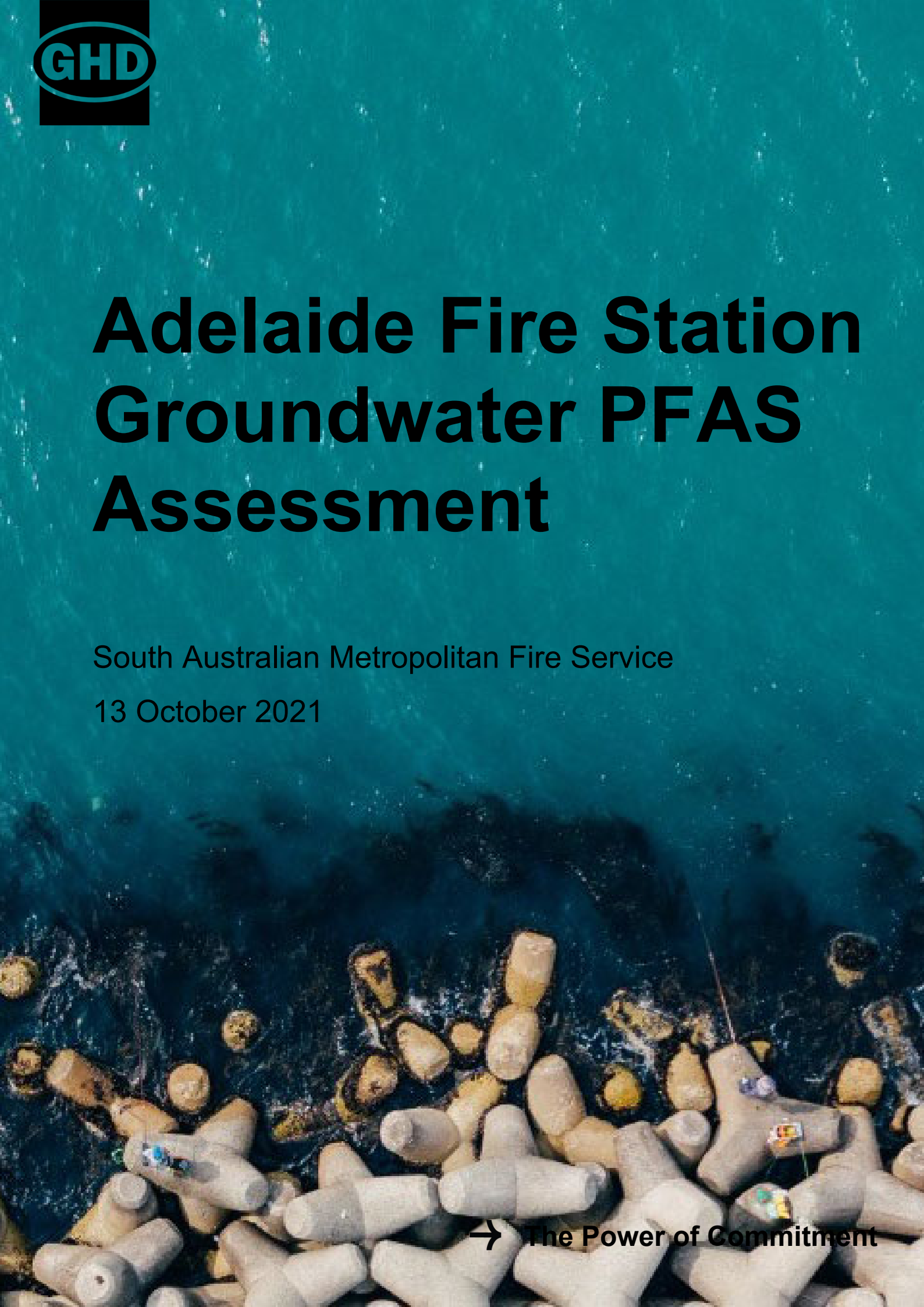
Adelaide Fire Station Groundwater PFAS Assessment

South Australian Metropolitan Fire Service

13 October 2021



The Power of Commitment

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Executive summary

The South Australian Metropolitan Fire Service (MFS) engaged GHD Pty Ltd (GHD) to undertake an environmental investigation at the Adelaide Fire Station (the site) to determine if per- and poly-fluoroalkyl substances (PFAS) associated with historical site activities were present in groundwater beneath the site. This report documents the scope of work, methodology and findings of a groundwater monitoring event (GME) carried out by GHD on 20 July 2021.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.3.

The objective of this groundwater investigation was to determine the on-site presence, nature and extent of groundwater PFAS impacts associated with historical MFS site activities at the Adelaide Fire Station.

The scope of the GME included the following:

- Preparation of a project-specific Job Safety and Environmental Analysis (JSEA) for the site works in accordance with Work Health and Safety (WHS) legislation and associated Codes of Practice.
- Gauging and sampling of six existing groundwater monitoring wells (GW101 – GW106), using no flow sampling techniques with high density polyethylene Hydrasleeve^{TM} samplers.
- Laboratory analysis of primary groundwater samples and quality control samples for PFAS short suite.
- Review of the results of previous 2016-2017 investigations undertaken by GHD.

Based on the findings of 2016-2017 limited soil, drains sediment and surface water investigations, the following conