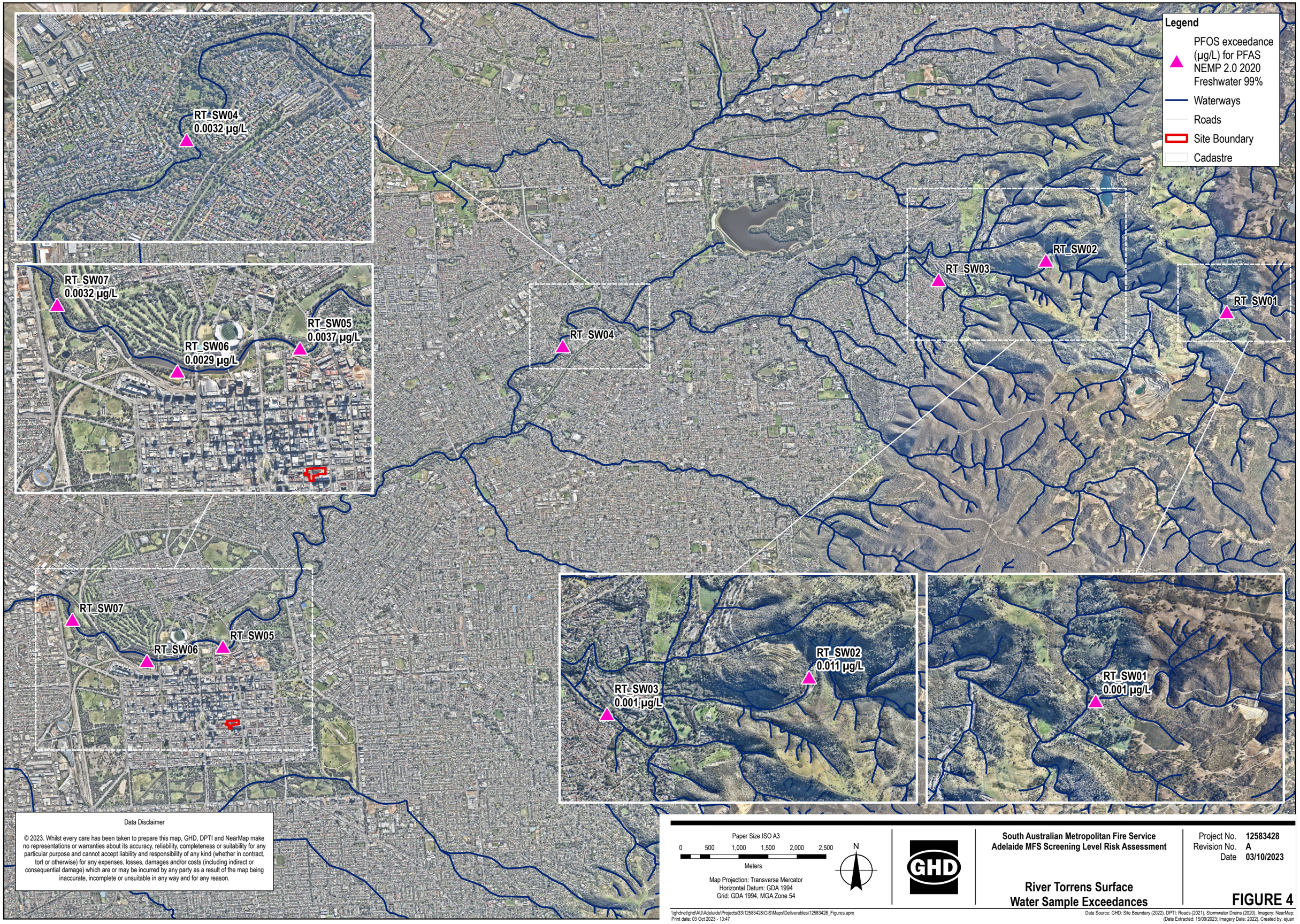

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

River Torrens Surface Water Sample Exceedances

Project No. **12583428**
Revision No. **A**
Date **03/10/2023**

FIGURE 4

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Park 23 Surface Water and Stormwater Sample Exceedances Plan

Project No. **12583428**
Revision No. **A**
Date **03/10/2023**

FIGURE 5

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Project No. **12583428**
Revision No. **A**
Date **06/10/2023**

Storm Water Sample Locations

FIGURE 6

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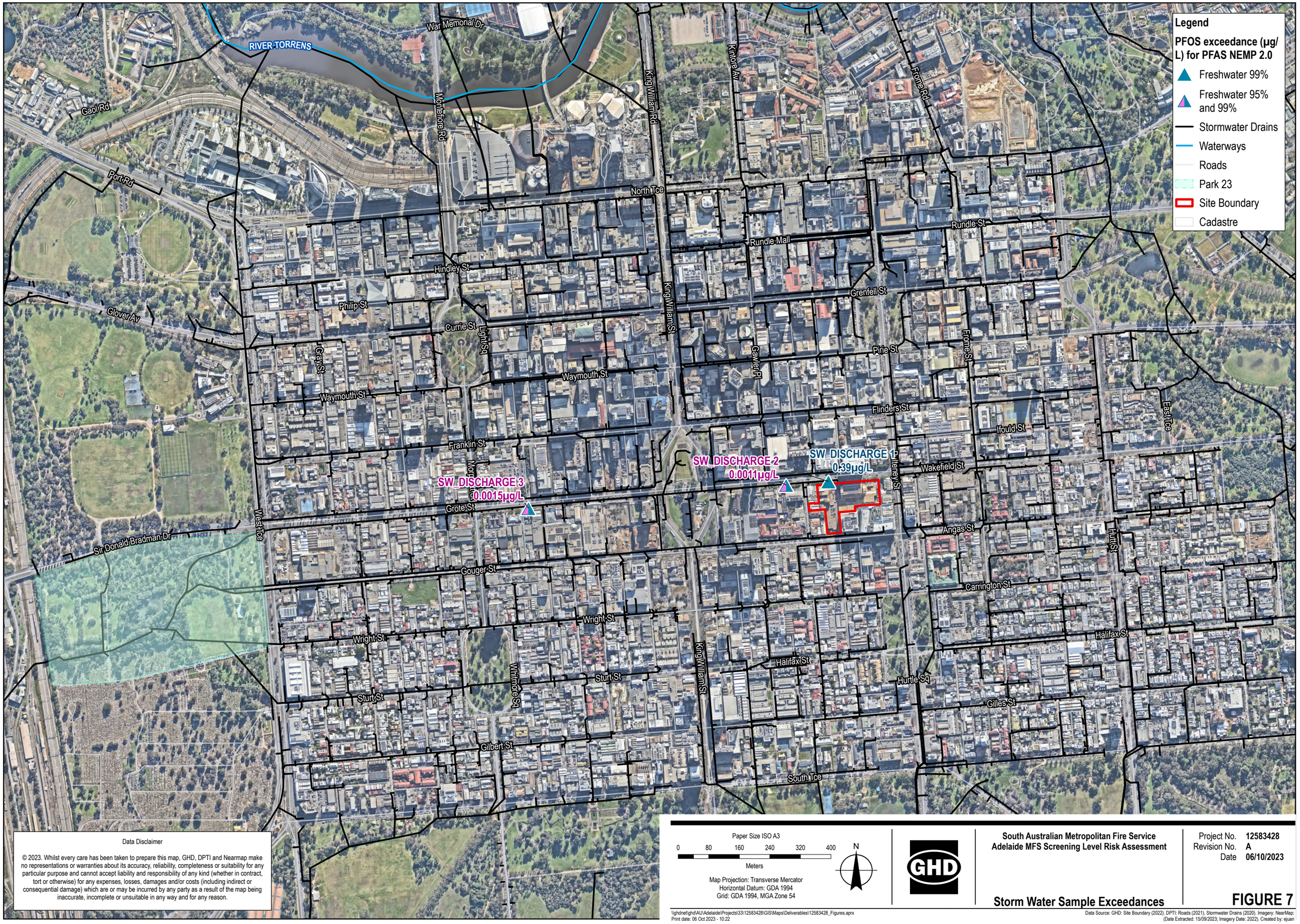

Data Disclaimer

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Storm Water Sample Exceedances

Project No. **12583428**
Revision No. **A**
Date **06/10/2023**

FIGURE 7

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Data Source: GHD: Site Boundary (2022). DPTI: Roads (2021), Stormwater Drains (2020). Imagery: NearMap: (Date Extracted: 15/09/2023; Imagery Date: 2022). Created by: ejuan

MW02	
Analyte	Concentration (ug/L)
PFHxS	0.0062
PFOS	0.0240
PFOA	0.020
Sum of PFHxS and PFOS	0.030

MW03	
Analyte	Concentration (ug/L)
PFHxS	0.3
PFOS	0.06
PFOA	0.01
Sum of PFHxS and PFOS	0.35

GW103	
Analyte	Concentration (ug/L)
PFHxS	4.8
PFOS	9.4
PFOA	0.41
Sum of PFHxS and PFOS	14

MW01	
Analyte	Concentration (ug/L)
PFHxS	0.18
PFOS	1.5000
PFOA	0.030
Sum of PFHxS and PFOS	1.600

GW106	
Analyte	Concentration (ug/L)
PFHxS	< 0.01
PFOS	0.02
PFOA	< 0.01
Sum of PFHxS and PFOS	0.02

GW101	
Analyte	Concentration (ug/L)
PFHxS	20
PFOS	22
PFOA	1.5
Sum of PFHxS and PFOS	41

Legend

- On-Site Groundwater Monitoring Wells
- Off-Site Groundwater Monitoring Wells
- Roads
- Site Boundary
- Cadastre

Criteria	pPFHxS (µg/L)	PFOS (µg/L)	PFOA (µg/L)	Sum of PFHxS and PFOS (µg/L)
PFAS NEMP 2.0 2020 Freshwater - 90% - highly disturbed systems	-	2	632	-
PFAS NEMP 2.0 2020 Health Drinking Water	0.07	0.07	0.56	0.07
PFAS NEMP 2.0 2020 Recreational Water	2	2	10	2

Paper Size ISO A3

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Historical Exceedances for Groundwater On and Off-site

Project No. **12583428**
Revision No. **A**
Date **06/10/2023**

FIGURE 8

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Data Source: GHD: Site Boundary (2022). DPTI: Roads (2021), Onsite & Offsite Locations (2020). Imagery: NearMap: (Date Extracted: 15/09/2023; Imagery Date: 2022). Created by: ejuan

DAM_S	
Analyte	**Concentration**
PFHxS	0.59
PFOS	1.8
PFOA	0.07
Sum of PFHxS and PFOS	2.4

DAM_B	
Analyte	**Concentration**
PFHxS	0.58
PFOS	1.8
PFOA	0.07
Sum of PFHxS and PFOS	2.4

SW2	
Analyte	**Concentration**
PFHxS	-
PFOS	6.12
PFOA	0.05
Sum of PFHxS and PFOS	6.12

Paper Size ISO A3

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994, MGA Zone 54

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South Australian Metropolitan Fire Service
Adelaide MFS Screening Level Risk Assessment

Historical Exceedances for Surface Water On-Site

Project No. **12583428**
Revision No. **A**
Date **09/10/2023**

FIGURE 9

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Appendix B

Data quality objectives and indicators

B-1 Data quality objectives

Data quality objectives (DQOs) were established for this surface and storm water monitoring event to assist in the design and implementation of data collection activities, such that the type, quantity, and quality of data obtained to address the project objectives and is outlined in Table B.8.1.

Table B.8.1 Data quality objectives (DQOs)

Step	Description
Step 1 State the problem to be resolved	Firefighting foams containing PFAS have historically been used at the CFS site for training purposes. Previous Environmental Investigations (GHD, 2022) have shown that PFAS contamination has migrated off-site via groundwater (down hydraulic gradient to the north-west of the site). The EPA and GHD agreed that further work was required to address data gaps associated with identified surface and storm water system receptors.
Step 2 Identify the decision/s to be made	To address the problem in Step 1, the following objectives need to be addressed: – Delineate the nature and extent of site contamination from the MFS Adelaide Fire Station. – Assess the potential risks to human-health, water, and the environment.
Step 3 Identify the inputs to the decision	To inform the decisions, the following information is considered necessary: – Collection and analysis of surface water and storm water samples under conditions where the stormwater system is flowing. – Assessment of quality assurance and quality control (QAQC) data to determine the reliability of the data set.
Step 4 Define the boundaries of the study	The lateral boundaries of the site and the Investigation Area are shown in Figure 2, 3, and 6 in Appendix A. The vertical boundary of the investigation is defined as the depth of waterways at the time of sampling. The temporal extent of the investigation was the sampling day/s.
Step 5 Develop decision rule	Surface and storm water PFAS concentrations are to be compared against the relevant WQG defined in the National Environment Protection (Assessment of Site Contamination) Measure (1999). If concentrations are below these guidelines, the risk profile defined by GHD (2022) would be confirmed (low and acceptable risks). If the criterion is exceeded, additional investigation may be required.
Step 6 Specify the tolerable limits on decision errors	Data generated as part of the surface water monitoring event must be appropriate to allow decisions to be made with confidence. Specific limits have been adopted in accordance with guidance from the AS 4482.1: 2005, which includes appropriate indicators of data quality. Data quality indicators (DQIs – provided in Table 4) were used to assess QAQC and GHD's Standard Field Operating Procedures. The data is considered suitable for the purposes of achieving the Step 2 goals provided that the following errors and their circumstances of occurrence are minimised. – False negative errors which indicate that a concentration of PFAS is not present above threshold concentrations when it actually is. – False positive errors which indicate that a concentration of PFAS is present above threshold concentrations, but it is actually not. – These errors can occur if: – Samples are not representative of the conditions within the Investigation Area. – Incorrect sampling methods are used. – Uncalibrated sampling equipment is used. – Errors in laboratory testing occur in association with, for example, sample handling, preparation, analysis and data reduction. – Errors in recording data occur, such as data transcription errors.
Step 7 Optimising the design for obtaining data	To optimise the design of the investigation, the surface water and storm water sampling and analytical program was developed based upon the results of previous investigations and in accordance with standard industry practices, the HEPA (2020) and SA EPA guidelines. Results (including QAQC results) were reviewed as they were received from the laboratory and any inconsistencies or unexpected data were further investigated with the laboratory.

B-2 Data quality indicators

Data quality indicators (DQIs) are evaluated as part of the DQOs. The DQIs for sample collection and laboratory analysis are provided in Table B.8.2.

Table B.8.2 Date quality indicators (DQIs)

DQIs	Description
Data representativeness	Expresses the degree to which sample data accurately and precisely represents a characteristic of a population or environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the Investigation Area. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.
Completeness	Defined as the percentage of measurements made, which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data is required to be collected. Additionally, appropriate laboratory limit of reporting (LOR) for the laboratory analysis are required.
Comparability	A qualitative parameter that expresses the confidence with which one data set can be compared with the other. This is achieved through maintaining a level of consistency in techniques used to collect samples and checking that analysing laboratories use consistent analysis techniques and reporting methods.
Precision	Measures the reproducibility of measurements given under a given set of conditions. The precision of the data is assessed by calculating the relevant percentage difference (RPD) between duplicate sample pairs. Nominal acceptance criterion will be adopted for the assessment including: – ± 30% RPD for inter-laboratory and intra-laboratory duplicates for inorganic analytes; and – ± 50% RPD for inter-laboratory and intra-laboratory duplicates for organic compounds (when contaminants concentrations are more than ten times the LOR) However, it is noted that this will not always be achieved, particularly at low analyte concentrations (less than 10 times the LOR)
Accuracy	Evaluates the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor samples preparation techniques and poor selection of analytical techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of the laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards. The nominal “acceptance limits” on laboratory control samples are defined as follows: – Laboratory spikes – 60-140% recovery for organic compounds – Laboratory duplicates – If contaminant concentration is less than 10 times the LOR: no RPD limit. If concentration is 10 to 20 times the LOR: 0% to 50% RPD. If greater than 20 times the LOR: 0% to 30% RPD. – Laboratory surrogates – 60-240% recovery. – Laboratory blanks - <LOR

Appendix C

Analytical results tables

				PFAS - Perfluoroalkyl Sulfonic Acids							PFAS - Perfluoroalkyl Carboxylic Acids										
				Perfluoropropanesulfonic acid (PFPrS)	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)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.001	0.001	0.001	0.001	0.001	0.0001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems									**0.13**						**220**						
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems									*0.00023*						*19*						
PFAS NEMP 2.0 2020 Recreational Water							2		2						10						
Location Code	**Date**	**Field ID**	**Lab Report Number**																		
Stormwater																					
	04 Aug 2023	FD01	1016272	<0.001	<0.002	<0.001	<0.001	<0.001	*0.0017*	<0.001	0.005	0.003	0.005	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
		FS01	1016272	<0.001	<0.002	<0.001	<0.001	<0.001	*0.0018*	<0.001	<0.005	0.003	0.005	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
		SW_DISCHARGE 1	1016272	0.002	0.004	0.003	0.029	0.003	***0.39***	0.001	0.005	0.004	0.013	<0.002	0.004	<0.001	0.001	0.003	<0.001	<0.001	<0.001
		SW_DISCHARGE 2	1016272	<0.001	<0.001	<0.001	<0.001	<0.001	*0.0011*	<0.001	<0.005	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
		SW_DISCHARGE 3	1016272	<0.001	<0.001	<0.001	<0.001	<0.001	*0.0015*	<0.001	<0.005	0.003	0.005	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Surface Water																					
PL_SW01	09 Jun 2023	PL_FB01	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		PL_SW01	997597	0.002	0.019	0.004	0.035	0.001	*0.062*	<0.001	<0.05	0.02	0.03	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PL_SW02	09 Jun 2023	PL_SW02	997597	0.004	0.018	0.006	0.057	0.003	***0.15***	<0.001	<0.05	0.02	0.05	0.02	0.05	0.01	0.02	<0.01	<0.01	<0.01	<0.01
RT_SW01	09 Jun 2023	RT_FB01	997597	<0.001	<0.001	<0.001	<0.001	<0.001	0.0002	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW01	997597	<0.001	<0.001	<0.001	<0.001	<0.001	*0.0010*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW02	09 Jun 2023	RT_FB02	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW02	997597	<0.001	<0.001	<0.001	0.001	<0.001	*0.0011*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW03	09 Jun 2023	RT_FB03	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW03	997597	<0.001	<0.001	<0.001	0.002	<0.001	*0.0010*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW04	09 Jun 2023	RT_FB04	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW04	997597	<0.001	<0.001	<0.001	0.001	<0.001	*0.0032*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW05	09 Jun 2023	RT_FB05	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_FD01	997597	<0.001	<0.001	<0.001	0.002	<0.001	*0.0024*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW05	997597	<0.001	<0.001	<0.001	0.002	<0.001	*0.0037*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW06	09 Jun 2023	RT_FB06	997597	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
		RT_SW06	997597	<0.001	<0.001	<0.001	0.002	<0.001	*0.0029*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RT_SW07	09 Jun 2023	RT_SW07	997597	<0.001	<0.001	<0.001	0.002	<0.001	*0.0032*	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Statistics

Number of Results	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Number of Detects	3	3	3	10	3	16	1	2	6	7	4	6	1	2	1	0	0	0
Minimum Concentration	<0.001	<0.001	<0.001	0.001	0.001	<0.0001	0.001	0.005	<0.001	0.002	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Minimum Detect	0.002	0.004	0.003	0.001	0.001	0.0002	0.001	0.005	0.003	0.002	0.002	0.001	0.01	0.001	0.003	ND	ND	ND
Maximum Concentration	0.004	0.019	0.006	0.057	0.003	0.39	0.001	<0.05	0.02	0.05	0.02	0.05	0.01	0.02	<0.01	<0.01	<0.01	<0.01
Maximum Detect	0.004	0.019	0.006	0.057	0.003	0.39	0.001	0.005	0.02	0.05	0.02	0.05	0.01	0.02	0.003	ND	ND	ND
Average Concentration *	0.0008	0.0023	0.001	0.0063	0.00075	0.029	0.00052	0.02	0.0058	0.0084	0.0049	0.0065	0.0042	0.0047	0.0041	0.004	0.004	0.004
Geometric Average *	0.00062	0.00081	0.00067	0.0013	0.00061	0.0011	0.00052	0.016	0.0047	0.006	0.0039	0.0042	0.0031	0.0033	0.0032	0.003	0.003	0.003
Median Concentration *	0.0005	0.0005	0.0005	0.0005	0.0005	0.0013	0.0005	0.025	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Standard Deviation *	0.00084	0.0053	0.0014	0.015	0.00074	0.087	0.00011	0.0092	0.0047	0.011	0.0037	0.0099	0.0023	0.0039	0.0018	0.0019	0.0019	0.0019
Geometric Standard Deviation *	1.8	3.1	2.1	4.4	1.7	13	1.2	2.4	2	2	2.1	2.4	2.8	2.8	2.5	2.7	2.7	2.7
95% UCL (Student's-t) *	0.0011	0.00428	0.00155	0.0117	0.00102	0.0606	0.00056184	0.0235	0.00757	0.0124	0.00624	0.0102	0.00505	0.00611	0.00475	0.00469	0.00469	0.00469
% of Detects	14	14	14	45	14	73	5	9	27	32	18	27	5	9	5	0	0	0
% of Non-Detects	86	86	86	55	86	27	95	91	73	68	82	73	95	91	95	100	100	100

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

				PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums					PFAS
				Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	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)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	PFAS (Sum of Total)(WA DER List)	Perfluorononane sulfonate (PFNS)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.005	0.001	0.001	0.001	0.001	0.005	0.001	0.005	0.001
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems																				
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems																				
PFAS NEMP 2.0 2020 Recreational Water															2					
Location Code	**Date**	**Field ID**	**Lab Report Number**																	
Stormwater																				
	04 Aug 2023	FD01	1016272	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0017	0.0037	0.0187	0.0037	0.0187	<0.001
		FS01	1016272	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0018	0.0028	0.0128	0.0028	0.0128	<0.001
		SW_DISCHARGE 1	1016272	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.002	<0.001	0.419	0.394	0.47	0.423	0.449	0.003
		SW_DISCHARGE 2	1016272	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0011	0.0011	<0.005	0.0011	<0.005	<0.001
		SW_DISCHARGE 3	1016272	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0015	0.0025	0.0125	0.0025	0.0125	<0.001
Surface Water																				
PL_SW01	09 Jun 2023	PL_FB01	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		PL_SW01	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.097	0.073	0.206	0.108	0.194	<0.001
PL_SW02	09 Jun 2023	PL_SW02	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.207	0.199	0.433	0.256	0.381	<0.001
RT_SW01	09 Jun 2023	RT_FB01	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_SW01	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.001	0.001	<0.005	0.001	<0.005	<0.001
RT_SW02	09 Jun 2023	RT_FB02	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_SW02	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0021	0.0011	<0.005	0.0021	<0.005	<0.001
RT_SW03	09 Jun 2023	RT_FB03	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_SW03	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.003	0.001	<0.005	0.003	<0.005	<0.001
RT_SW04	09 Jun 2023	RT_FB04	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_SW04	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0042	0.0052	0.0112	0.0062	0.0102	<0.001
RT_SW05	09 Jun 2023	RT_FB05	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_FD01	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0044	0.0044	0.0104	0.0064	0.0104	<0.001
		RT_SW05	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0057	0.0057	0.0127	0.0077	0.0117	<0.001
RT_SW06	09 Jun 2023	RT_FB06	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	<0.005	<0.001
		RT_SW06	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0049	0.0059	0.0149	0.0079	0.0129	<0.001
RT_SW07	09 Jun 2023	RT_SW07	997597	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0052	0.0062	0.0152	0.0082	0.0132	<0.001

Statistics

Number of Results	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Number of Detects	1	0	0	0	0	0	0	0	0	0	0	15	15	11	15	11	1
Minimum Concentration	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.001	0.001	<0.005	0.001	<0.005	<0.001
Minimum Detect	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	0.001	0.0104	0.001	0.0102	0.003
Maximum Concentration	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.002	<0.001	0.419	0.394	0.47	0.423	0.449	0.003
Maximum Detect	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.419	0.394	0.47	0.423	0.449	0.003
Average Concentration *	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0005	0.0025	0.00052	0.0005	0.035	0.032	0.057	0.038	0.052	0.00061
Geometric Average *	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.0005	0.0025	0.00052	0.0005	0.0028	0.0028	0.009	0.0033	0.0087	0.00054
Median Concentration *	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.0005	0.0025	0.0005	0.0005	0.00175	0.0018	0.00645	0.00265	0.00635	0.0005
Standard Deviation *	0.0094	0.0097	0.0097	0.0097	0.0097	0.0097	0.0097	0	0	0.00011	0	0.098	0.092	0.13	0.1	0.12	0.00053
Geometric Standard Deviation *	2.6	2.7	2.7	2.7	2.7	2.7	2.7	1	1	1.2	1	7.2	7.1	5.4	7.5	5.3	1.5
95% UCL (Student's-t) *	0.0235	0.0234	0.0234	0.0234	0.0234	0.0234	0.0234	0.0005	0.0025	0.00056184	0.0005	0.0706	0.066	0.106	0.0762	0.0981	0.00080918
% of Detects	5	0	0	0	0	0	0	0	0	0	0	68	68	50	68	50	5
% of Non-Detects	95	100	100	100	100	100	100	100	100	100	100	32	32	50	32	50	95

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately distur
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

		PFAS - Perfluoroalkyl Sulfonic Acids						PFAS - Perfluoroalkyl Carboxylic Acids											
		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)
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.02	0.02	0.01	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
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems						**0.13**						**220**							
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems						*0.00023*						*19*							
PFAS NEMP 2.0 2020 Recreational Water				2		2						10							
Date	**Field ID**																		
17 May 2017	DAM_B	0.06	0.05	0.62	0.06	***2.33***	<0.02	<0.1	0.31	0.5	0.12	0.22	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
		0.08	-	0.76	-	***3.07***	-	-	4.62	1.92	0.65	0.35	-	-	-	-	-	-	0.04
15 Sep 2017	DAM_B	<0.02	<0.02	0.27	0.04	***2.35***	<0.02	<0.1	<0.02	0.14	<0.02	0.05	<0.02	0.02	<0.02	<0.02	<0.02	<0.05	0.02
		0.03	0.03	0.28	-	***2.60***	-	-	0.90	1.37	0.39	0.37	0.04	-	-	-	-	-	-
17 Oct 2017	DAM_B	0.03	0.03	0.29	0.04	***1.65***	<0.02	<0.1	0.16	0.20	0.08	0.09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	0.03
		<1.00	<1.00	<1.00	<1.00	***2.00***	-	-	<1.00	<1.00	<1.00	<1.00	-	-	-	-	-	-	<1.00
21 Oct 2022	DAM_B	-	-	0.58	-	***1.8***	-	-	-	-	-	0.07	-	-	-	-	-	-	-
Statistics																			
Number of Results		6	6	7	6	7	3	3	6	6	6	7	5	4	3	3	3	3	6
Number of Detects		4	4	6	5	7	0	0	4	5	4	6	2	1	0	0	0	0	3
Minimum Concentration		<0.02	<0.02	0.27	0.04	1.65	<0.02	<0.1	<0.02	0.14	<0.02	0.05	0.02	0.02	<0.02	<0.02	<0.02	<0.05	0.02
Minimum Detect		0.03	0.03	0.27	0.04	1.65	ND	ND	0.16	0.14	0.08	0.05	0.02	0.02	ND	ND	ND	ND	0.02
Maximum Concentration		<1	<1	<1	<1	3.07	<0.02	<0.1	4.62	1.92	<1	<1	0.04	0.02	<0.02	<0.02	<0.02	<0.05	<1
Maximum Detect		0.08	0.05	0.76	0.06	3.07	ND	ND	4.62	1.92	0.65	0.37	0.04	0.02	ND	ND	ND	ND	0.04
Average Concentration *		0.12	0.11	0.47	0.12	2.3	0.01	0.05	1.1	0.77	0.29	0.24	0.018	0.012	0.01	0.01	0.01	0.025	0.1
Geometric Average *		0.053	0.047	0.44	0.07	2.2	0.01	0.05	0.32	0.51	0.15	0.17	0.015	0.012	0.01	0.01	0.01	0.025	0.033
Median Concentration *		0.045	0.04	0.5	0.05	2.33	0.01	0.05	0.405	0.5	0.255	0.22	0.01	0.01	0.01	0.01	0.01	0.025	0.025
Standard Deviation *		0.19	0.21	0.19	0.23	0.49	0	0	1.8	0.71	0.26	0.18	0.014	0.0029	0	0	0	0	0.21
Geometric Standard Deviation *		3.7	3.7	1.5	2.7	1.2	1	1	7.7	2.8	4.8	2.5	1.9	1.4	1	1	1	1	4.3
95% UCL (Student's-t) *		0.273	0.269	0.615	0.275	2.616	0.01	0.05	2.531	1.359	0.505	0.364	0.0304	0.0184	0.01	0.01	0.01	0.025	0.262
% of Detects		67	67	86	83	100	0	0	67	83	67	86	40	25	0	0	0	0	50
% of Non-Detects		33	33	14	17	0	100	100	33	17	33	14	60	75	100	100	100	100	50

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

		PFAS - Perfluoroalkyl Sulfonamide						PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums				PFAS TOPA - Sums	
		N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	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)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)	Sum of TOP C4 - C14 as Fluorine	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.05	0.05	0.02	0.05	0.05	0.02	0.05	0.01	0.02	0.05	0.01	0.01	0.01	0.01	0.01	0.01
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems																	
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems																	
PFAS NEMP 2.0 2020 Recreational Water												2					
Date	**Field ID**																
17 May 2017	DAM_B	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	2.95	-	8.17	8.02	-	10.7
		-	-	-	-	-	-	-	2.1	0.88	-	3.83	-	10.7	-	-	-
15 Sep 2017	DAM_B	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	2.63	-	3.55	3.49	3.96	6.06
		-	-	-	-	-	-	-	0.46	0.21	-	2.87	-	6.06	-	-	-
17 Oct 2017	DAM_B	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	0.91	0.49	0.13	1.94	-	2.00	3.90	1.29	2.00
		-	-	-	-	-	-	-	<1.00	<1.00	<1.00	2.00	-	4.13	-	-	-
21 Oct 2022	DAM_B	-	-	-	-	-	-	-	0.13	0.06	-	2.4	1.9	2.6	-	-	-
Statistics																	
Number of Results		3	3	3	3	3	3	3	7	7	4	7	1	7	3	2	3
Number of Detects		0	0	0	0	0	0	0	4	4	1	7	1	7	3	2	3
Minimum Concentration		<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	1.94	1.9	2	3.49	1.29	2
Minimum Detect		ND	ND	ND	ND	ND	ND	ND	0.13	0.06	0.13	1.94	1.9	2	3.49	1.29	2
Maximum Concentration		<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	2.1	<1	<1	3.83	1.9	10.7	8.02	3.96	10.7
Maximum Detect		ND	ND	ND	ND	ND	ND	ND	2.1	0.88	0.13	3.83	1.9	10.7	8.02	3.96	10.7
Average Concentration *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.59	0.31	0.17	2.7		5.3	5.1	2.6	6.3
Geometric Average *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.23	0.15	0.08	2.6	1.9	4.6	4.8	2.3	5.1
Median Concentration *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.46	0.21	0.0775	2.63	1.9	4.13	3.9	2.625	6.06
Standard Deviation *		0	0	0	0	0	0	0	0.74	0.32	0.23	0.65		3.2	2.5	1.9	4.4
Geometric Standard Deviation *		1	1	1	1	1	1	1	5.7	4.4	4.3	1.3		1.8	1.6	2.2	2.3
95% UCL (Student's-t) *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	1.134	0.551	0.435	3.136		7.65	9.36	11.05	13.59
% of Detects		0	0	0	0	0	0	0	57	57	25	100	100	100	100	100	100
% of Non-Detects		100	100	100	100	100	100	100	43	43	75	0	0	0	0	0	0

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately di
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation v
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

		PFAS - Perfluoroalkyl Sulfonic Acids						PFAS - Perfluoroalkyl Carboxylic Acids											
		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)
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.02	0.02	0.01	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
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems						**0.13**						**220**							
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems						*0.00023*						*19*							
PFAS NEMP 2.0 2020 Recreational Water				2		2						10							
Date	**Field ID**																		
17 May 2017	DAM_S	0.07	0.05	0.65	0.06	***2.36***	<0.02	<0.1	0.3	0.55	0.12	0.22	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
		0.08	0.06	0.78	0.07	***3.07***	-	-	4.13	1.66	0.61	0.3	-	-	-	-	-	-	0.05
15 Sep 2017	DAM_S	0.02	<0.02	0.29	0.04	***2.54***	<0.02	<0.1	<0.02	0.13	<0.02	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
		-	0.03	-	-	***2.90***	-	-	0.66	1.31	0.30	0.34	0.03	-	-	-	-	-	0.03
17 Oct 2017	DAM_S	0.02	0.03	0.22	0.03	***1.34***	<0.02	<0.1	0.09	0.15	0.04	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
		<1.00	<1.00	<1.00	<1.00	***1.90***	-	-	<1.00	<1.00	<1.00	<1.00	-	-	-	-	-	-	-
21 Oct 2022	DAM_S	-	-	0.59	-	***1.8***	-	-	-	-	-	0.07	-	-	-	-	-	-	-
Statistics																			
Number of Results		6	6	7	6	7	3	3	6	6	6	7	5	3	3	3	3	3	5
Number of Detects		4	4	6	5	7	0	0	4	5	4	6	2	0	0	0	0	0	2
Minimum Concentration		0.02	<0.02	0.22	0.03	1.34	<0.02	<0.1	<0.02	0.13	<0.02	0.05	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
Minimum Detect		0.02	0.03	0.22	0.03	1.34	ND	ND	0.09	0.13	0.04	0.05	0.02	ND	ND	ND	ND	ND	0.03
Maximum Concentration		<1	<1	<1	<1	3.07	<0.02	<0.1	4.13	1.66	<1	<1	0.03	<0.02	<0.02	<0.02	<0.02	<0.05	0.05
Maximum Detect		0.08	0.06	0.78	0.07	3.07	ND	ND	4.13	1.66	0.61	0.34	0.03	ND	ND	ND	ND	ND	0.05
Average Concentration *		0.12	0.11	0.47	0.12	2.3	0.01	0.05	0.95	0.72	0.26	0.22	0.016	0.01	0.01	0.01	0.01	0.025	0.022
Geometric Average *		0.047	0.049	0.43	0.068	2.2	0.01	0.05	0.27	0.48	0.13	0.16	0.014	0.01	0.01	0.01	0.01	0.025	0.017
Median Concentration *		0.045	0.04	0.5	0.05	2.36	0.01	0.05	0.4	0.525	0.21	0.22	0.01	0.01	0.01	0.01	0.01	0.025	0.01
Standard Deviation *		0.2	0.19	0.22	0.2	0.62	0	0	1.6	0.63	0.25	0.17	0.0095	0	0	0	0	0	0.018
Geometric Standard Deviation *		4.1	3.7	1.6	2.8	1.3	1	1	7.6	2.9	5	2.6	1.7	1	1	1	1	1	2.1
95% UCL (Student's-t) *		0.273	0.27	0.63	0.276	2.732	0.01	0.05	2.246	1.235	0.469	0.346	0.0245	0.01	0.01	0.01	0.01	0.025	0.0391
% of Detects		67	67	86	83	100	0	0	67	83	67	86	40	0	0	0	0	0	40
% of Non-Detects		33	33	14	17	0	100	100	33	17	33	14	60	100	100	100	100	100	60

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

		PFAS - Perfluoroalkyl Sulfonamide						PFAS - Fluorotelomer Sulfonic Acids				PFAS - Sums				PFAS TOPA - Sums	
		N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	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)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)	Sum of TOP C4 - C14 as Fluorine	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.05	0.05	0.02	0.05	0.05	0.02	0.05	0.01	0.02	0.05	0.01	0.01	0.01	0.01	0.01	0.01
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems																	
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems																	
PFAS NEMP 2.0 2020 Recreational Water												2					
Date	**Field ID**																
17 May 2017	DAM_S	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	3.01	-	8.29	8.11	-	9.92
		-	-	-	-	-	-	-	2	1	-	3.85	-	9.92	-	-	-
15 Sep 2017	DAM_S	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	2.83	-	3.82	3.75	3.86	5.92
		-	-	-	-	-	-	-	0.52	0.22	-	3.19	-	5.92	-	-	-
17 Oct 2017	DAM_S	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	0.49	0.25	<0.05	1.56	-	1.90	2.66	1.23	1.90
		-	-	-	-	-	-	-	<1.00	<1.00	-	1.90	-	2.72	-	-	-
21 Oct 2022	DAM_S	-	-	-	-	-	-	-	0.12	0.06	-	2.4	1.9	2.6	-	-	-
Statistics																	
Number of Results		3	3	3	3	3	3	3	7	7	3	7	1	7	3	2	3
Number of Detects		0	0	0	0	0	0	0	4	4	0	7	1	7	3	2	3
Minimum Concentration		<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	1.56	1.9	1.9	2.66	1.23	1.9
Minimum Detect		ND	ND	ND	ND	ND	ND	ND	0.12	0.06	ND	1.56	1.9	1.9	2.66	1.23	1.9
Maximum Concentration		<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	2	1	<0.05	3.85	1.9	9.92	8.11	3.86	9.92
Maximum Detect		ND	ND	ND	ND	ND	ND	ND	2	1	ND	3.85	1.9	9.92	8.11	3.86	9.92
Average Concentration *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.53	0.3	0.025	2.7		5	4.8	2.5	5.9
Geometric Average *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.21	0.14	0.025	2.6	1.9	4.2	4.3	2.2	4.8
Median Concentration *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	0.49	0.22	0.025	2.83	1.9	3.82	3.75	2.545	5.92
Standard Deviation *		0	0	0	0	0	0	0	0.69	0.35	0	0.79		3.1	2.9	1.9	4
Geometric Standard Deviation *		1	1	1	1	1	1	1	5.3	4.3	1	1.4		1.9	1.8	2.2	2.3
95% UCL (Student's-t) *		0.025	0.025	0.01	0.025	0.025	0.01	0.025	1.031	0.556	0.025	3.254		7.305	9.702	10.85	12.67
% of Detects		0	0	0	0	0	0	0	57	57	0	100	100	100	100	100	100
% of Non-Detects		100	100	100	100	100	100	100	43	43	100	0	0	0	0	0	0

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderat
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conserva
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

			Inorganics	PFAS - Perfluoroalkyl Sulfonic Acids								PFAS - Perfluoroalkyl Carboxylic Acids									
			Moisture (%)	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)
			%	µg/L	µg/L	mg/kg	µg/L	µg/L	mg/kg	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/kg	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.1	0.0004	0.001	0.0001	0.0002	0.001	0.0001	0.0002	0.002	0.002	0.002	0.0004	0.0004	0.0001	0.0002	0.001	0.002	0.002	0.005
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems										**0.13**							**220**				
PFAS NEMP 2.0 2020 Recreational Water							2			2							10				
Location Code	**Date**	**Lab Report Number**																			
	29 Sep 2022	33831	-	1.7	2.1	-	20	1.4	-	**22**	<0.02	0.99	1.8	9.2	0.79	-	1.5	0.19	<0.02	<0.02	<0.05
		EM2219291	-	1.38	2.29	-	22.0	1.62	-	**20.3**	<0.02	0.3	1.86	10.7	0.71	-	1.08	0.18	<0.02	<0.02	<0.02
GW101	20 Jul 2022						26			**27**							1.9				
	29 Sep 2022	33831	-	-	-	-	<0.01	-	-	<0.01	-	-	-	-	-	-	<0.01	-	-	-	-
GW102	20 Jul 2022						<0.02			<0.03							<0.01				
	05 Oct 2022	307356	-	-	-	-	4.8	-	-	**9.4**	-	-	-	-	-	-	0.41	-	-	-	-
GW103	20 Jul 2022						11			**16**							0.87				
	29 Sep 2022	33831	-	-	-	-	<0.01	-	-	<0.01	-	-	-	-	-	-	<0.01	-	-	-	-
GW104	20 Jul 2022						0.04			0.099							<0.01				
	05 Oct 2022	307356	-	-	-	-	<0.01	-	-	<0.01	-	-	-	-	-	-	<0.01	-	-	-	-
GW105	20 Jul 2022						<0.01			0.02							<0.01				
	29 Sep 2022	33831	-	-	-	-	<0.01	-	-	0.02	-	-	-	-	-	-	<0.01	-	-	-	-
GW106	20 Jul 2022						0.02			0.11							<0.01				
	12 Aug 2022	33106	34	-	-	0.0005	-	-	0.0025	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW01	05 Oct 2022	307356	-	-	-	-	0.18	-	-	**1.5**	-	-	-	-	-	-	0.03	-	-	-	-
	29 Sep 2022	33830	30	-	-	0.0001	-	-	<0.0001	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW02	05 Oct 2022	307356	-	0.002	<0.001	-	0.0062	<0.001	-	0.024	<0.002	<0.02	<0.002	0.0045	0.004	-	0.020	0.001	<0.002	<0.002	<0.005
	29 Sep 2022	33830	30	-	-	<0.0001	-	-	<0.0001	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW03		33831	-	0.07	0.03	-	0.30	0.02	-	0.06	<0.02	0.07	<0.02	0.04	<0.01	-	0.01	<0.01	<0.02	<0.02	<0.05
	29 Sep 2022	33830	35	-	-	<0.0001	-	-	<0.0001	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW05	05 Oct 2022	307356	-	-	-	-	0.09	-	-	<0.01	-	-	-	-	-	-	<0.01	-	-	-	-
	29 Sep 2022	33830	33	-	-	<0.0001	-	-	<0.0001	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW06		33831	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.02	<0.02	<0.02	<0.01	<0.01	-	<0.01	<0.01	<0.02	<0.02	<0.05
	29 Sep 2022	33830	29	-	-	<0.0001	-	-	<0.0001	-	-	-	-	-	-	<0.0001	-	-	-	-	-
MW07		33831	-	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	<0.02	<0.02	<0.02	<0.01	<0.01	-	<0.01	<0.01	<0.02	<0.02	<0.05
Statistics																					
Number of Results			6	6	6	6	13	6	6	13	6	6	6	6	6	6	13	6	6	6	6
Number of Detects			6	4	3	2	7	3	1	7	0	3	2	4	3	0	6	3	0	0	0
Minimum Concentration			29	0.002	<0.001	0.0001	0.0062	<0.001	<0.0001	<0.01	<0.002	<0.02	<0.002	0.0045	0.004	<0.0001	0.01	0.001	<0.002	<0.002	<0.005
Minimum Detect			29	0.002	0.03	0.0001	0.0062	0.02	0.0025	0.02	ND	0.07	1.8	0.0045	0.004	ND	0.01	0.001	ND	ND	ND
Maximum Concentration			35	1.7	2.29	0.0005	22	1.62	0.0025	22	<0.02	0.99	1.86	10.7	0.79	<0.0001	1.5	0.19	<0.02	<0.02	<0.05
Maximum Detect			35	1.7	2.29	0.0005	22	1.62	0.0025	22	ND	0.99	1.86	10.7	0.79	ND	1.5	0.19	ND	ND	ND
Average Concentration *			32	0.53	0.74	0.00013	3.6	0.51	0.00046	4.1	0.0085	0.23	0.62	3.3	0.25	0.00005	0.24	0.064	0.0085	0.0085	0.019
Geometric Average *			32	0.045	0.035	0.000082	0.07	0.029	0.000096	0.076	0.0068	0.052	0.039	0.087	0.026	0.00005	0.022	0.013	0.0068	0.0068	0.015
Median Concentration *			31.5	0.0375	0.0175	0.00005	0.0062	0.0125	0.00005	0.02	0.01	0.04	0.01	0.0225	0.005	0.00005	0.005	0.005	0.01	0.01	0.025
Standard Deviation *			2.5	0.79	1.1	0.00018	7.8	0.78	0.001	8	0.0037	0.39	0.94	5.2	0.39	0	0.49	0.094	0.0037	0.0037	0.01
Geometric Standard Deviation *			1.1	20	32	2.5	28	27	4.9	32	2.6	7.4	23	43	14	1	8.9	8.7	2.6	2.6	2.6
95% UCL (Student's-t) *			33.88	1.178	1.668	0.00028202	7.513	1.149	0.00128	8.057	0.0115	0.551	1.389	7.565	0.57	0.00005	0.478	0.141	0.0115	0.0115	0.027
% of Detects			100	67	50	33	54	50	17	54	0	50	33	67	50	0	46	50	0	0	0
% of Non-Detects			0	33	50	67	46	50	83	46	100	50	67	33	50	100	54	50	100	100	100

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

			PFAS - Perfluoroalkyl Sulfonamide								PFAS - Fluorotelomer Sulfonic Acids						PFAS - Sums			
			Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	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)	Sum of PFHxS and PFOS		Sum of US EPA PFAS (PFOS + PFOA)*	
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/kg	µg/L	mg/kg	µg/L	µg/L	mg/kg	µg/L	mg/kg	µg/L
EQL			0.01	0.05	0.01	0.05	0.05	0.002	0.05	0.05	0.002	0.001	0.0001	0.0004	0.0002	0.0004	0.002	0.0001	0.0002	0.0001	0.0002
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systen																					
PFAS NEMP 2.0 2020 Recreational Water																			2		
Location Code	**Date**	**Lab Report Number**																			
	29 Sep 2022	33831	<0.1	<0.5	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	-	0.67	-	<0.02	<0.02	-	41	-	23
		EM2219291	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	<0.05	<0.02	<0.05	-	0.62	-	<0.05	<0.05	-	42.3	-	-
GW101	20 Jul 2022													1.2		>0.05			53		29
	29 Sep 2022	33831	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.02	-	-	<0.01	-	<0.01
GW102	20 Jul 2022													<0.05		<0.02			0.03		0.03
	05 Oct 2022	307356	-	-	-	-	-	-	-	-	-	-	-	0.72	-	<0.02	-	-	14	-	9.9
GW103	20 Jul 2022													1.5		<0.02			27		17
	29 Sep 2022	33831	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.02	-	-	<0.01	-	<0.01
GW104	20 Jul 2022													<0.01		<0.02			0.14		0.1
	05 Oct 2022	307356	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.02	-	-	<0.01	-	<0.01
GW105	20 Jul 2022													<0.01		<0.02			0.02		0.02
	29 Sep 2022	33831	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.02	-	-	0.02	-	0.02
GW106	20 Jul 2022													<0.01		<0.02			0.13		0.11
	12 Aug 2022	33106	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	0.0030	-	0.0025	-
MW01	05 Oct 2022	307356	-	-	-	-	-	-	-	-	-	-	-	0.08	-	<0.02	-	-	1.6	-	1.5
	29 Sep 2022	33830	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	0.0001	-	<0.0001	-
MW02	05 Oct 2022	307356	<0.01	<0.05	<0.02	<0.05	<0.1	<0.004	<0.05	<0.5	<0.002	<0.001	-	0.020	-	<0.0004	<0.002	-	0.030	-	0.044
	29 Sep 2022	33830	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	<0.0001	-	<0.0001	-
MW03		33831	<0.1	<0.5	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	-	0.02	-	<0.02	<0.02	-	0.35	-	0.07
	29 Sep 2022	33830	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	<0.0001	-	<0.0001	-
MW05	05 Oct 2022	307356	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.02	-	-	0.09	-	<0.01
	29 Sep 2022	33830	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	<0.0001	-	<0.0001	-
MW06		33831	<0.1	<0.5	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	-	0.02	-	<0.02	<0.02	-	<0.01	-	<0.01
	29 Sep 2022	33830	-	-	-	-	-	-	-	-	-	-	<0.0001	-	<0.0002	-	-	<0.0001	-	<0.0001	-
MW07		33831	<0.1	<0.5	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	-	0.05	-	<0.02	<0.02	-	<0.01	-	<0.01
Statistics																					
Number of Results			6	6	6	6	6	6	6	6	6	6	6	13	6	13	6	6	13	6	12
Number of Detects			0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	2	8	1	6
Minimum Concentration			<0.01	<0.05	<0.02	<0.05	<0.05	<0.004	<0.05	<0.05	<0.002	<0.001	<0.0001	<0.01	<0.0002	<0.0004	<0.002	0.0001	<0.01	<0.0001	<0.01
Minimum Detect			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	ND	0.0001	0.02	0.0025	0.02
Maximum Concentration			<0.1	<0.5	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.05	<0.0001	0.72	<0.0002	<0.05	<0.05	0.003	42.3	0.0025	23
Maximum Detect			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.72	ND	ND	ND	0.003	42.3	0.0025	23
Average Concentration *			0.036	0.17	0.037	0.025	0.046	0.0087	0.025	0.21	0.0085	0.0076	0.00005	0.17	0.0001	0.01	0.011	0.00055	7.6	0.00046	2.9
Geometric Average *			0.026	0.12	0.029	0.025	0.045	0.0076	0.025	0.17	0.0068	0.0045	0.00005	0.031	0.0001	0.0079	0.0079	0.00011	0.13	0.000096	0.051
Median Concentration *			0.05	0.25	0.05	0.025	0.05	0.01	0.025	0.25	0.01	0.005	0.00005	0.02	0.0001	0.01	0.01	0.00005	0.03	0.00005	0.0125
Standard Deviation *			0.022	0.12	0.021	0	0.01	0.0033	0	0.092	0.0037	0.0087	0	0.29	0	0.0052	0.0077	0.0012	16	0.001	6.9
Geometric Standard Deviation *			2.8	3.3	2.3	1	1.3	1.9	1	2.6	2.6	3.5	1	7.2	1	3.1	2.9	5.1	36	4.9	24
95% UCL (Student's-t) *			0.0539	0.271	0.0537	0.025	0.0542	0.0114	0.025	0.288	0.0115	0.0148	0.00005	0.312	0.0001	0.0129	0.0174	0.00154	15.34	0.00128	6.478
% of Detects			0	0	0	0	0	0	0	0	0	0	0	62	0	0	0	33	62	17	50
% of Non-Detects			100	100	100	100	100	100	100	100	100	100	100	38	100	100	100	67	38	83	50

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to mo
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

			PFAS (Sum of Total)		PFAS (Sum of Total)(WA DER List)
			mg/kg	µg/L	µg/L
EQL			0.0001	0.0002	0.01
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systen					
PFAS NEMP 2.0 2020 Recreational Water					
Location Code	**Date**	**Lab Report Number**			
	29 Sep 2022	33831	-	62	-
		EM2219291	-	63.0	59.0
GW101	20 Jul 2022			56	
	29 Sep 2022	33831	-	<0.01	-
GW102	20 Jul 2022			0.03	
	05 Oct 2022	307356	-	15	-
GW103	20 Jul 2022			29	
	29 Sep 2022	33831	-	<0.01	-
GW104	20 Jul 2022			0.14	
	05 Oct 2022	307356	-	<0.01	-
GW105	20 Jul 2022			0.02	
	29 Sep 2022	33831	-	0.02	-
GW106	20 Jul 2022			0.13	
	12 Aug 2022	33106	0.0030	-	-
MW01	05 Oct 2022	307356	-	1.8	-
	29 Sep 2022	33830	0.0001	-	-
MW02	05 Oct 2022	307356	-	0.083	-
	29 Sep 2022	33830	<0.0001	-	-
MW03		33831	-	0.63	-
	29 Sep 2022	33830	<0.0001	-	-
MW05	05 Oct 2022	307356	-	0.09	-
	29 Sep 2022	33830	<0.0001	-	-
MW06		33831	-	0.02	-
	29 Sep 2022	33830	<0.0001	-	-
MW07		33831	-	0.05	-

Statistics

Number of Results	6	13	1
Number of Detects	2	10	1
Minimum Concentration	0.0001	<0.01	59
Minimum Detect	0.0001	0.02	59
Maximum Concentration	0.003	63	59
Maximum Detect	0.003	63	59
Average Concentration *	0.00055	11	
Geometric Average *	0.00011	0.21	59
Median Concentration *	0.00005	0.083	59
Standard Deviation *	0.0012	23	
Geometric Standard Deviation *	5.1	33	
95% UCL (Student's-t) *	0.00154	22.46	
% of Detects	33	77	100
% of Non-Detects	67	23	0

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to mo
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

				Inorganics	PFAS - Perfluoroalkyl Sulfonic Acids		PFAS - Perfluoroalkyl Carboxylic Acids	PFAS - Fluorotelomer Sulfonic Acids		PFAS - Sums		
				Moisture (%)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
				%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)					**20**	**20**	**50**			**20**		
Date	**Field ID**	**Lab Report Number**										
12 Aug 2022	SED01	33105	47	0.0095	1.3	0.0040	0.0053	0.016	1.3	1.3	1.3	
	SED05	33105	39	0.0023	0.034	<0.001	<0.001	<0.002	0.037	0.034	0.037	
	SED06	33105	78	<0.005	0.15	<0.005	<0.005	0.017	0.15	0.15	0.17	
	SED07	33105	37	0.0026	0.036	<0.001	<0.001	<0.002	0.038	0.036	0.038	
	SED11	33105	18	<0.001	0.033	<0.001	<0.001	<0.002	0.033	0.033	0.033	
Statistics												
Number of Results			5	5	5	5	5	5	5	5	5	
Number of Detects			5	3	5	1	1	2	5	5	5	
Minimum Concentration			18	<0.001	0.033	<0.001	<0.001	<0.002	0.033	0.033	0.033	
Minimum Detect			18	0.0023	0.033	0.004	0.0053	0.016	0.033	0.033	0.033	
Maximum Concentration			78	0.0095	1.3	<0.005	0.0053	0.017	1.3	1.3	1.3	
Maximum Detect			78	0.0095	1.3	0.004	0.0053	0.017	1.3	1.3	1.3	
Average Concentration *			44	0.0035	0.31	0.0016	0.0019	0.0072	0.31	0.31	0.32	
Geometric Average *			39	0.0023	0.095	0.001	0.0011	0.0031	0.098	0.095	0.1	
Median Concentration *			39	0.0025	0.036	0.0005	0.0005	0.001	0.038	0.036	0.038	
Standard Deviation *			22	0.0035	0.56	0.0016	0.0021	0.0085	0.55	0.56	0.55	
Geometric Standard Deviation *			1.7	2.8	4.9	2.8	3.1	4.6	4.8	4.9	4.9	
95% UCL (Student's-t) *			64.66	0.00679	0.84	0.00312	0.00387	0.0153	0.84	0.84	0.843	
% of Detects			100	60	100	20	20	40	100	100	100	
% of Non-Detects			0	40	0	80	80	60	0	0	0	

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)

			PFAS - Perfluoroalkyl Sulfonic Acids		PFAS - Perfluoroalkyl Carboxylic Acids	PFAS - Fluorotelomer Sulfonic Acids		PFAS - Sums		
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems				**0.13**	**220**					
PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems				*0.00023*	*19*					
PFAS NEMP 2.0 2020 Recreational Water			2	2	10			2		
Date	**Field ID**	**Lab Report Number**								
13 Oct 2016			***2.64***	***22.8***	0.32	6.01	0.73	25.4	-	-
12 Aug 2022	SW01	33107	0.20	***5.0***	0.04	6.12	0.1	5.2	5.0	5.4
13 Oct 2016	SW02		<0.02	***6.12***	0.05	0.53	0.11	6.12	-	-
12 Aug 2022	SW03	33107	0.09	***1.8***	0.01	0.05	0.04	1.9	1.8	2.0
12 Aug 2022	SW05	33107	0.09	***0.31***	<0.01	<0.01	<0.02	0.40	0.31	0.40
12 Aug 2022	SW06	33107	0.35	***1.7***	0.05	0.14	0.06	2.1	1.7	2.3
12 Aug 2022	SW11	33107	0.24	***1.4***	0.03	0.09	0.04	1.6	1.4	1.8
12 Aug 2022	SW14	33107	0.13	***0.53***	0.01	<0.01	<0.02	0.66	0.54	0.67
12 Aug 2022	SW16	33107	1.3	***0.15***	0.11	<0.01	<0.02	1.5	0.26	1.6

Statistics

Number of Results	7	7	7	7	7	7	7	7
Number of Detects	7	7	6	4	4	7	7	7
Minimum Concentration	0.09	0.15	0.01	<0.01	<0.02	0.4	0.26	0.4
Minimum Detect	0.09	0.15	0.01	0.05	0.04	0.4	0.26	0.4
Maximum Concentration	1.3	5	0.11	0.14	0.1	5.2	5	5.4
Maximum Detect	1.3	5	0.11	0.14	0.1	5.2	5	5.4
Average Concentration *	0.34	1.6	0.036	0.059	0.039	1.9	1.6	2
Geometric Average *	0.22	0.91	0.023	0.027	0.027	1.4	0.99	1.5
Median Concentration *	0.2	1.4	0.03	0.05	0.04	1.6	1.4	1.8
Standard Deviation *	0.43	1.7	0.037	0.058	0.033	1.6	1.6	1.6
Geometric Standard Deviation *	2.6	3.3	3	4.9	2.6	2.3	2.9	2.3
95% UCL (Student's-t) *	0.66	2.775	0.0633	0.102	0.0631	3.069	2.781	3.23
% of Detects	100	100	86	57	57	100	100	100
% of Non-Detects	0	0	14	43	43	0	0	0

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, January 2020, PFAS NEMP 2.0 2020 Freshwater - 99% - high conservation value systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix D

QA/QC results tables

					PFAS - Perfluoroalkyl Sulfonic Acids							PFAS - Perfluoroalkyl Carboxylic Acids							
					Perfluoropropanesulfonic acid (PFPrS)	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)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					0.001	0.0005	0.0005	0.0005	0.0005	0.0001	0.0005	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Date	**Field ID**	**Matrix Type**	**Sample Type**	**Lab Report Number**															
09 Jun 2023	RT_SW05	Water	Normal	997597	<0.001	<0.001	<0.001	0.002	<0.001	0.0037	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	RT_FD01	Water	Field_D	997597	<0.001	<0.001	<0.001	0.002	<0.001	0.0024	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
RPD					0	0	0	0	0	**43**	0	0	0	0	0	0	0	0	0
09 Jun 2023	RT_SW05	Water	Normal	997597	<0.001	<0.001	<0.001	0.002	<0.001	0.0037	<0.001	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
05 Jun 2023	RT_FS01	Water	Interlab_D	EM2310715	-	<0.0005	<0.0005	0.0021	<0.0005	0.0030	<0.0005	<0.0020	0.0012	0.0024	<0.0005	0.0019	<0.0005	0.0012	<0.0005
RPD					-	0	0	5	0	21	0	0	0	0	0	0	0	0	0
04 Aug 2023	SW_DISCHARGE 1	Water	Normal	1016272	0.002	0.004	0.003	0.029	0.003	0.39	0.001	0.005	0.004	0.013	<0.002	0.004	<0.001	0.001	0.003
	FD01	Water	Field_D	1016272	<0.001	<0.002	<0.001	<0.001	<0.001	0.0017	<0.001	0.005	0.003	0.005	0.002	0.002	<0.001	<0.001	<0.001
RPD					**67**	**67**	**100**	**187**	**100**	**198**	0	0	29	**89**	0	**67**	0	0	**100**

***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: 30 (1 - 10 x EQL); 30 (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**

					PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids				
					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 sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	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)	Sum of PFHxS and PFOS
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.0005	0.001	0.001	0.0005	0.001	0.001	0.001	0.001	0.0002
Date	**Field ID**	**Matrix Type**	**Sample Type**	**Lab Report Number**															
09 Jun 2023	RT_SW05	Water	Normal	997597	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0057
	RT_FD01	Water	Field_D	997597	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0044
RPD					0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
09 Jun 2023	RT_SW05	Water	Normal	997597	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.005	<0.001	<0.001	0.0057
05 Jun 2023	RT_FS01	Water	Interlab_D	EM2310715	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.001	<0.001	<0.001	0.0051
RPD					0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
04 Aug 2023	SW_DISCHARGE 1	Water	Normal	1016272	<0.001	<0.001	<0.001	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.002	<0.001	0.419
	FD01	Water	Field_D	1016272	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	0.0017
RPD					0	0	0	0	0	0	0	0	0	0	0	0	0	0	**198**

***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: 30 (**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in th**

					PFAS - Sums				PFAS
					Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	PFAS (Sum of Total)(WA DER List)	Perfluorononane sulfonate (PFNS)
					µg/L	µg/L	µg/L	µg/L	µg/L
EQL					0.001	0.0002	0.001	0.0002	0.001
Date	**Field ID**	**Matrix Type**	**Sample Type**	**Lab Report Number**					
09 Jun 2023	RT_SW05	Water	Normal	997597	0.0057	0.0127	0.0077	0.0117	<0.001
	RT_FD01	Water	Field_D	997597	0.0044	0.0104	0.0064	0.0104	<0.001
RPD					26	20	18	12	0
09 Jun 2023	RT_SW05	Water	Normal	997597	0.0057	0.0127	0.0077	0.0117	<0.001
05 Jun 2023	RT_FS01	Water	Interlab_D	EM2310715	-	0.0118	-	0.0106	-
RPD					-	7	-	10	-
04 Aug 2023	SW_DISCHARGE 1	Water	Normal	1016272	0.394	0.47	0.423	0.449	0.003
	FD01	Water	Field_D	1016272	0.0037	0.0187	0.0037	0.0187	<0.001
RPD					**196**	**185**	**197**	**184**	**100**

***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: 30 (**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in th**

Appendix E

QA/QC Assessment

E-1 QA/QC Data Assessment

5-1-1 Field program

Fieldwork was conducted in accordance with GHDs Standard Field Operating Procedures. These procedures are designed to facilitate the collection of environmental samples using uniform and systematic methods, as required by GHD's quality assurance system. Key requirements of these procedures are as follows:

- Appropriately trained and experienced staff who documented sampling activities using photographs and notes on standard field forms.
- Decontamination procedures – including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location (using PFAS and phosphate free detergent) and the use of dedicated laboratory provided sampling containers.
- Logging procedures – all samples are described using a recognised system.
- Calibration procedures – all field monitoring equipment is appropriately calibrated.
- Sample identification procedures – collected samples were immediately transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers were clearly labelled with a sample number, sample location, sample depth (for soil samples) and sample date. The sample containers were then transferred to an ice filled cooler for sample preservation during shipment to the testing laboratory.
- Chain of custody information requirements – a chain-of-custody form was completed and forwarded to the testing laboratory.

5-1-2 Field quality control program

Field quality control procedures used during the project were comprised of the collection and analysis of the following:

- **Intra-laboratory (blind) duplicates:** a single sample divided into two sampling bottles. Both samples are sent anonymously to the project laboratory. Intra-laboratory blind duplicates provide an indication of the analytical precision of the laboratory but are influenced by other factors such as sampling technique and sample media heterogeneity.
- **Inter-laboratory (blind) duplicates:** a single sample divided into two sampling bottles. One sample (primary) is sent anonymously to the project laboratory while the second sample is sent to a secondary laboratory. Inter-laboratory duplicates provide an indication of the analytical precision of the project laboratory.
- **Rinsate –** a sample of analyte-free water poured over decontaminated field equipment prior to the collection of water samples, used to address the effectiveness of the decontamination process.

5-1-3 Laboratory quality control program

The Project laboratories adopted their own internal procedures and NATA accredited methods in accordance with their quality assurance system. Laboratory quality control procedures used during the investigation included:

- **Laboratory duplicate samples:** the laboratory collects duplicate sub-samples from one sample submitted for analytical testing, at a rate equivalent to one in twenty samples per analytical batch. If a batch has less than twenty samples, one sample per batch is used. A laboratory duplicate provides data on the analytical precision and reproducibility of the test results.
- **Spiked samples:** A field sample is 'spiked' by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spiked sample provides documentation of the effect of the sample matrix on the extraction and analytical techniques. Spiked samples are used for each batch where the samples are being analysed for organic chemicals.
- **Certified reference standards:** A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard (CRS), also known as a Laboratory Control Spike, provides an indication of the analytical accuracy and precision of the test method and is used for inorganic analyses.

- **Surrogate standard/spikes:** Surrogate standards are organic compounds similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions, but which are not normally found in environmental samples. These surrogate compounds are 'spiked' into samples that have been submitted for organic analyses, prior to sample extraction. Surrogate standard/spikes provide a means of checking that no gross errors have occurred during any stage of testing, leading to significant analyte loss.
- **Method Blank:** Usually, an organic or aqueous solution that is as free as possible of any 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 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 method blank is used to correct any possible contamination resulting from the preparation or processing of the sample.

The project laboratory provided this information to GHD. The individual testing laboratories conducted an internal assessment of the laboratory QC program, and the results were independently review and assessed by GHD. Laboratory duplicate samples should return relative percentage differences (RPDs) within the ASC NEPM (1999) acceptance criteria.

E-2 Quality assurance / quality control assessment summary

A review of the field and laboratory QA/QC performance from the contamination investigation is presented in Table E.3 and Table E.4. The QA/QC assessment concluded that the data is of acceptable quality upon which to draw meaningful conclusions regarding contamination impacts at the site.

Table E.3 Laboratory report summary

Report type	Report number reference
Primary – Eurofins	997597_SW
Secondary – ALS	EM310715_SW

Table E.4 Sample summary

Item (required sample rate)	Surface water sample rate	Stormwater sample rate	Comment
Field information			
Number of primary samples analysed	9	3	-
Number of days sampling	1	1	-
Item (required sample rate)	**Surface water sample rate**	**Stormwater sample rate**	**Comment**
Intra laboratory field duplicates (1/20 samples (5%))	2/12 (17%)	-	-
Inter-laboratory field duplicates (1/20 samples (5%))	1/12 (8%)	-	-
Field blanks	6	1	-
Item (required sample rate)	**Surface water sample rate**	**Stormwater sample rate**	**Comment**
Sample handling			
Were the sample holding times met?	Y	Y	All sample holding times were met for the media analysed.
Were the samples in proper custody between the field and reaching the laboratory?	Y	Y	-
Were the samples properly and adequately preserved?	Y	Y	-
Did the laboratory receive the samples in good condition?	Y	Y	-
Item (required sample rate)	**Surface water sample rate**	**Stormwater sample rate**	**Comment**
Precision / accuracy assessment			
Was a NATA registered laboratory used?	Y	Y	-
Did the laboratory perform the requested tests?	Y	Y	-

Item (required sample rate)	Surface water sample rate	Stormwater sample rate	Comment
Were the laboratory methods adopted NATA endorsed?	Y	Y	-
Were the appropriate test procedures followed?	Y	Y	-
Were the reporting limits satisfactory?	Y	Y	-
Was the NATA Seal on the reports?	Y	Y	-
Did an authorised person sign the reports?	Y	Y	-
Item (required sample rate)	**Surface water sample rate**	**Stormwater sample rate**	**Comment**
Field duplicates			
Were an adequate number of intra and inter-laboratory field duplicates analysed?	Y	Y	-
Were RPDs within Control Limits?	N	N	Table D1 identifies several RPD exceedances recorded during the surface water investigation. The variations are expected to be associated with the inherent heterogeneity in sample concentrations.
Field blanks / rinsate blanks			
Were an adequate number of field blanks analysed?	Y	Y	-
Were the trip blanks, field blanks and rinsate blanks free of contamination?	Y	Y	-
Laboratory QA/QC			
Did all method blanks meet adopted criteria?	Y	Y	-
Did all matrix spikes meet adopted criteria?	Y	Y	-
Did all laboratory control samples/spikes meet adopted criteria?	Y	Y	-
Did all laboratory duplicates meet adopted criteria.	Y	Y	-
Data useability		Conclusions	
Data directly usable		The QA/QC assessment for this investigation indicates that the data is suitable for its intended purpose. Any QA/QC irregularities identified have been assesses not affect the outcome of the investigation.	
Data usable with the following qualifications		N/A	
Data not usable		N/A	

Appendix F

Field records

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 12583428	
Job Name: Adelaide Station DST		Date: 02/08/2022	
GHD Representative:	Matt Bold	Arrival Time: 10:00	Departure Time: 15:00
Weather Conditions:	(Please circle) Fine (Overcast) (Light Rain) (Heavy Rain) Other_____		
Works Being Undertaken:	On-site service clearance.		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Matt Bold (GHD)	✓	10:00	15:00
James Sanderson (Veris)	✓	10:00	15:00

Photographs Taken: (Please circle) (Yes) No If Yes, list below or attach photo register. Tech Folder.

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
On-site	10:00	MB (GHD) and JS (Veris) inducted / sign-on to GHD JSEA, brief MFS site induction with Glen Phillis (MFS).
"	10:30	Commenced on-site service locating.
		Limited plans provided by MFS. Good detail on fire water main location.
		MB required to act as spotter for Veris service locator.
		Service location works covered:
		- on-site SW dam
		- on-site SW pipes in western and southern portion of site.
		- on-site water mains.
		- on-site electrical.
		- on-site fuel systems, including line to 'day tank' under main building.
"	14:30	Notified of weather alert by Ben P. (GHD).
"	15:00	All personnel signed-out and left site.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) Yes (No)

Provide Details:

Further Inspection and/or Testing Required on above Work:	Further service clearance to occur 03/08/2022.

Are there any H&S requirements to be considered for future works? N/A

Has the site been reinstated suitably (left clean and tidy)? ✓

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 12583428	
Job Name: Adelaide Station DSI		Date: 03/08/2022	
GHD Representative:	Matt Bold	Arrival Time: 0745	Departure Time: 1630
Weather Conditions:	(Please circle) (Fine) Overcast (Light Rain) Heavy Rain Other_____		
Works Being Undertaken:	On-site servicing clearance (continued).		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Matt Bold (GHD)	✓	0745	1630
James Sanderson (Veris)	✓	0800	1615.

Photographs Taken: (Please circle) (Yes) No If Yes, list below or attach photo register. Tech Folder

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
On-site	0745	MB (GHD) & JS (Veris) sign-in via MFS, conduct daily toolbox meeting, conduct HSE009 via GHD Smartapp.
	0815	On-site servicing clearance. Identification of: - Electrical (not all on MFS plans). - Stormwater - Gas (not on MFS plans) - Water - Sewer - Irrigation - USTs / fuel lines - Comms - StateNet SAPOL O.F. (NOT ON PLANS - CRITICAL SERVICE) * Assistance from MFS/SAPOL to access pits for StateNet Fibre.
	1530	Locations selected for 18x soil bores, 1x GW monitoring well.
	1600	Pack-up, left site at 1630 after logistics discussions w/ MFS.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) (Yes) No

Provide Details: On-site SC works likely exceeded allowed time.

Further Inspection and/or Testing Required on above Work:	On-site SC completed to satisfactory level.

Are there any H&S requirements to be considered for future works? N/A.

Has the site been reinstated suitably (left clean and tidy)? ✓

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 12583428	
Job Name: Adelaide Station DSI		Date: 04/08/2022	
GHD Representative:	Matt Bold, Ally Kirkman, BP	Arrival Time: 0830	Departure Time: 1630
Weather Conditions:	(Please circle) (Fine) (Overcast) (Light Rain) Heavy Rain Other_____		
Works Being Undertaken:	On-site GW MW installation " SB drilling.		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Matt Bold, Ally Kirkman (GHD Field Staff)	✓	0815/0845	1630
Ben Pettigrew (GHD PD)	✓	0845	0945
Ian Watt (WB Drilling)	✓	0830	1630
David Watt (WB Drilling)	✓	0830	1630

Photographs Taken: (Please circle) (Yes) No If Yes, list below or attach photo register. Tech Folder

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
On-site	0830	MFS inductions for drillers.
~~08~~		
	0900	Daily toolbox, JSEA sign-on, HSE009 submission. - all personnel present.
	0915	Begin drilling MW01, gauged near-by existing wells, SWL ~ 11.5 - 12 m bTOC. - CC through pavers - HA to 0.9 m bgl - SA to 15 m bgl. - infilled w/ 5m screen, 10 - 15 m bgl.
	1245	Drilling, installation and clean-up at MW01 complete.
		2x full waste drums to collect from site via Cleanaway.
	1315	Completed BH09. Target depth 2.5 m bgl achieved.
	1345	Completed BH11. Refusal 0.6 m bgl. Possible services. Abandoned.
	1415	BH12. Target 2.5 m bgl achieved.
	1500	BH13 Target 2.5 m bgl achieved.
	1545	BH06. Target 2.5 m bgl achieved.
	1630	Pack-up completed / decon. All personnel off-site.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) Yes (No)

Provide Details: As per SAQP scope.

Further Inspection and/or Testing Required on above Work:	Continue w/ soil bore drilling 05/08/2022

Are there any H&S requirements to be considered for future works? N/A

Has the site been reinstated suitably (left clean and tidy)? ✓

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 12583428	
Job Name: Adelaide Station DSI		Date: 05/08/2022	
GHD Representative:	Matt Bold, Ally K.	Arrival Time: 0800	Departure Time: 1700
Weather Conditions:	(Please circle) Fine (Overcast) (Light Rain) (Heavy Rain) Other_____		
Works Being Undertaken:	On-site SB drilling		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Matt Bold (GHD)	✓	0800	1700
Ally Kirkman (GHD)	✓	0800	1700
Ian Watt (WB Drilling)	✓	0800	1630
David Watt (WB Drilling)	✓	0800	1630

Photographs Taken: (Please circle) (Yes) No If Yes, list below or attach photo register. Tech Folder.

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
On-site.	0800	Daily toolbox, JSEA review, HJED9 sign-on.
	0900	BH07. Refusal @ 1.4 m bgl w/ Push tube. Packing stand at 1.0-1.4 Possible service / U.G. infrastructure? Abandoned.
	0930	BH08. Wire encountered @ ~0.7 m bgl.
		* James Sanderson (Vens) on-site ~0950 - 1030 to confirm no service identifiable, discussed w/ B.P. & MFS.
	1030	Completed BH08, target 2.5 m bgl achieved.
	1130	Heavy rain @ site, brief stand down.
	1145	BH09. Target 2.5 m bgl achieved. Some core loss due to moisture, HC odour, 20-30 ppm PID readings identified.
	1300	BH14. Target 2.5 m bgl achieved.
	1345	BH15. Target 2.5 m bgl achieved.
	1445	BH16. Target 2.5 m bgl achieved.
	1530	BH18. > Target. 2.5 m bgl achieved.
	1615	BH09B. Return ~0.7 m south BH09, drilled to 3.8 m bgl (HC delineation)
	1630	Drillers off-site.
		1 x additional waste drum for Clearaway. Potential HC soil.
	1700	MB / AK pack-up, label and store waste drums, off-site by 1700.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) (Yes) No

Provide Details: Additional SB for HC delineation to 4 m bgl. 3 x SB locations from PFAS DSI remain

Further Inspection and/or Testing Required on above Work:	Still to-do: BH04 (right access), BH10, BH17 (HA).

Are there any H&S requirements to be considered for future works? N/A

Has the site been reinstated suitably (left clean and tidy)? ✓

GHD CLIENTS PEOPLE PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 12583428	
Job Name: Adelaide Station DSI		Date: 11/08/2022	
GHD Representative:	Matt Bald, Ally Kirkman	Arrival Time: 1030	Departure Time: 1430
Weather Conditions:	(Please circle) Fine Overcast Light Rain Heavy Rain Other_____		
Works Being Undertaken:	MW01 Development, 2x HA SBs.		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Matt Bald (GHD)	✓	1030	1430
Ally Kirkman (GHD)	✓	1030	1430

Photographs Taken: (Please circle) Yes No If Yes, list below or attach photo register. Tech Folder.

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
On-site	1030	Daily ~~toolbox~~, JSEA review, HSE009 submission.
	1100	Gauging + well development of MW01.
		- surging
		- removal of ~14 L before well dry.
		- SS bailer methodology.
	1215	Pack-up GW, store waste (1x liquid waste drum).
	1315	BH10. Refused @ 1.4 mbgl. HA only - Stiff clay. Natural.
	1405	BH17. Refused @ 0.55 m bgl. HA only. Rock/gravel/hard material. Tried 2x at location to advance BH further without success.
	1430	All personnel off-site.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) Yes No

Provide Details: As per SAQP scope.

Further Inspection and/or Testing Required on above Work: May need to return to attempt BH17 with mechanical drill rig.

Are there any H&S requirements to be considered for future works?
Has the site been reinstated suitably (left clean and tidy)?

Groundwater Gauging Sheet

Client: MFS	**WL Meter Type: Dip / Fox / Int.Fce / Gge**
Project: Adelaide Station DSI	**Date:** 04/08/2022
Job No.: 12583428	**Time:** 0900 – 1030.
Location: Adelaide Fire Station.	**Sampler:** MB/AK.

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW105	–	11.931m		16.4m total depth
GW103	–	11.872m		14.1m total depth

Purging and Sampling Record

Bore ID: MW01

Job Information

Client: MFS
Project: 12583428
Proj. No.: Adelaide Station DSI
Sampler: MB, AK
Date: 11/08/2022
Round: Development

Sampling Information

Purge Method: SS Bailer
Sample Method: N/A
WQ Meter Type: YSI Pro Plus
Flow Cell: Y / N (N) Pump Depth: ~ m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): 11.930 m
Screen: From: 10 to 15 m
NAPL Check: N/A
Ref.datum:
Bore Depth: 15.05 m
Logic Check:
Stick Up: m
Bore Diam.: 50 mm
Well Cap Secure? Y

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
	1.0	20	6.56	13826	0.90	171.4			Orange-brown, turbid, no odour, no sheen
	5.0	19.8	6.65	13614	1.71	164.8			orange-brown, turbid, no odour, no sheen
	10.0	19.8	6.79	13399	1.86	151.0			orange-brown, turbid, no odour, no sheen
	~~15.0~~ 13.5	19.7	7.08	12835	1.83	144.3	14.855		orange-brown, very turbid, no odour, no sheen
									Near-dry after 14.0 L removed.

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.				
Preservatives													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Development only, no sample collected

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

*samples labelled as BH09.

BOREHOLE LOG

Environmental

Bore No.: BH05

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING							SOIL DESCRIPTION			CONTAMINANT INDICATORS	
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
0.0		HA					Ground Surface				0.00
		HA					0.0-0.08; Fill; Pavement				0.00
		HA	0.1	0.1-0.2			0.08-0.4; Fill; Gravelly SAND; black	sl. M	L	no odour	
0.5		HA	0.0	0.4-0.5			0.4-0.9; Sandy CLAY; brown, sl. stiff, D, trace gravels	sl. M	St	trace brick fragments	
1.0		PT	0.0	1.0-1.1			0.9-1.3; Sandy CLAY; brown-orange	sl. M	St	-	
1.5		PT	0.0	1.5-1.6			1.3-2.5; CLAY; light brown-grey, sl. soft, HP	sl. M.	St.	-	
2.0			0.0	2.4-2.5							
2.5							E.O.H. @ 2.5 mbgl				
3.0											
4.0											
5.0											
6.0											
7.0											
8.0											
9.0											
10.0											

NOTES:

HA = Hand Auger
PT = Push Tube

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH11
Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: **Checked by:**

DRILLING

Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0		HA		Oearon			0-0.1 pavement				0.00
		HA		0.1-0.2			gravel SAND	D	L	No odour	
0.5		HA		0.4-0.5			SAND; orange/brown trace quartz gravel				
							medium-coarse SAND				
3.0											
1.0							EOH - refusal on unknown material 4) service locater advised HA				
7.0											

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH2
Page: 1 of 1

Client:	**Drilling Co.:**	**Easting:** 0
Project:	**Driller:**	**Northing:** 0
Job No.:	**Rig Type:**	**Grid Ref:**
Location:	**Total Depth (m):**	**Collar RL:**
Date Drilled: to:	**Diameter (mm):**	**Logged by:** **Checked by:**

DRILLING												
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0		CC					0-0.1 pavement				0.00
0.1		HA		0.1-0.2 (2J)			0.1-0.3 gravely SAND black/grey	D	L	No odour	
0.3		HB		0.4-0.5			0.3-1.2 sandy CLAY brown/grey fine-coarse sands (wet at 1.0)	SL M	M O	-Trace brick fragments - Trace black material	
1.0		PT		1.0-1.1			1.2-2.0 sandy CLAY red-brown fine-medium sands	SL M	ST	No odour	
1.5		PT		1.5-1.6							
2.0							2.0-2.5 CLAY brown-grey trace fine sands	SL M	SL S	No odour	
2.5				2.4-2.5							

NOTES: CC = concrete core

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH13

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING												
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
0.0							Ground Surface				0.00
0.0		CC					0.0 - 0.1; Fill; pavement	D		—	0.00
0.1			0.2	0.1 - 0.2			0.1 - 0.4; Gravelly SAND; light brown, F-C sands	D	L	no odour	
0.4		HA									
0.5			0.3	0.4 - 0.5			0.4 - 0.6; Sandy CLAY; brown, F-M sands	SL M.	Soft	trace brick fragments, no odour	
0.6							0.6 - 1.0; Gravelly SAND; grey, F-M sands	D	L	concrete ?	
1.0			0.0	0.9 - 1.0			1				
1.0							1.0 - 1.7; Sandy CLAY; brown - orange/brown, F-M sands	SL M	Soft	no odour	
1.5		PT	0.3	1.4 - 1.5							
1.7							1.7 - 2.5; CLAY; light brown, high plasticity		St	no odour	
2.0											
2.5			0.3	2.4 - 2.5							

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH06

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING								SOIL DESCRIPTION			CONTAMINANT INDICATORS	
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log		Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
								Ground Surface				0.00
0.0		CC						0.0-0.1 fill, pavement	D		—	0.00
		HA	0.0	0.1-0.2				0.1-0.3 gravelly SAND light brown, subangular gravels <15mm d)	SL M	L	No odour	
0.5		HA	0.1	0.4-0.5				0.3-0.8 sandy CLAY dark brown, fine-medium sands, low plasticity	SL M	LP	Trace brick fragments	
1.0				1.0-1.1				0.8-1.5 sandy CLAY red-brown, fine sands	SL M	ST	Brick fragment ~1.0m	
			0.1									
1.5				1.6-1.7				1.5-2.5 CLAY grey-brown, medium plasticity	D	ST	No odour	
2.0												
2.5			0.3	2.4-2.5								

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH07

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING							SOIL DESCRIPTION				
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0							0.0 - 0.03; fill; pavement	-	-		0.00
			0.2	BH07_ 0.1-0.2			0.03 - 0.3; Gravelly SAND; light brown	SL M	L	no odour	
0.5			0.2	BH07_ 0.4-0.5 + FD01 + FS01			0.3 - 1.0; Sandy CLAY; dark brown, LP, FM sands	SL M	SL Soft	~~black~~ ~~mms~~ brick fragments	
				BH07_0.9-1.0							
1.0			0.1	BH07_ 1.3-1.4			1.0 - 1.4; SAND; brown, M sands,	SL M.	L	black material at E.O.H. (?).	
1.5							E.O.H. @ 1.4 m bgl Refusal on hard material (unknown). Discontinued due to risk of potential service.				
2.0											
2.5											
3.0											

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH08.
Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING												
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)	
0.0							Ground Surface				0.00	
0.0		CC					0-0.08; FILL; pavement	-	-	-	0.00	
			0.1	0.1-0.2 FD02 FS02			0.1-0.3 gravelly SAND light brown.	SL M	L			
0.5		HA		0.4-0.5 (2J)			0.3-0.8 sandy CLAY brown, black, grey	SL M	S	Brick fragments, wire, scrap metal		
1.0		PT ↓	0.1	1.0-1.1			0.8-1.3 sandy CLAY orange, brown	SL M	SL S	Coarse black material at 1m		
1.5							1.3-1.8 clay SAND orange, brown	SL M	MD	No odour		
			0.1	1.6-1.7								
2.0							1.8-2.5 CLAY grey with orange mottling medium plasticity	D	ST	No odour		
2.5			0.1	2.4-2.5								

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH 09
Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING

Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
0.0							Ground Surface				0.00
		CC		0.1-0.2			0-0.1 fill, pavement				0.00
0.5		HA	11.2	0.4-0.5			0.1-0.3 gravelly SAND light brown 0.3-1.0 sandy CLAY dark grey			Brick frag Mod hydrocarbon odour	
1.0		PT	11.2	1.1-1.2			1.0-2.5 CLAY (sandy) grey, brown			Mod hydrocarbon odour	
1.5			22.1	2.3-2.4							
2.0											
2.5											

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993

BOREHOLE LOG

Environmental

Bore No.: BH4

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING												
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth Elevation (m)	
							Ground Surface				0.00	0.00
0.0		CC					0.0 - 0.08; FILL; pavement.	-	-	no odour		
			0.1	0.1-0.2 +FD03 +FS03			0.08 - 0.35; Gravelly SAND; FILL; grey-brown,	SI M	L	no odour		
0.5		HA	0.1	0.4-0.5			0.35 - 0.6; Gravelly SAND; light brown,	SI M	L	no odour		
							0.6 - 1.3; Sandy CLAY; FILL, trace rootlets.	SI M	SI Soft	brick fragments,		
1.0			0.1	1.0-1.1								
							1.3 - 1.8; Sandy CLAY; dark brown,	D	Soft	no odour		
1.5		PT										
			0.0	1.6-1.7								
2.0							1.8 - 2.5; CLAY; grey w/ trace red-orange mottling	D	St.	no odour		
2.5			0.0	2.4-2.5								

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH15

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING							SOIL DESCRIPTION			CONTAMINANT INDICATORS	
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0		CC					0.0 - 0.08; FILL; pavement.				0.00
			0.1	0.1 - 0.2			0.08 - 0.6; FILL; gravelly SAND; grey-black;	SI M	L	no odour	
0.5			0.1	0.4 - 0.5							
							0.6 - 1.1; Sandy CLAY; grey-orange, trace gravels	SI M.	SI. Stff	no odour	
1.0			0.0	0.9 - 1.0							
							1.1 - 1.9; Sandy CLAY; grey-blue/green, trace brown/oge mottling,	SI M	Stff	HC blue appearance, no odour, no PID.	
1.5											
			0.0	1.6 - 1.7							
2.0							1.9 - 2.5; CLAY; grey/ orange-brown mottling	D	stiff	no odour	
2.5				2.4 - 2.5							

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993

BOREHOLE LOG

Environmental

Bore No.: BH16

Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: to:

Drilling Co.:
Driller:
Rig Type:
Total Depth (m):
Diameter (mm):

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: Checked by:

DRILLING								SOIL DESCRIPTION			CONTAMINANT INDICATORS	
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log		Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
								Ground Surface				0.00
0.0		CC						0.0-0.1 fill, pavement				0.00
			0.1	0.1-0.2 FD04 FS04				0.1-0.35 fill, gravelly SAND light brown	SL M			
0.5		HA		0.4-0.5 (2J)				0.35-0.7 sandy CLAY	SL M		Waste fragments	
			00					0.7-1.2 sandy CLAY red. brown	D	St		
1.0		PT										
			00	1.0-1.1				1.2-2.5 CLAY grey, brown with trace orange mottling	D	SL soft	No odour	
1.5								slightly soft, stiff pas + 1.8m		stiffer		
			00	1.6-1.7								
2.0												
2.5			00	2.4-2.5								

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993

BOREHOLE LOG

Environmental

Bore No.: BH18
Page: 1 of 1

Client:	**Drilling Co.:**	**Easting:** 0	
Project:	**Driller:**	**Northing:** 0	
Job No.:	**Rig Type:**	**Grid Ref:**	
Location:	**Total Depth (m):**	**Collar RL:**	
Date Drilled: to:	**Diameter (mm):**	**Logged by:**	**Checked by:**

DRILLING												
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0		CC					0.0-0.18 fill, concrete				0.00
		HA	0.1	0.2-0.3			0.18-0.4 gravelly SAND orange brown → dark brown	D	L	No odour	
0.5							0.4-1.2 sandy CLAY dark brown	D			
			0.1	0.5-0.6							
1.0											
			0.2	1.0-1.1							
		PT					1.2-2.5 CLAY orange brown ↓ pale brown low plasticity	D	stiff	No odour	
1.5											
			0.2	1.6-1.7							
2.0											
2.5			0.2	2.4-2.5							

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH17
Page: 1 of 1

Client:	**Drilling Co.:**	**Easting:** 0
Project:	**Driller:**	**Northing:** 0
Job No.:	**Rig Type:**	**Grid Ref:**
Location:	**Total Depth (m):**	**Collar RL:**
Date Drilled: 11/8/22 to: 11/8/22	**Diameter (mm):**	**Logged by:** **Checked by:**

DRILLING											
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	SOIL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0							0.0-0.1; topsoil, Sandy CLAY; dark brown, trace OM.	M	Soft	no odour	0.00
			0.2	0.1-0.2			0.1-0.35; FILL; Sandy CLAY; orange-brown, LP, trace rootlets	M	Soft	no odour.	
1.0											
			0.1	0.4-0.5			0.35-0.55; FILL; gravelly SAND; grey-brown,	D	L	grey/black material, suspected anthropogenic	
2.0											
							E.O.H. @ 0.55 mbgl Refusal on rock/ ground/ hard surface				
3.0											
4.0											
5.0											
6.0											
7.0											
8.0											
9.0											
10.0											

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

BOREHOLE LOG

Environmental

Bore No.: BH10
Page: 1 of 1

Client:
Project:
Job No.:
Location:
Date Drilled: 11/8/22 to: 11/8/22

Drilling Co.:
Driller:
Rig Type:
Total Depth (m): 1.4
Diameter (mm): ~90.

Easting: 0
Northing: 0
Grid Ref:
Collar RL:
Logged by: **Checked by:**

DRILLING							SOIL DESCRIPTION			CONTAMINANT INDICATORS	
Depth (m)	Field Rank	Sample Method	PID (ppm)	Sample ID	Water	Graphic Log	Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture Condition	Consistency	Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Depth/ Elevation (m)
							Ground Surface				0.00
0.0							0-0.1; FILL; topsoil; silty CLAY; dark brown, OM, rootlets	M	Soft	no odour	0.00
				0.1-0.2							
1.0			0.0				0.1-0.45; FILL; sandy CLAY; brown, M-C sands, trace rootlets	M	Soft	no odour	
0.5			0.0	0.4-0.5 (2J) MM8							
							0.45-0.9; SAND; light brown, M-C sands, trace gravels	sl. M.	L	trace brick fragments, etc.	
3.0											
				0.9-1.0 (2J)			0.9-1.1; Sandy CLAY; brown	sl. M	St.	trace brick fragments	
1.0											
							1.1-1.4; Sandy CLAY; brown w/ grey mottling, F-M sands, trace calcareous deposits.	sl. M	St.	no odour.	
5.0				1.3-1.4							
1.5							E.O.H. @ 1.4 m bgl				
7.0											
8.0											
9.0											
10.0											

NOTES:

GHD Soil Classifications: The GHD Soil Classification is based on Australian Standards AS 1726-1993.

Groundwater Gauging Sheet

Client: MFS	**WL Meter Type: Dip / Fox / Int.Fce / Gge**
Project: Adelaide Station DSI	**Date:** 04/08/2022
Job No.: 12583428	**Time:** 0900 – 1030.
Location: Adelaide Fire Station.	**Sampler:** MB/AK.

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW105	–	11.931m		16.4m total depth
GW103	–	11.872m		14.1m total depth

MW02

10:30

DTW - 17.525

20.6 C

0.15 DO

5103 C

6.8 ph

~~147.2~~

145.1 ORP

5/10/22

11:00

MW05

DTW - 11.50

TWD - 15.00

21 C

0.28 DO

13219 C

6.59 ph

175.10RR

12:00

~~GW103~~ MW01

DTW - 11.960

20.3

0.68

12491

6.46

276.3

GW103

~~Added~~ 11:30

DTW - 11.90

TWD - 15:00

20.9 °C

0.21 DO

14595

6.38 pH

227.9 ORP

GW103 – North 11.960
GW105 – West 11=990

GW105

DTW = 11.990 12:38
TWA = 15.00
20.2 C
0.98 DO
9313 EC
6.57 pH
411.2 Redox

HSE009 Job Safety and Environmental Analysis (JSEA)

ABN 39008488373

Reference Documentation	HSE306 HSE Business Management
Purpose of Form	JSEAs outline a safe and environmentally responsible method of work, identification of individual training needs, plant / machinery and equipment, inspection and legislative requirements for a specific activity taking into consideration the hazards and risks involved in completing the activity (during routine, non-routine and emergency working conditions).
Responsibility for Completion	Project Manager (or delegate) to complete in consultation with the GHD project team (includes identification and delivery of training).
Frequency of Completion and Review	JSEA to be developed prior to commencement of site work and reviewed at no more than 6 monthly intervals or where there are significant changes to the job scope, equipment, environment, personnel or statutory framework. PD or qualified delegate responsible for review and approval.

Project Name & description:	MFS Adelaide Fire Station SAQP & DSI			**Activity:**	Groundwater Monitoring Well Installation
Project Number:	12583428	**Activity location:**	99 Wakefield St, Adelaide SA 5000	**Activity Date:**	4 - 5 August 2022

Task Step in Sequential Order	Hazards (What could cause injury or ill health, damage to property or damage to the environment (e.g. Water way, Refuelling))	Event & Potential Outcome (What could go wrong (e.g. fall in water / diesel spill) and what might happen as a result (e.g. person drowns / soil contamination))	Initial Risk Rating: Consequence	Initial Risk Rating: Likelihood	Initial Risk Rating: Risk Rating	Control Measures (Hazards should be eliminated wherever possible or minimised where elimination is not reasonably practicable. Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, Personal and Environmental Protective Equipment).	Ref Guide (e.g. Hazard Guides)	Residual Risk Rating: Consequence	Residual Risk Rating: Likelihood	Residual Risk Rating: Risk Rating	Person (s) Responsible (for implementing control measures)
Note: Consequence should be assessed first so that the likelihood rating is the likelihood of the selected consequence occurring.											
1	Vehicles/ driving	Injury / death resulting from motor vehicle accident Damage to vehicles / property resulting from motor vehicle accident Injury / death to wildlife Damage to vegetation / habitat	D	5	Extreme	**Staff undertaking driving will undertake the GHD e-learning package - H927 Driving vehicles** Vehicles selected for activities on the job will be fit for purpose and staff operating these will be licensed in accordance with jurisdictional requirements. Vehicles will be driven in accordance with jurisdictional laws and client requirements (e.g. speeds). Only persons trained 4WD operation and recovery will drive 4WD vehicles off demarcated roads (e.g. bitumen or gravel). Travel to and from site will be counted as part of total work hours for the purposes of managing fatigue management. Vehicles will be inspected by the driver prior to use to identify if there are any issues that may affect the performance or safety of the vehicle. Use of mobile phones in vehicles will be in accordance with jurisdiction and/or client requirements and as a minimum only used when blue tooth or hands-free mode is in use.	HSE308 HSE326 HSE226 HSE211 HSE374 HSE227 HSE357 HSE257	D	1	Moderate	GHD Field Staff
2	Slips and trips	Injuries to persons resulting from falling at the same level	C	3	Moderate	Staff exposed to slip and trip hazards have undertaken the GHD e-learning package - Slips and Trips. High risk slip and trip areas will be identified and access limited. Staff will wear ankle high lace up safety footwear with soles appropriate to the hazards presented (e.g. gravel or oily surfaces). Staff will practice sound housekeeping practices - e.g. cleaning up spillage immediately; implementing waste management practices to prevent rubbish build up; keeping walkways clear of trailing cables or other obstructions and obstacles; and providing adequate and appropriate storage facilities to minimise risk of slips and trips.	HSE266	C	1	Low	GHD Field Staff

3	Traffic - Working Around	Injury / death due to contact with motor vehicle(s) Damage to property due to impact from motor vehicle(s)	E	4	Extreme	Staff undertaking activities in proximity to live traffic (including on designated footpaths) will undertake the GHD e-learning package - H924 Working Around Traffic. A Traffic Management Plan will be developed in accordance with jurisdictional and client requirements where activities are being undertaken in close proximity to live traffic. GHD staff and persons under GHD control will maintain safe working distance from live traffic as described in HSE271. Speed zones and appropriate clearances are summarised below: Speed zone: 40 km; Clearance: < 1.5 m / 4 ft Speed zone: 60 km; Clearance: < 3 m / 10 ft to 1.5 m / 4 ft Speed zone: 80 km; Clearance: > 3 m / 10 ft to 6 m / 20 ft Only trained and accredited persons will develop Traffic Management Plans and provide traffic control services All staff in the vicinity of live traffic(including undertaking work activities on designated footpaths) will wear jurisdictional and GHD approved (and client where necessary) high visibility clothing including high visibility vest or jacket, safety footwear and other PPE as appropriate. Retroflective striping will be on all night time PP E outer garments (e.g. vests, jackets, wet weather gear etc.)	HSE371 HSE271	E	1	Moderate	GHD Field Staff
4	Biological hazards	Illness/ death resulting from transfer or contraction of COVID-19 during site work Illness resulting from transfer of diseases / bacteria or exposure to waste products	D	4	Significant	**COVID-19** Pre-Site Checks; - Follow relevant State or Territory health advice - Check with client for client specific Covid Controls - GHD Boarding Pass SOP to be followed at all times - PM to contact all site personnel on the day of site work and check they do not have any flu like symptoms and have not been exposed to anyone with COVID-19. On-site protocols; - Wash hands before eating and at the end of work - Do not share vehicles, if you must, wear a mask and open windows - Discuss and document onsite COVID hazard controls and document these during Pre-Start/ Pre-work assessment meeting. **Biological** Personal hygiene is most important; - Damaged skin must be covered with waterproof dressings. - Hands should be de-contaminated prior to eating and drinking. Site to site contamination to be minimised; - Decontamination / sterilisation to be completed for tools, equipment and clothing before moving another site. - Thoroughly wash footwear. - Do not attempt to handle sharps.	HSE205 HSE350 HSE339	D	1	Moderate	GHD Field Staff
5	Outdoor exposure	Exposure to UV Sunburn - heightened risk of melanoma Dehydration Hypothermia Hyperthermia Heat Stress Organ failure Death	D	3	Significant	Personnel undertaking activities outdoors will wear a broad brimmed hat, long sleeved shirts with a collar; long legged trousers and 30+ sunscreen protection on exposed areas. Drinking water will be carried by the job team to minimise risk of de-hydration. Programmed rest breaks, rostering, etc. and additional PPE will be implemented where personnel are required to work in extreme temperatures to reduce risk of fatigue, hyperthermia, heat stroke etc. Individuals exposed to extreme temperatures (+ or -) will be monitored for adverse effects - heat stress/stroke; frost bite; excessive fatigue	HSE270	D	1	Moderate	GHD Field Staff

6	Fatigue	Loss of concentration / decreased productivity / impaired judgement Illness (if prolonged exposure to stressors) Injury to self or others due to loss of concentration / coordination	C	5	Significant	Rostered hours of work will be simple and predictable. Commuting and travelling time will be considered part of the total hours worked in a day. Work arrangements will allow sufficient time off each 24 hours to allow at least 7-8 hours consecutive sleep. Arrangements will be made to prevent staff; working more than 16 hours in a 24-hour period, working above 14 hours per day for more than 5 days, working more than an average of 60 hours per week over a four-week period. Project director and OC HSE Manager/Coordinator approval (based on risk assessment) required to work outside these arrangements.	HSE326 HSE226	C	2	Low	GHD Field Staff
7	Mobile Plant / Machinery - Working around	Injury or death to persons and / damage to vehicles and / or equipment	D	5	Extreme	**Staff undertaking activities in the proximity to mobile plant/machinery will undertake the GHD e-learning package - H915 Mobile Plant/machinery(working around).** As a general rule, staff will not work within 3 metres / 10 feet of moving plant or within the 'swing area' of revolving plant/machinery. When approaching mobile plant/machinery, staff will make eye contact with the operator and signal for the operator to stop work before moving into this area. Defined physical barriers and exclusion zones will be implemented to delineate plant/machinery movement areas and prevent access of wider site personnel or members of the public (e.g. pedestrians or traffic). Where physical barriers and exclusions are not implemented, and persons (site personnel or public) remain in close proximity of moving plant/machinery a spotter will be assigned to that item of plant/machinery. Communication systems will be established between spotters, workers on foot and plant/machinery operators. Persons working in the proximity of moving plant/machinery will wear approved high visibility clothing, safety footwear and head protection.	HSE348 HSE248 HSE308 HSE363 HSE371 HSE271	D	1	Moderate	GHD Field Staff
8	Noise and vibration	Health affects from prolonged exposure to noise may include temporary threshold shift / permanent hearing loss Health affects from prolonged exposure to vibration may include blood pressure and heart problems and nervous disorders and / or hand / arm operation conditions	C	3	Moderate	Staff exposed to work generated noise will undertake the GHD e-learning package - Noise. If the noise in an area is suspected to be above 85 dB (a) and cannot be reduced by other means (e.g. isolating staff from the noise source), staff will wear PPE (e.g. earplug, earmuff) of a suitable attenuation to reduce the level of noise reaching the persons ears. Noise levels are to be confirmed with drillers prior to the works being undertaken. Staff to wear PPE (earplugs / earmuffs) at all times during drilling activities. Administrative controls e.g. job rotation, job re-design or rosters may be necessary to assist engineering controls reduce noise to an acceptable level. Where administrative controls are relied on they are to be regularly reviewed to satisfy compliance. PPE will be maintained in accordance with manufacturer's standards to maintain quality of noise reduction. Where required, Service Group Managers are responsible for organising audiometric examinations for their staff in accordance with the GHD Occupational Health Monitoring Procedure.	HSE249 HSE350	C	1	Low	GHD Field Staff
9	Utilities - Underground	Injury from contact with electrical services Injury / illness from gas explosion / escape of gases Injury from release of water (under pressure) Erosion of soil Impacts on flora and fauna Soil run off and sedimentation of local waterways Illness resulting from exposure to sewage Release of sewage to waterways Damage to property and equipment	E	4	Extreme	**Staff undertaking activities that may come into contact with underground utilities (e.g. ground penetration) will undertake the GHD e-learning package - H926 Utilities - Underground.** Site utility plans and data (obtained through DBYD) will be thoroughly reviewed to identify potential underground and checked by a suitable team member prior to starting work. Actual location of underground utilities will be identified using electronic detection devices by trained persons. and marked on site plans. A professional service locator will be hired by GHD to locate underground services and provide clearance prior to drilling. On-site locations ot be hand augered to 1.2 m depth to clear for services. NDD/Potholing of the off-site borehole locations to a depth determine by the type/depth of utilities present within a 5 m radius before mechanical drilling. Emergency response processes will be identified and documented by to work commencing activities to enable safe recovery in the event of striking an underground utility. Any underground markers disturbed during earth disturbance activities (e.g. identification tape) will be reinstated to pre-existing condition.	HSE320 HSE220 HSE352 HSE252	E	1	Moderate	GHD Field Staff

10	Manual handling	Injury to back and/or other parts of the body	C	4	Moderate	Staff undertaking activities involving manual handling (e.g. hand augering) have undertaken the GHD e-learning package - Manual Handling. Project Team to use appropriate storage areas and plan for heavy and awkward shaped items to be stored at locations that are easy to reach and are located between knee and shoulder height. Team handling should only be used in as a temporary interim control. When completing team lifting, consideration will be given to the individual's physical capabilities and heights. Where object to be carried or moved exceeds 16 kgs / 35 lbs. in weight or the item is awkward to handle, team lifting or mechanical equipment - forklift truck; barrow; etc. will be used to assist.	HSE347 HSE247	C	1	Low	GHD Field Staff
11	Chemicals	Injury to staff and other people Release to environment e.g. air, water and ground	C	3	Moderate	Health monitoring requirements for high risk chemicals e.g. isocyanides; silica; asbestos; arsenic and creosote; organophosphate pesticides, and lead will be identified and implemented as per the GHD Occupational Health Monitoring Procedure. All sources of potential spill and runoff of chemicals on site will be identified and measures put in place to prevent environmental damage. Persons exposed to chemicals will use and maintain the PPE as identified within the Safety Data Sheet and listed on last page of the JSEA. Emergency planning on site will include control measures for all chemicals on the site such that personnel and the environment are not placed at unnecessary risk.	HSE350 HSE230	C	1	Low	GHD Field Staff
12	Waste management / contamination	Incorrect / illegal disposal of waste materials Injury / illness resulting from contact with hazardous waste materials Contamination of land / water resulting from incorrect handling / disposal of waste materials Excessive waste generation Non-compliance with GHD policy and local laws/regulation	C	4	Moderate	A Spill Kit will be made available on site. All waste generated by GHD activities will be collected and removed from site or deposited into client provided receptacles. Where liquid materials are being stored on site, secure bunding will be installed.	HSE316 HSE230	C	1	Low	GHD Field Staff

13	Drilling	Rotating or moving parts on drill rig. Loose clothing/items/hair caught in drill rig resulting in personal injury/death.	D	5	Extreme	Ensure that all personnel are familiar with cut off switch for the drill rig. Location of cut off switches must be communicated by the driller to all members of the work team during the Pre Start Brief. Do not touch a moving auger. When collecting samples, only approach auger after signal with the driller. Ensure the auger is resting on the ground and motor is switched off before collecting samples. Always wear a hard hat when located within 3 metres of the drill rig and ensure that loose items of clothing are kept away from auger and drill rig. Ensure that long hair is tied back.	HSEG215	D	2	Moderate	GHD Field Staff
14	Drilling - Production of Dust	Dust inhalation resulting in acute or chronic respiratory illness.	C	3	Moderate	Field personnel must continually monitor the generation of dust during drilling. If visible dust is generated, cease work and implement dust suppression procedures such as wetting down the area or vacuum extraction. Field staff should stand upwind of any dust being generated. Have a P2 particulate face mask available for use if required.	HSEG222	C	2	Low	GHD Field Staff
15	Hazardous materials (contaminated soils, water)	Exposure to hazardous materials resulting in acute or chronic illness, skin irritations, or burns.	C	3	Moderate	Avoid exposure with contaminated soil or water by using safety glasses, nitrile gloves, long sleeves and pants and safety boots / waders (when working in waterway) . Maintaining general hygiene involving washing hands or using antiseptic wipes prior to eating or drinking. No eating, drinking or smoking in work area. Stop work if asbestos encountered. Field personnel to liase with Job Manager and site contact to determine the appropriate course of action.	HSEG201 HSEG222	C	1	Low	GHD Field Staff
16	Hazardous materials (water collection)	Improper sampling procedure and/or lack of personal protection resulting in exposure to hazardous materials.	C	3	Moderate	Ensure sleeves rolled down and nitrile gloves worn and safety glasses to prevent exposure to water / acid splash. Tip water samples into acid bottles very slowly and use caution not to splash acid out. Hold bottle away from body, if acid contacts the skin ensure flush thoroughly with water. Ensure lids are tightly secured onto sample bottles when complete and pack securely into esky in upright condition.	HSEG203	C	1	Low	GHD Field Staff

List inspection and maintenance required for this activity:	List the relevant sections of Legislation, Codes of Practice or Standards applying to this activity:	Provide details of statutory and non-statutory certificates/ permits/approvals required for this activity & location if required:
- Inspect vehicle prior to departure - Check weather prior to departure - Update whereabouts, advise BGL/Office Admin of travel ADD ADDITIONAL CONTROLS HERE - THE ABOVE ARE MANDATORY & CANNOT BE DELETED	Overarching Legislation: Work Health and Safety Act 2012 Work Health and Safety Regulation 2012 Environmental Protection Act 1993 Environmental Protection Regulations 2009	- Induction to Facility - - Use of Underground Service Identification Devices -
- HSE033 - Vehicle Safety Inspection -		Construction Industry Induction in your jurisdiction

Emergency Arrangements:		List plant/machinery and personal and/or environment protective equipment required:	Certifications / training GHD e-learning required to complete activity (PM to confirm with project team:
Role	Name & Contact Number	- Hi Vis Vest - - Hard hat - - Ankle High Steel Capped Boots - - Long Sleeves and Trousers - - Gloves - - Hearing Protection - - Comms - Mobile Phone / Satellite Phone - - Sunscreen and Hat - - First Aid Kit - --- - Check SDS and add requirements here -	HSE205 Biological Hazards - GHD e-learning H902 HSE230 Hazardous Substances and Dangerous Goods - GHD e-learning H913 HSE247 Manual Handling - GHD e-learning H914 HSE249 Noise and Vibration - GHD e-learning H916 HSE266 Slips and Trips - GHD e-learning H921 HSE273 Underground Utilities - GHD e-learning H926 HSE248 Mobile Plant/Machinery (working around) - GHD e-learning H915 HSE271 Traffic - working Around Traffic - GHD e-learning H924 HSE211 Driving Vehicles - GHD e-learning H927 HSE270 Extreme Temperatures - GHDe-learning H930 HSE226 Fatigue - GHDe-learning H907 Subcontractor management - obtain and review subcontractor JSAs, training, licences, etc. Induction to Facility Drivers Licence Instruction in the use of specific chemicals
Project Manager	Dilara Valiff (0420 959 236)		
Client Contact	Krystle Mitchell (0407 727 948)		
HSE Manager / Coordinator	Brad Ramsden +61 8 8111 6875		
Emergency Services	Dial 000		
Nearest Hospital	Calvary Adelaide Hospital (08 8227 7000)		
Information to provide in case of an emergency			
Assembly Point	Angas St south of site, next to the Adventist Church		
Nearest Rd / St and distance	Angas St (4.7 m south of site)		
Local landmarks	Police Headquarters adjacent to / south of site		

Created by PM Name (or suitably delegate)	Signature	Date	Reviewed & Approved by PD Name (or suitably skilled and experienced delegate)	Signature	Date	PD Review in BWISE (HSE065)?
Steven Castillo	SC	3/08/2022				Yes / No

By signing, I understand and agree to work to this JSEA, referenced procedures and have completed listed training. I am empowered to stop work if any person's safety or the environment are at risk.

GHD Project Team Name	Position	Qualification	Signature	Date
Matt Bald	Environmental Scientist	BSc (Hons)	MBald	4/8/22
David Ward	OFFSIDER			4/8/22
Ian Ward	Driver			4/8/22
Ben P	PA			4/8/22
Ally Kirkman	Field staff			4/8/22

HSE009 Multi-Day Pre-Work Assessment

Reference Documentation	HSE306 Business Management SOP
Purpose of Form	Daily methodology used to facilitate communication and consultation of HSE information, confirm all hazards have been identified on the JSEA, identify new hazards or altered conditions that may affect the delivery of the JSEA and check HSE training requirements
Responsibility for Completion	Project Manager (or delegate) to facilitate and include all members of the project team including GHD engaged subcontractors / subconsultants and visitors
Frequency of Completion and Review	To be performed daily on arrival to site but prior to the commencement of work and at any other time during the day where circumstances change (e.g. following an incident, changes to weather conditions, implementation of Stop Work Authority) an additional assessments will be carried out to identify possible new hazards and agreed control measures

Project Name & description:	MFS Adelaide Fire Station SAQP & DSI	**Activity:**	Groundwater Monitoring Well Installation
Project No:	12583428	**Activity Location:**	99 Wakefield St, Adelaide SA 5000

Date and Time	Specific Site Location	Hazard(s) (Not addressed in JSEA. Indicate if no new hazards are identified)	Consequence	Likelihood	Risk Rating	Control Measures (Hazards should be eliminated wherever possible or minimised where elimination is not reasonably practicable. Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, Personal and Environmental Protective Equipment).	Consequence	Likelihood	Risk Rating	Sign-off (Includes all GHD Team Members, subcontractors, visitors)
Notes: Print a sufficient number of Pre-Work Assessments sheets for the number of days on site. Allow more space for large job teams if applicable, or use the Single-Day Pre-Work Assessment Template										
Upon arrival at site, the Job JSEA should be reviewed and hazards that are no longer relevant crossed out. Site specific hazards identified are to be assessed below.										
5/8/22	MFS ADL	As per HSE009								MTB, AK, JW
11/8/22	MFS ADL	As per HSE009 Submission								MTB AK
12/8/22	MFS ADL	As per HSE009								MTB AK.

I understand the site-specific hazards and control measures identified and the emergency response arrangements for the site. I have completed required training and am empowered to stop work if any person's safety or the environment are at risk. If at any stage during the day circumstances change or a Stop Work Authority is implemented, an additional assessment will be carried out to identify possible new hazards and agreed control measures.

Guidance Information

GHD HSE Consequence Descriptors

Consequence Descriptors					
	Insignificant	Minor	Moderate	Major	Catastrophic
Health and Safety	Incident requiring no first aid.	Incident requiring first aid only and no medical treatment. Reversible health effects of little concern, requiring first aid treatment at most. Minor irritations of eyes, throat, nose and or skin, or minor unaccustomed muscular discomfort.	A medical treatment or minor lost time injury. E.g. Sprains and strains and minor fracture (including fingers, thumbs and toes). Reversible health effects of concern that would typically result in medical treatment.	A significant lost time injury. E.g. Significant fracture (other than digits), amputations, dislocations, loss of sight, electric shock or injuries requiring admittance to hospital. Severe, reversible health effects of concern that would typically result in a lost time incident.	Fatality(s) or permanent disability. Irreversible health effects or disabling illness.
Environment	Negligible on-site / off-site environmental impact and of low significance.	On-site / off-site environmental localised impact, immediately contained.	On-site / off-site environmental short-term impact, immediately recoverable.	On-site / off-site environmental medium term impact or repeated non-compliance with potential in some jurisdictions for prosecution.	Significant on-site / off-site environmental long-term harm that is not recoverable. Significant fines and prosecution at company and individual level may apply in some jurisdictions.

GHD HSE Consequence Descriptors

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Moderate	Significant	Extreme	Extreme
Likely	Low	Low	Moderate	Significant	Extreme
Possible	Negligible	Low	Moderate	Significant	Extreme
Unlikely	Negligible	Negligible	Low	Moderate	Significant
Very Unlikely	Negligible	Negligible	Low	Moderate	Moderate

Potential HSE Hazards - Hazard Guide form number included if applicable	E-Learning Course Code (if available)	Potential HSE Hazards - Hazard Guide form number included if applicable	E-Learning Course Code (if available)
HSE202 Asbestos	H901	HSE233 Hot Work (NA)	N/A
HSE 205 Biological Hazards	H902	HSE247 Manual Handling (and Lifting)	H914
HSE209 Confined Spaces	H904	HSE248 Mobile Plant / Machinery (working around)	H915
HSE211 Driving Vehicles	H927	HSE249 Noise and Vibration	H916
HSE221 Electricity	N/A	HSE256 Rail Corridor	H919
HSE220 Excavations	H906	HSE257 Remote Isolated Lone Working	H920
HSE270 Extreme Temperatures	H930	HSE266 Slips and Trips	H921
HSE226 Fatigue	H907	HSE268 Soil Erosion, Sedimentation & Dust Control	N/A
HSE227 4WD Vehicles	H908	HSE237 Hand Operated Tools includes power tools	H923
HSE223 First Aid	N/A	HSE271 Traffic - working around traffic	H924
HSE229 Fixed Plant / Machinery	H909	HSE278 Unexploded Ordnance	H941
HSE225 Flora and Fauna	H910	HSE252 Utilities - Overhead	H925
HSE230 Hazardous Substances & Dangerous Goods	H913	HSE273 Utilities - Underground	H926
HSE231 Heights (Work at Heights)	H911	Waste management and contamination	N/A
HSE232 Heritage and Cultural Significance	H912	HSE276 Water - working in/on/ near water	H929

GHD Likelihood Descriptors

Likelihood Descriptor		
	Guidance	Exposure
5 – Almost Certain	Expected to occur in most circumstances	Frequent (daily) exposure at > 10 x Occupational Exposure Limit (OEL)
4 – Likely	Will probably occur in most circumstances	Frequent (daily) exposure at > OEL
3 – Possible	Is conceivable that it may occur	Frequent (daily) exposure at > 50% of OEL. Infrequent exposure at > OEL
2 – Unlikely	It is improbable that it may occur	Frequent (daily) exposure at > 10% of OEL. Infrequent exposure at > 50% of OEL
1 – Very Unlikely	Highly doubtful but could occur in exceptional circumstances Might occur every 100 or more jobs	Frequent (daily) exposure at < 10% of OEL. Infrequent exposure at > 10% of OEL

GHD SFAR Reporting Framework

SFARP Actions				
Residual Risk Category	Negligible/Low Residual Risk	Moderate Residual Risk	Significant Residual Risk	Extreme Residual Risk
Actions	Continue task or activity within existing systems, processes and controls	Continue task or activity considering all practicable controls to reduce risk Active monitoring of the risk is required	Adopt and implement all practicable risk reduction measures to reduce risk Active management of the risk is required	Do not accept the Job / Do not commence work / Stop task or activity and notify management immediately Do not proceed until level of risk has been reduced
Source of Risk	SFARP Management Responsibility			
Project Specific	Listed on relevant risk assessment and JSEA	Project Director	Project Director If risk reduction not achieved –Group Manager	General Manager If risk reduction not achieved – Practice Management Group Representative
Work Group Specific		Work Group Manager If risk reduction not achieved –Operating Centre Management Group Representative	Work Group Manager If risk reduction not achieved – Management Group Representative	General Manager If risk reduction not achieved - Executive Management Group Representative
Region Wide		General Manager Group Representative	General Manager	Executive General Manager If risk reduction not achieved – Executive Management Group Representative

Appendix G

Laboratory reports

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

1 of 1

Company	GHD Pty Ltd	Project №	12583428	Project Manager	Vera Biermann
Address	211 Victoria Square, Level 4, Adelaide, 5000	Project Name	MFS Adelaide HHERA	EDD Format (ESdat, EQuIS etc)	Esdat
Contact Name	Ally Kirkman				
Phone №	412625108				
Special Directions	Please forward RT_FS01 to ALS				
Purchase Order					
Quote ID №	GHD rates				

Sampler(s)	AK / AO
Handed over by	AK / AO
Email for Invoice	AaccountspayableAU@ghd.com vera.biermann@ghd.com
Email for Results	GHDLabReports@ghd.com vera.biermann@ghd.com ally.kirkman@ghd.com

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Containers — Change container type & size if necessary.

Required Turnaround Time (TAT) — Default will be 5 days if not ticked.

♦Surcharge will apply
Overnight (reporting by 9am)♦
Same day♦ 1 day♦
2 days♦ 3 days♦
5 days (Standard)
Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	PFAS Extended Suite - 30 PFAS with Ultra Trace PFOS	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
21	RT_FS01		W	X						2			Please forward to ALS
22	RT_FB01		W	X						1			
23	RT_FB02		W	X						1			
24	RT_FB03		W	X						1			
25	RT_FB04		W	X						1			#997597 Pasquale
26	RT_FB05		W	X						1			
27	RT_FB06		W	X						1			
28	PL_FB01		W	X						1			
29													
30													
	Total Counts			8						9			

Environmental Division
Melbourne
Work Order Reference
EM2310715

Telephone : + 61-3-8549 9600

Method of Shipment	Courier (#)	Hand Delivered	Postal	Name		Signature		Date	Time	Temperature
Laboratory Use Only	Received By	Pasquale	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	8/9/06	Time	2pm	
	Received By	BW	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	14/6	Time	11.05	Report №

Eurofins Environment Testing Australia Pty Ltd

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | Environment Testing Standard Terms and Conditions unless agreed otherwise. A copy is available on request.

Relinquished by Jessica-S
Ef 8am 14/6

CERTIFICATE OF ANALYSIS

Work Order	: **EM2310715**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: VERA BIERMANN	Contact	: Shirley LeCornu
Address	: Level 4, 211 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9630
Project	: 12583428	Date Samples Received	: 14-Jun-2023 11:05
Order number	: ----	Date Analysis Commenced	: 22-Jun-2023
C-O-C number	: ----	Issue Date	: 23-Jun-2023 13:25
Sampler	: AK/AO		
Site	: ----		
Quote number	: ME/875/20 B - SECONDARY WORK ONLY		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RT_FS01	----	----	----	----
				Sampling date / time	05-Jun-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2310715-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L		<0.0005	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L		**0.0021**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L		**0.0030**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L		<0.0005	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L		<0.0020	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L		**0.0012**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L		**0.0024**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L		**0.0019**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L		**0.0012**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L		<0.0005	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L		<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L		<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L		<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RT_FS01	----	----	----	----
				Sampling date / time	05-Jun-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM2310715-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L		<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L		<0.001	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L		<0.0005	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L		<0.001	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L		<0.001	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L		<0.001	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		<0.001	----	----	----	----
EP231P: PFAS Sums									
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L		**0.0051**	----	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L		**0.0106**	----	----	----	----
^ Sum of PFAS	----	0.0002	µg/L		**0.0118**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%		**88.0**	----	----	----	----
13C8-PFOA	----	0.0005	%		**89.0**	----	----	----	----

Surrogate Control Limits

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

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) EP231B: Perfluoroalkyl Carboxylic Acids

(WATER) EP231A: Perfluoroalkyl Sulfonic Acids

(WATER) EP231P: PFAS Sums

(WATER) EP231S: PFAS Surrogate

(WATER) EP231D: (n:2) Fluorotelomer Sulfonic Acids

(WATER) EP231C: Perfluoroalkyl Sulfonamides

QUALITY CONTROL REPORT

Work Order	: **EM2310715**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: VERA BIERMANN	Contact	: Shirley LeCornu
Address	: Level 4, 211 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9630
Project	: 12583428	Date Samples Received	: 14-Jun-2023
Order number	: ----	Date Analysis Commenced	: 22-Jun-2023
C-O-C number	: ----	Issue Date	: 23-Jun-2023
Sampler	: AK/AO		
Site	: ----		
Quote number	: ME/875/20 B - SECONDARY WORK ONLY		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 5120613)									
EM2310715-001	RT_FS01	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0030	0.0030	0.0	0% - 50%
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0021	0.0020	0.0	No Limit
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
ES2319892-001	Anonymous	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0025	0.0027	8.1	No Limit
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0028	0.0031	9.1	No Limit
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 5120613)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 5120613) - continued									
EM2310715-001	RT_FS01	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0012	0.0011	0.0	No Limit
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0024	0.0024	0.0	No Limit
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0019	0.0018	7.3	No Limit
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	0.0012	0.0014	14.4	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.0	No Limit
ES2319892-001	Anonymous	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0109	0.0114	4.4	0% - 20%
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0073	0.0070	3.9	0% - 50%
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0106	0.0109	2.3	0% - 20%
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0014	0.0015	0.0	No Limit
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0010	<0.0010	0.0	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	0.0064	0.0064	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 5120613)									
EM2310715-001	RT_FS01	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 5120613) - continued									
EM2310715-001	RT_FS01	EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
ES2319892-001	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 5120613)									
EM2310715-001	RT_FS01	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
ES2319892-001	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 5120613)									
EM2310715-001	RT_FS01	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0051	0.0050	2.0	0% - 20%
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0106	0.0103	2.9	0% - 20%
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	0.0118	0.0117	0.9	0% - 20%
ES2319892-001	Anonymous	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0053	0.0058	9.0	0% - 50%
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0419	0.0430	2.6	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231P: PFAS Sums (QC Lot: 5120613) - continued									
ES2319892-001	Anonymous	EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	0.0419	0.0430	2.6	0% - 20%

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 5120613)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.004 µg/L	92.3	72.0	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.004 µg/L	107	71.0	127
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.004 µg/L	86.2	68.0	131
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.004 µg/L	101	69.0	134
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.004 µg/L	83.9	65.0	140
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.004 µg/L	108	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 5120613)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.02 µg/L	94.9	73.0	129
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.004 µg/L	106	72.0	129
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.004 µg/L	98.8	72.0	129
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.004 µg/L	104	72.0	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.004 µg/L	99.6	71.0	133
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.004 µg/L	100.0	69.0	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.004 µg/L	104	71.0	129
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	76.4	69.0	133
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.004 µg/L	87.5	72.0	134
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	103	65.0	144
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.01 µg/L	119	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 5120613)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.004 µg/L	76.0	67.0	137
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.01 µg/L	69.4	68.0	141
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.01 µg/L	90.1	56.6	136
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.01 µg/L	72.8	61.9	129
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.01 µg/L	89.8	52.8	135
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.004 µg/L	77.2	65.0	136
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.004 µg/L	101	61.0	135

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 5120613)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.004 µg/L	111	63.0	143
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.004 µg/L	108	64.0	140
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.004 µg/L	76.8	67.0	138
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.004 µg/L	79.7	60.9	136
EP231P: PFAS Sums (QCLot: 5120613)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 5120613)							
EM2310715-001	RT_FS01	EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.004 µg/L	119	72.0	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.004 µg/L	86.5	71.0	127
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.004 µg/L	76.9	68.0	131
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.004 µg/L	87.0	69.0	134
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.004 µg/L	75.3	65.0	140
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.004 µg/L	135	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 5120613)							
EM2310715-001	RT_FS01	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.02 µg/L	116	73.0	129
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.004 µg/L	98.4	72.0	129
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.004 µg/L	96.0	72.0	129
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.004 µg/L	88.0	72.0	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.004 µg/L	85.1	71.0	133
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.004 µg/L	109	69.0	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.004 µg/L	91.4	71.0	129
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.004 µg/L	109	69.0	133
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.004 µg/L	120	72.0	134
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.004 µg/L	77.3	65.0	144
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.01 µg/L	124	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 5120613)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 5120613) - continued							
EM2310715-001	RT_FS01	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.004 µg/L	77.1	67.0	137
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.01 µg/L	116	68.0	141
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.01 µg/L	75.7	56.6	136
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.01 µg/L	79.6	61.9	129
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.01 µg/L	85.8	52.8	135
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.004 µg/L	80.1	65.0	136
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.004 µg/L	122	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 5120613)							
EM2310715-001	RT_FS01	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.004 µg/L	121	63.0	143
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.004 µg/L	93.5	64.0	140
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.004 µg/L	82.4	67.0	138
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.004 µg/L	120	60.9	136

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2310715**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: VERA BIERMANN	Telephone	: +6138549 9630
Project	: 12583428	Date Samples Received	: 14-Jun-2023
Site	: ----	Issue Date	: 23-Jun-2023
Sampler	: AK/AO	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-SUT)							
RT_FS01	**05-Jun-2023**	**22-Jun-2023**	02-Dec-2023	✓	**23-Jun-2023**	02-Dec-2023	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-SUT)							
RT_FS01	**05-Jun-2023**	**22-Jun-2023**	02-Dec-2023	✓	**23-Jun-2023**	02-Dec-2023	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-SUT)							
RT_FS01	**05-Jun-2023**	**22-Jun-2023**	02-Dec-2023	✓	**23-Jun-2023**	02-Dec-2023	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-SUT)							
RT_FS01	**05-Jun-2023**	**22-Jun-2023**	02-Dec-2023	✓	**23-Jun-2023**	02-Dec-2023	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-SUT)							
RT_FS01	**05-Jun-2023**	**22-Jun-2023**	02-Dec-2023	✓	**23-Jun-2023**	02-Dec-2023	✓

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)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	GHD Pty Ltd	Project №	12583428	Project Manager	Vera Biermann
Address	211 Victoria Square, Level 4, Adelaide, 5000	Project Name	MFS Adelaide HHERA	EDD Format (ESdat, EQuIS etc)	Esdat
Contact Name	Ally Kirkman				
Phone №	412625108				
Special Directions	Please forward RT_FS01 to ALS				
Purchase Order					
Quote ID №	GHD rates				

Sampler(s)	AK / AO
Handed over by	AK / AO
Email for Invoice	AaccountspayableAU@ghd.com vera.biermann@ghd.com
Email for Results	GHDLabReports@ghd.com vera.biermann@ghd.com ally.kirkman@ghd.com

Analyses — Where metals are requested please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing

Containers — Change container type & size if necessary

Required Turnaround Time (TAT) — Default will be 5 days if not ticked

♦Surcharge will apply
Overnight (reporting by 9am)♦
Same day♦ 1 day♦
2 days♦ 3 days♦
5 days (Standard)
Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh mm	Matrix Solid (S) Water (W)	PFAS Extended Suite - 30 PFAS with Ultra Trace PFOS	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
21	RT_SW01		W	X	2								
22	RT_SW02		W	X	2								
23	RT_SW03		W	X	2								
24	RT_SW04		W	X	2								#997597 Parkerad
25	RT_SW05		W	X	2								
26	RT_SW06		W	X	2								
27	RT_SW07		W	X	2								
28	PL_SW01		W	X	2								11.3°C +0.3°C 11.6°C on ice
29	PL_SW02		W	X	2								
30	RT_FD01		W	X	2								
	Total Counts			10	20								

Method of Shipment: Courier (#) | Hand Delivered | Postal | Name | Signature | Date | Time | Temperature

Laboratory Use Only									
Received By	Parkerad	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	09/06	Time	2 pm	Temperature
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	GHD Pty Ltd	Project №	12583428	Project Manager	Vera Biermann
Address	211 Victoria Square, Level 4, Adelaide, 5000	Project Name	MFS Adelaide HHERA	EDD Format (ESdat, EQuIS etc)	Esdat
Contact Name	Ally Kirkman				
Phone №	412625108				
Special Directions	Please forward RT_FS01 to ALS				
Purchase Order					
Quote ID №	GHD rates				

Sampler(s)	AK / AO
Handed over by	AK / AO
Email for Invoice	AaccountspayableAU@ghd.com vera.biermann@ghd.com
Email for Results	GHDLabReports@ghd.com vera.biermann@ghd.com ally.kirkman@ghd.com

Analyses (Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attach SUITE pricing)

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	PFAS Extended Suite - 30 PFAS with Ultra Trace PFOS	Containers: 500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
21	RT_FS01		W	X						2			Please forward to ALS
22	RT_FB01		W	X						1			
23	RT_FB02		W	X						1			
24	RT_FB03		W	X						1			
25	RT_FB04		W	X						1			#997597
26	RT_FB05		W	X						1			Passed
27	RT_FB06		W	X						1			
28	PL_FB01		W	X						1			
29													
30													
	Total Counts			8						9			

Containers: Change container type & size if necessary

Required Turnaround Time (TAT): Default will be 5 days if not ticked

*Surcharge will apply
Overnight (reporting by 9am)*
Same day* 1 day*
2 days* 3 days*
5 days (Standard)
Other( )

Method of Shipment	Courier (#)	Hand Delivered	Postal	Name		Signature		Date	Time
Laboratory Use Only	Received By: Passed	SYD | BNE | MEL | PER | ADL | NTL | DRW		Signature		Date: 09/08	Time: 2pm	Temperature	
	Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW		Signature		Date	Time	Report №	

QS3009_R10 Modified by: Dr. R Symons Approved by: G. Jackson Approved on: 6 August 2019

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www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd

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NATA# 1261 Site# 18217

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Mitchell
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NATA# 1261 Site# 20794

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NATA# 1261
Site# 25079 & 25289

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NATA# 2377 Site# 2370

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IANZ# 1327

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: +64 3 343 5201
IANZ# 1290

Sample Receipt Advice

Company name:	GHD Pty Ltd SA
Contact name:	Vera Biermann
Project name:	MFS Adelaide HHERA
Project ID:	12583428
Turnaround time:	5 Day
Date/Time received	Jun 9, 2023 3:02 PM
Eurofins reference	997597

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	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).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Amy Meunier on phone : or by email: AmyMeunier@eurofins.com

Results will be delivered electronically via email to Vera Biermann - vera.biermann@ghd.com.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd SA email address.

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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NATA# 1261 Site# 25466

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Site# 25079 & 25289

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IANZ# 1290

Company Name: GHD Pty Ltd SA
Address: GPO Box 2052
Adelaide
SA 5001

Project Name: MFS Adelaide HHERA
Project ID: 12583428

Order No.:
Report #: 997597
Phone: 08 8111 6600
Fax: 08 8111 6699

Received: Jun 9, 2023 3:02 PM
Due: Jun 19, 2023
Priority: 5 Day
Contact Name: Vera Biermann

Eurofins Analytical Services Manager : Amy Meunier

Sample Detail						Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Melbourne Laboratory - NATA # 1261 Site # 1254						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	RT_SW01	Jun 09, 2023		Water	M23-Jn0022884	X
2	RT_SW02	Jun 09, 2023		Water	M23-Jn0022885	X
3	RT_SW03	Jun 09, 2023		Water	M23-Jn0022886	X
4	RT_SW04	Jun 09, 2023		Water	M23-Jn0022887	X
5	RT_SW05	Jun 09, 2023		Water	M23-Jn0022888	X
6	RT_SW06	Jun 09, 2023		Water	M23-Jn0022889	X
7	RT_SW07	Jun 09, 2023		Water	M23-Jn0022890	X
8	PL_SW01	Jun 09, 2023		Water	M23-Jn0022891	X
9	PL_SW02	Jun 09, 2023		Water	M23-Jn0022892	X
10	RT_FD01	Jun 09, 2023		Water	M23-Jn0022893	X
11	RT_FB01	Jun 09, 2023		Water	M23-Jn0022894	X
12	RT_FB02	Jun 09, 2023		Water	M23-Jn0022895	X
13	RT_FB03	Jun 09, 2023		Water	M23-Jn0022896	X

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261 Site# 1254	NATA# 1261 Site# 25403	NATA# 1261 Site# 18217	NATA# 1261 Site# 25466	NATA# 1261 Site# 20794	Site# 25079 & 25289

Eurofins ARL Pty Ltd
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NATA# 2377 Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

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Penrose,	Rolleston,
Auckland 1061	Christchurch 7675
Tel: +64 9 526 4551	Tel: +64 3 343 5201
IANZ# 1327	IANZ# 1290

Company Name: GHD Pty Ltd SA
Address: GPO Box 2052
Adelaide
SA 5001

Project Name: MFS Adelaide HHERA
Project ID: 12583428

Order No.:
Report #: 997597
Phone: 08 8111 6600
Fax: 08 8111 6699

Received: Jun 9, 2023 3:02 PM
Due: Jun 19, 2023
Priority: 5 Day
Contact Name: Vera Biermann

Eurofins Analytical Services Manager : Amy Meunier

Sample Detail						Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Melbourne Laboratory - NATA # 1261 Site # 1254						X
14	RT_FB04	Jun 09, 2023		Water	M23-Jn0022897	X
15	RT_FB05	Jun 09, 2023		Water	M23-Jn0022898	X
16	RT_FB06	Jun 09, 2023		Water	M23-Jn0022899	X
17	PL_FB01	Jun 09, 2023		Water	M23-Jn0022900	X
Test Counts						17

GHD Pty Ltd
GPO Box 2052
Adelaide
SA 5001

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Vera Biermann**

Report **997597-W**
Project name MFS Adelaide HHERA
Project ID 12583428
Received Date Jun 09, 2023

Client Sample ID			**RT_SW01**	**RT_SW02**	**RT_SW03**	**RT_SW04**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M23-Jn0022884**	**M23-Jn0022885**	**M23-Jn0022886**	**M23-Jn0022887**
Date Sampled			**Jun 09, 2023**	**Jun 09, 2023**	**Jun 09, 2023**	**Jun 09, 2023**
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace						
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluoroheptanoic acid (PFHpA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
13C4-PFBA (surr.)	1	%	65	73	59	100
13C5-PFPeA (surr.)	1	%	62	85	86	107
13C5-PFHxA (surr.)	1	%	78	97	100	105
13C4-PFHpA (surr.)	1	%	83	96	92	100
13C8-PFOA (surr.)	1	%	87	95	87	95
13C5-PFNA (surr.)	1	%	95	98	88	97
13C6-PFDA (surr.)	1	%	108	114	92	85
13C2-PFUnDA (surr.)	1	%	109	115	99	88
13C2-PFDoDA (surr.)	1	%	110	103	94	92
13C2-PFTeDA (surr.)	1	%	109	61	81	96
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace						
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.001	[N09]0.001	[N09]0.002	[N09]0.001
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.0001	ug/L	0.0010	0.0011	0.0010	0.0032
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	82	96	96	100
18O2-PFHxS (surr.)	1	%	96	98	94	99
13C8-PFOS (surr.)	1	%	109	109	95	93

Client Sample ID			RT_SW01	RT_SW02	RT_SW03	RT_SW04
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022884	M23-Jn0022885	M23-Jn0022886	M23-Jn0022887
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonamido substances- Ultra Trace						
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
13C8-FOSA (surr.)	1	%	119	110	97	95
D3-N-MeFOSA (surr.)	1	%	97	124	67	113
D5-N-EtFOSA (surr.)	1	%	97	123	66	120
D7-N-MeFOSE (surr.)	1	%	113	151	82	89
D9-N-EtFOSE (surr.)	1	%	109	115	78	92
D5-N-EtFOSAA (surr.)	1	%	95	116	96	90
D3-N-MeFOSAA (surr.)	1	%	101	113	103	92
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	57	118	89	100
13C2-6:2 FTSA (surr.)	1	%	67	91	88	101
13C2-8:2 FTSA (surr.)	1	%	77	110	89	90
13C2-10:2 FTSA (surr.)	1	%	89	103	105	95
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.001	0.0021	0.003	0.0042
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.001	0.0011	0.001	0.0052
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.001	0.0021	0.003	0.0062
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.005	< 0.005	< 0.005	0.0102
Sum of PFASs (n=30)*	0.005	ug/L	< 0.005	< 0.005	< 0.005	0.0112

Client Sample ID			RT_SW05	RT_SW06	RT_SW07	PL_SW01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022888	M23-Jn0022889	M23-Jn0022890	M23-Jn0022891
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace						
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	0.02
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	0.03
Perfluoroheptanoic acid (PFHpA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	[N09]< 0.01
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	[N09]0.01

Client Sample ID			RT_SW05	RT_SW06	RT_SW07	PL_SW01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022888	M23-Jn0022889	M23-Jn0022890	M23-Jn0022891
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace						
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
13C4-PFBA (surr.)	1	%	171	166	138	70
13C5-PFPeA (surr.)	1	%	135	157	141	104
13C5-PFHxA (surr.)	1	%	131	137	130	99
13C4-PFHpA (surr.)	1	%	123	129	125	119
13C8-PFOA (surr.)	1	%	114	116	132	119
13C5-PFNA (surr.)	1	%	108	112	112	120
13C6-PFDA (surr.)	1	%	109	104	104	112
13C2-PFUnDA (surr.)	1	%	104	94	93	98
13C2-PFDoDA (surr.)	1	%	106	91	88	110
13C2-PFTeDA (surr.)	1	%	107	99	64	127
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace						
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	0.019
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	0.002
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	[N09]0.004
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	[N09]0.002	[N09]0.002	[N09]0.002	[N09]0.035
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	[N09]0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.0001	ug/L	0.0037	0.0029	0.0032	0.062
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	115	128	118	104
18O2-PFHxS (surr.)	1	%	112	111	109	106
13C8-PFOS (surr.)	1	%	104	102	100	83
Perfluoroalkyl sulfonamido substances- Ultra Trace						
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
13C8-FOSA (surr.)	1	%	100	100	101	91
D3-N-MeFOSA (surr.)	1	%	100	85	58	50
D5-N-EtFOSA (surr.)	1	%	101	109	73	70
D7-N-MeFOSE (surr.)	1	%	79	100	79	58
D9-N-EtFOSE (surr.)	1	%	101	106	90	78
D5-N-EtFOSAA (surr.)	1	%	97	100	104	124
D3-N-MeFOSAA (surr.)	1	%	107	104	107	115

Client Sample ID			RT_SW05	RT_SW06	RT_SW07	PL_SW01
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022888	M23-Jn0022889	M23-Jn0022890	M23-Jn0022891
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	150	131	132	102
13C2-6:2 FTSA (surr.)	1	%	119	124	121	135
13C2-8:2 FTSA (surr.)	1	%	107	112	119	125
13C2-10:2 FTSA (surr.)	1	%	110	95	91	120
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.0057	0.0049	0.0052	0.097
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.0057	0.0059	0.0062	0.073
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.0077	0.0079	0.0082	0.108
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.0117	0.0129	0.0132	0.194
Sum of PFASs (n=30)*	0.005	ug/L	0.0127	0.0149	0.0152	0.206

Client Sample ID			PL_SW02	RT_FD01	RT_FB01	RT_FB02
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022892	M23-Jn0022893	M23-Jn0022894	M23-Jn0022895
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace						
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	0.02	< 0.01	< 0.01	< 0.01
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	0.05	< 0.01	< 0.01	< 0.01
Perfluoroheptanoic acid (PFHpA)[N11]	0.01	ug/L	[N09]0.02	< 0.01	< 0.01	< 0.01
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	0.05	[N09]< 0.01	< 0.01	< 0.01
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	0.01	< 0.01	< 0.01	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	0.02	< 0.01	< 0.01	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
13C4-PFBA (surr.)	1	%	95	120	85	94
13C5-PFPeA (surr.)	1	%	65	78	81	90
13C5-PFHxA (surr.)	1	%	58	80	89	95
13C4-PFHpA (surr.)	1	%	58	76	80	92
13C8-PFOA (surr.)	1	%	75	75	74	85
13C5-PFNA (surr.)	1	%	81	73	72	80
13C6-PFDA (surr.)	1	%	76	83	88	95
13C2-PFUnDA (surr.)	1	%	100	86	78	86
13C2-PFDoDA (surr.)	1	%	102	116	83	84
13C2-PFTeDA (surr.)	1	%	156	189	75	55

Client Sample ID			PL_SW02	RT_FD01	RT_FB01	RT_FB02
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022892	M23-Jn0022893	M23-Jn0022894	M23-Jn0022895
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace						
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	0.018	< 0.001	< 0.001	< 0.001
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	0.004	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	[N09]0.006	< 0.001	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	[N09]0.057	[N09]0.002	< 0.001	< 0.001
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	[N09]0.003	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.0001	ug/L	0.15	0.0024	0.0002	< 0.0001
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	81	95	90	95
18O2-PFHxS (surr.)	1	%	84	84	79	91
13C8-PFOS (surr.)	1	%	78	79	86	91
Perfluoroalkyl sulfonamido substances- Ultra Trace						
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
13C8-FOSA (surr.)	1	%	71	116	93	92
D3-N-MeFOSA (surr.)	1	%	186	199	116	90
D5-N-EtFOSA (surr.)	1	%	121	193	127	93
D7-N-MeFOSE (surr.)	1	%	116	161	71	71
D9-N-EtFOSE (surr.)	1	%	120	181	78	66
D5-N-EtFOSAA (surr.)	1	%	94	99	96	99
D3-N-MeFOSAA (surr.)	1	%	66	88	86	93
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	66	66	95	107
13C2-6:2 FTSA (surr.)	1	%	88	94	99	108
13C2-8:2 FTSA (surr.)	1	%	95	85	108	107
13C2-10:2 FTSA (surr.)	1	%	110	117	101	106
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	0.207	0.0044	< 0.001	< 0.001
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.199	0.0044	< 0.001	< 0.001
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.256	0.0064	< 0.001	< 0.001
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.381	0.0104	< 0.005	< 0.005
Sum of PFASs (n=30)*	0.005	ug/L	0.433	0.0104	< 0.005	< 0.005

Client Sample ID			RT_FB03	RT_FB04	RT_FB05	RT_FB06
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022896	M23-Jn0022897	M23-Jn0022898	M23-Jn0022899
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace						
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluoroheptanoic acid (PFHpA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
13C4-PFBA (surr.)	1	%	94	92	93	91
13C5-PFPeA (surr.)	1	%	92	93	94	92
13C5-PFHxA (surr.)	1	%	95	94	94	92
13C4-PFHpA (surr.)	1	%	90	91	90	92
13C8-PFOA (surr.)	1	%	88	93	91	89
13C5-PFNA (surr.)	1	%	86	90	88	84
13C6-PFDA (surr.)	1	%	103	107	104	100
13C2-PFUnDA (surr.)	1	%	93	93	89	91
13C2-PFDoDA (surr.)	1	%	94	80	76	92
13C2-PFTeDA (surr.)	1	%	101	61	53	80
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace						
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.0001	ug/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	95	95	94	96
18O2-PFHxS (surr.)	1	%	91	91	94	94
13C8-PFOS (surr.)	1	%	97	101	102	94
Perfluoroalkyl sulfonamido substances- Ultra Trace						
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
13C8-FOSA (surr.)	1	%	104	99	93	93
D3-N-MeFOSA (surr.)	1	%	132	114	132	139
D5-N-EtFOSA (surr.)	1	%	154	121	150	153
D7-N-MeFOSE (surr.)	1	%	99	80	80	79

Client Sample ID			RT_FB03	RT_FB04	RT_FB05	RT_FB06
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M23-Jn0022896	M23-Jn0022897	M23-Jn0022898	M23-Jn0022899
Date Sampled			Jun 09, 2023	Jun 09, 2023	Jun 09, 2023	Jun 09, 2023
Test/Reference	LOR	Unit				
Perfluoroalkyl sulfonamido substances- Ultra Trace						
D9-N-EtFOSE (surr.)	1	%	102	93	85	81
D5-N-EtFOSAA (surr.)	1	%	106	102	92	103
D3-N-MeFOSAA (surr.)	1	%	100	99	96	96
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
13C2-4:2 FTSA (surr.)	1	%	100	98	101	101
13C2-6:2 FTSA (surr.)	1	%	106	105	107	102
13C2-8:2 FTSA (surr.)	1	%	113	112	146	131
13C2-10:2 FTSA (surr.)	1	%	121	103	93	116
PFASs Summations						
Sum (PFHxS + PFOS)*	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Sum of PFASs (n=30)*	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			PL_FB01
Sample Matrix			Water
Eurofins Sample No.			M23-Jn0022900
Date Sampled			Jun 09, 2023
Test/Reference	LOR	Unit	
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace			
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	< 0.01
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	< 0.01
Perfluoroheptanoic acid (PFHpA)[N11]	0.01	ug/L	< 0.01
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	< 0.01
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01
13C4-PFBA (surr.)	1	%	96
13C5-PFPeA (surr.)	1	%	97
13C5-PFHxA (surr.)	1	%	98
13C4-PFHpA (surr.)	1	%	94
13C8-PFOA (surr.)	1	%	94
13C5-PFNA (surr.)	1	%	90
13C6-PFDA (surr.)	1	%	105
13C2-PFUnDA (surr.)	1	%	92

Client Sample ID			PL_FB01
Sample Matrix			Water
Eurofins Sample No.			M23-Jn0022900
Date Sampled			Jun 09, 2023
Test/Reference	LOR	Unit	
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace			
13C2-PFDoDA (surr.)	1	%	83
13C2-PFTeDA (surr.)	1	%	48
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace			
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.001
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.001
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.0001	ug/L	< 0.0001
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001
13C3-PFBS (surr.)	1	%	97
18O2-PFHxS (surr.)	1	%	98
13C8-PFOS (surr.)	1	%	102
Perfluoroalkyl sulfonamido substances- Ultra Trace			
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05
13C8-FOSA (surr.)	1	%	101
D3-N-MeFOSA (surr.)	1	%	122
D5-N-EtFOSA (surr.)	1	%	130
D7-N-MeFOSE (surr.)	1	%	77
D9-N-EtFOSE (surr.)	1	%	82
D5-N-EtFOSAA (surr.)	1	%	101
D3-N-MeFOSAA (surr.)	1	%	100
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.005	ug/L	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001
13C2-4:2 FTSA (surr.)	1	%	106
13C2-6:2 FTSA (surr.)	1	%	109
13C2-8:2 FTSA (surr.)	1	%	125
13C2-10:2 FTSA (surr.)	1	%	110

Client Sample ID			PL_FB01
Sample Matrix			**Water**
Eurofins Sample No.			**M23-Jn0022900**
Date Sampled			**Jun 09, 2023**
Test/Reference	LOR	Unit	
PFASs Summations			
Sum (PFHxS + PFOS)*	0.001	ug/L	< 0.001
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	< 0.001
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	< 0.001
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.005
Sum of PFASs (n=30)*	0.005	ug/L	< 0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

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
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace	Melbourne	Jun 14, 2023	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - ultra trace			
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace	Melbourne	Jun 14, 2023	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - ultra trace			
Perfluoroalkyl sulfonamido substances- Ultra Trace	Melbourne	Jun 14, 2023	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - ultra trace			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace	Melbourne	Jun 14, 2023	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - ultra trace			

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Company Name: GHD Pty Ltd SA
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Project Name: MFS Adelaide HHERA
Project ID: 12583428

Order No.:
Report #: 997597
Phone: 08 8111 6600
Fax: 08 8111 6699

Received: Jun 9, 2023 3:02 PM
Due: Jun 19, 2023
Priority: 5 Day
Contact Name: Vera Biermann

Eurofins Analytical Services Manager : Amy Meunier

Sample Detail						Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Melbourne Laboratory - NATA # 1261 Site # 1254						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	RT_SW01	Jun 09, 2023		Water	M23-Jn0022884	X
2	RT_SW02	Jun 09, 2023		Water	M23-Jn0022885	X
3	RT_SW03	Jun 09, 2023		Water	M23-Jn0022886	X
4	RT_SW04	Jun 09, 2023		Water	M23-Jn0022887	X
5	RT_SW05	Jun 09, 2023		Water	M23-Jn0022888	X
6	RT_SW06	Jun 09, 2023		Water	M23-Jn0022889	X
7	RT_SW07	Jun 09, 2023		Water	M23-Jn0022890	X
8	PL_SW01	Jun 09, 2023		Water	M23-Jn0022891	X
9	PL_SW02	Jun 09, 2023		Water	M23-Jn0022892	X
10	RT_FD01	Jun 09, 2023		Water	M23-Jn0022893	X
11	RT_FB01	Jun 09, 2023		Water	M23-Jn0022894	X
12	RT_FB02	Jun 09, 2023		Water	M23-Jn0022895	X
13	RT_FB03	Jun 09, 2023		Water	M23-Jn0022896	X

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Company Name: GHD Pty Ltd SA
Address: GPO Box 2052
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SA 5001

Project Name: MFS Adelaide HHERA
Project ID: 12583428

Order No.:
Report #: 997597
Phone: 08 8111 6600
Fax: 08 8111 6699

Received: Jun 9, 2023 3:02 PM
Due: Jun 19, 2023
Priority: 5 Day
Contact Name: Vera Biermann

Eurofins Analytical Services Manager : Amy Meunier

Sample Detail						Per- and Polyfluoroalkyl Substances (PFASs) - Ultra Trace
Melbourne Laboratory - NATA # 1261 Site # 1254						X
14	RT_FB04	Jun 09, 2023		Water	M23-Jn0022897	X
15	RT_FB05	Jun 09, 2023		Water	M23-Jn0022898	X
16	RT_FB06	Jun 09, 2023		Water	M23-Jn0022899	X
17	PL_FB01	Jun 09, 2023		Water	M23-Jn0022900	X
Test Counts						17

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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.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - 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.
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.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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 carboxylic acids (PFCAs) - Ultra Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.05			0.05	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.01			0.01	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.01			0.01	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.01			0.01	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.01			0.01	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.01			0.01	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.01			0.01	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.01			0.01	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.01			0.01	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.01			0.01	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.01			0.01	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.0001			0.0001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Ultra Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.05			0.05	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.05			0.05	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.05			0.05	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	ug/L	< 0.05			0.05	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	ug/L	< 0.05			0.05	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.05			0.05	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.05			0.05	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace							
Perfluorobutanoic acid (PFBA)	%	97			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	82			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	83			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	84			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	88			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	108			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	98			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	93			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	88			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	63			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	87			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace							
Perfluorobutanesulfonic acid (PFBS)	%	75			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	89			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	99			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	91			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	88			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	94			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	95			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	83			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Ultra Trace							
Perfluorooctane sulfonamide (FOSA)	%	77			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	92			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	70			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	%	116			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	%	95			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	98			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	81			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	91			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	%	130			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	97			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	82			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace				Result 1					
Perfluorobutanoic acid (PFBA)	M23-Jn0022894	CP	%	96			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	M23-Jn0022894	CP	%	82			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	M23-Jn0022894	CP	%	80			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	M23-Jn0022894	CP	%	85			50-150	Pass	
Perfluorooctanoic acid (PFOA)	M23-Jn0022894	CP	%	90			50-150	Pass	
Perfluorononanoic acid (PFNA)	M23-Jn0022894	CP	%	113			50-150	Pass	
Perfluorodecanoic acid (PFDA)	M23-Jn0022894	CP	%	93			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	M23-Jn0022894	CP	%	100			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	M23-Jn0022894	CP	%	90			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	M23-Jn0022894	CP	%	58			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M23-Jn0022894	CP	%	100			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)	M23-Jn0022894	CP	%	75			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	M23-Jn0022894	CP	%	89			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	M23-Jn0022894	CP	%	99			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	M23-Jn0022894	CP	%	91			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M23-Jn0022894	CP	%	89			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoroheptanesulfonic acid (PFHpS)	M23-Jn0022894	CP	%	87			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	M23-Jn0022894	CP	%	88			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	M23-Jn0022894	CP	%	84			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances- Ultra Trace				Result 1					
Perfluorooctane sulfonamide (FOSA)	M23-Jn0022894	CP	%	86			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M23-Jn0022894	CP	%	139			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M23-Jn0022894	CP	%	104			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	M23-Jn0022894	CP	%	152			50-150	Fail	Q08
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	M23-Jn0022894	CP	%	123			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	M23-Jn0022894	CP	%	94			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	M23-Jn0022894	CP	%	86			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M23-Jn0022894	CP	%	89			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	M23-Jn0022894	CP	%	94			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M23-Jn0022894	CP	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M23-Jn0022894	CP	%	88			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M23-Jn0022884	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	M23-Jn0022884	CP	ug/L	0.0010	0.0008	26	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Ultra Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	M23-Jn0022884	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	M23-Jn0022884	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M23-Jn0022884	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Ultra Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M23-Jn0022900	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)- Ultra Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	M23-Jn0022900	CP	ug/L	< 0.0001	< 0.0001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Ultra Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	M23-Jn0022900	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Ultra Trace				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	M23-Jn0022900	CP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M23-Jn0022900	CP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M23-Jn0022900	CP	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
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
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).
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Catherine Wilson	Analytical Services Manager
Joseph Edouard	Senior Analyst-PFAS

Glenn Jackson
Managing Director

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.

Appendix H

Photographic log

Appendix H1 – Photographic log – Surface Water Locations

Park 23

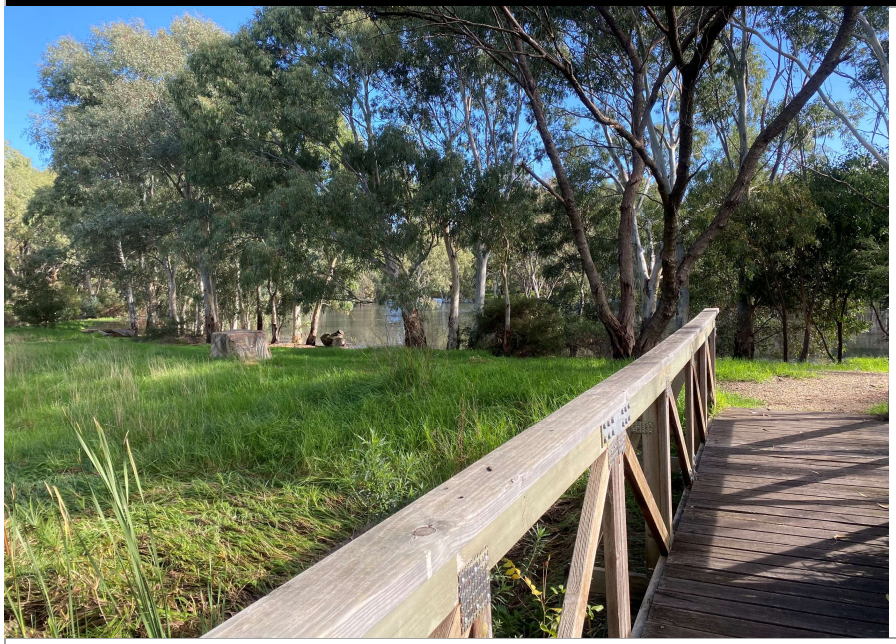


Photo 1 *Bridge access within Park 23* (Wirranendi).

Photo 2 *Vegetation of Park 23* (Wirranendi).

Photo 3 *Wetlands of Park 23* (Wirranendi).

Photo 4 *Sampling location PL_SW01*

Photo 5 *Fencing of creek near sampling location PL_SW02*

Photo 6 *Sampling location PL_SW02*

River Torrens

Photo 7 *Playford Bridge near sampling location RT_SW01.*

Photo 8 *Sampling location RT_SW01.*

Photo 9 *Underneath Playford Bridge, near sampling location RT_ SW01.*

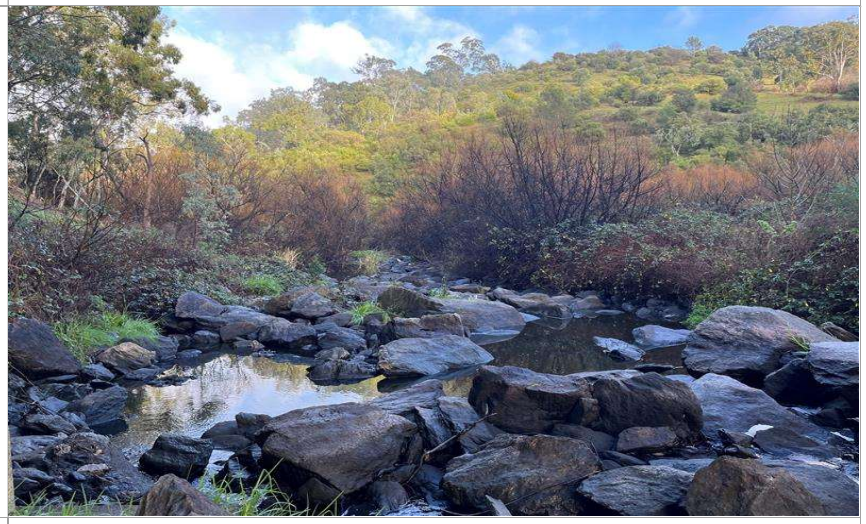


Photo 10 *Upstream of sampling location RT_SW01.*

Photo 11 *Sampling location RT_SW01*

Photo 12 *Track access to sampling location RT_SW02.*

Photo 13 *Entrance to sampling location RT_SW02.*

Photo 14 *Adjacent road to sampling location RT_SW02.*

Photo 15 *Continued track access to location RT_SW02.*

Photo 16 *Sampling location RT_SW02.*

Photo 17 *Flow observed at location RT_SW02.*

Photo 18 *Downstream of sampling location RT_SW02.*

Photo 19 *Sampling location RT_SW03.*

Photo 20 *Flow of water upstream of sample location RT_SW03.*

Photo 21 *Sampling location RT_SW04.*

Photo 22 *Sampling location RT_SW04 showing stormwater outlet.*

Photo 23 *Sampling location RT_SW05 near University Footbridge.*

Photo 24 *Downstream viewpoint of sampling location RT_SW05.*

Photo 25 *Upstream viewpoint of sampling location RT_SW05.*

Photo 26 *Sampling location RT_SW05.*

Photo 27 Wooden planks providing access to sampling location RT_SW06 in Torrens Lake.

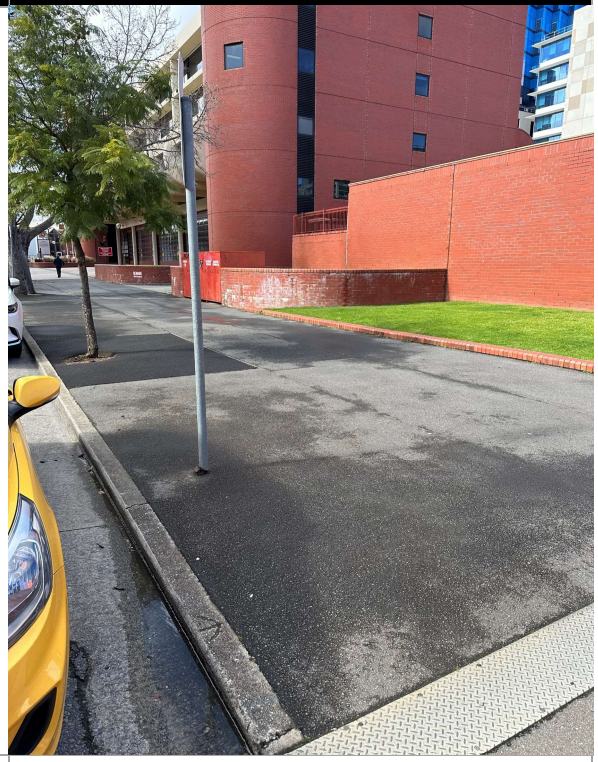
Photo 28 Torrens Lake.

Photo 29 Sampling location RT_SW06 in Torrens Lake behind rail yard, convention centre and Royal Adelaide Hospital.

Photo 30 Downstream of sampling location RT_SW07.

Photo 31 *Upstream of sampling location RT_SW07.*

Appendix H2 – Photographic Log – Stormwater Locations

Park 23		
		
Photo 1 Drainage from site directly to stormwater drain where sample SW_Discharge 1 was collected.	*Photo 2 Stormwater flowing east down Wakefield Street from the site.*	*Photo 3 Looking west from sample location SW_Discharge 1 along Wakefield Street.*

Park 23		

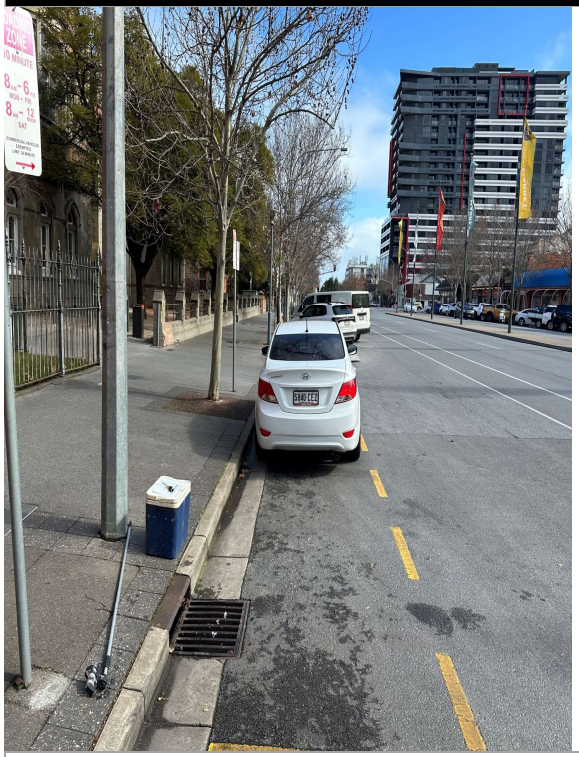



Photo 4 Sample location SW_Discharge 2 looking east along Wakefield Street.	*Photo 5 Sample location SW_Discharge 3 looking west along Wakefield Street.*	*Photo 6 Sample location SW_Discharge 3 on Grote Street east of Adelaide Central Markets. Sample location is approximately halfway between site and Park 23.*

Appendix I

Groundwater bores (WaterConnect SA)

Registered bores

Unit_No	Location	Current Land Use	Well type	Aquifer	Original drilled date	Max. drill depth	Cased to	Case min. diameter	Standing water level (SWL)	Water level date	Total Dissolved Salinity (TDS)	Electrical Conductivity (EC)	Salinity date	MGA Easting	MGA Northing	MGA Zone
6628-27036	Convention Centre (festival dr)	Commercial	WW	Qpah	1/08/2013	5	1.8	150	2.7	1/08/2013				280293.14	6133148.85	54
6628-27474	Convention Centre	Commercial	WW	Qpah		5	1.8	150	2.7	6/08/2013				280340.88	6133144.56	54
6628-27479	Convention Centre	Commercial	WW			5								280301.57	6133140.51	54
6628-27482	Convention Centre	Commercial	WW	Qpah		5	1.8	150	2.7	8/08/2013				280278.22	6133138.51	54
6628-22752	Convention Centre (festival dr)	Commercial	WW		29/01/2007	7.1	3.5	80	4.5	29/01/2007				280283.92	6133182.71	54
6628-25770	South Australian Health and Medical Research Institute (SAHMRI) (George st)	Commercial	WW		19/06/2009	10.5								279885.22	6133042.92	54
6628-233	Offices (Grenfell St)	Commercial	WW			17.07								280817.29	6132743.67	54
6628-25771	SAHMRI (George st)	Commercial	WW		23/06/2009	17.5	14	50	15.5	23/06/2009				279828.37	6133011.8	54
6628-494	Myer Centre	Commercial	WW			18.29								280802.38	6132888.82	54
6628-23716	Apartment block (Franklin st)	Residential	WW	Qpah	27/03/2008	19.5	16.5	50	18	27/03/2008				280081.25	6132399.99	54
6628-23718	Ranelagh Alley	Commercial	WW	Qpah	23/03/2008	20	14	50	18	23/03/2008				280124.13	6132464.29	54
6628-25945	SAHMRI (Nth terrace)	Commercial	WW		29/07/2009	20	16	50	17.5	29/07/2009				279872.99	6132981.35	54
6628-28244	Student accomodation (Crowther st)	Residential	WW			20								279950.53	6132445.46	54
6628-26134	Law Office (Paul Kelly Ln)	Commercial	WW		22/01/2011	21.2								280886.7	6132460.41	54
6628-613	Offices (Gawler Pl)	Commercial	WW		1/01/1908	21.34								280943.31	6132550.79	54
6628-29197	Carpark (Roger st)	Commercial	WW		8/11/2017	22	16	50	18	8/11/2017				281205.49	6132374.93	54
6628-608	Offices (Grenfell St)	Commercial	WW	Qpah		22.25			17.98					280935.33	6132757.82	54
6628-21953	ANZ King william st	Commercial	WW		24/12/2004	22.4		90						280696.31	6132520.22	54
6628-21954	Back of GPO (Advertise Ln)	Commercial	WW		23/12/2004	22.7		90						280669	6132496.7	54
6628-300	Central Markets	Commercial	WW	Qpah	3/10/1934	23.09					1014	1837	6/06/2006	280578.35	6132129.69	54
6628-28245	Student accomodation (Crowther st)	Residential	WW			24								279944.69	6132444.76	54
6628-22020	Adelaide City Parcel Lockers	Commercial	WW		23/02/2005	24.9	15.7	52						280609.24	6132449.65	54
6628-28445	Apartment block (Rundle mall)	Residential	WW	Qpah	23/08/2016	25	15	50	16	23/08/2016				281203.17	6133002.54	54
6628-28631	Vacant block (Waymouth st)	Commercial	WW		7/12/2016	25								281250.3	6132320.84	54
6628-21955	Back of GPO (Advertise Ln)	Commercial	WW		23/12/2004	26.55		90						280647.15	6132523.15	54
6628-515	Convention Centre	Commercial	WW		7/10/1926	29.57								280274.25	6133128.64	54
6628-80	Offices (Pulteney St)	Commercial	WW			29.87								281248.34	6132967.77	54
6628-226	Currie St Garage	Commercial	WW		1/02/1915	30.48			3.66	3/03/1915				279740.45	6132699.79	54
6628-82	Café (Rundle Mall)	Commercial	WW	Toc(T2)	1/01/1915	31.7			31.09	1/01/1915				281100.35	6132909.73	54
6628-495	Offices (King William st)	Commercial	WW			33.53								280688.33	6132909.83	54
6628-28160	Adelaide Festival Centre	Commercial	WW		16/02/2016	35	4.5	50						280633.86	6133225.41	54
6628-413	Path (along River Torrens)	Recreation	WP								285	518	4/11/1949	280553.2	6133397.73	54
6628-440	Parliament House (North terrace)	Commercial	WP								1242	2247	16/10/1939	280659.46	6133057.76	54
6628-514	Convention Centre	Commercial	WW		1/01/1912									280206.17	6133138.77	54
6628-527	Adelaide Festival Centre	Commercial	WW											280595.3	6133273.88	54
6628-529	Adelaide Festival Centre	Commercial	WW											280630.34	6133253.74	54
6628-530	Adelaide Festival Centre	Commercial	WW											280586.31	6133225.93	54
6628-531	Adelaide Festival Centre	Commercial	WW											280531.24	6133211.96	54
6628-532	Adelaide Festival Centre	Commercial	WW											280451.35	6133188.73	54
6628-533	Adelaide Festival Centre	Commercial	WW											280629.39	6133209.65	54
6628-535	Restaurant (King William st)	Commercial	WW											280578.23	6133139.72	54
6628-536	Parliament House (North terrace)	Commercial	WW											280581.76	6133038.47	54

Note: Highlighted registered bores were considered during the current investigation. No abstraction bores were identified for beneficial use.

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The Power of Commitment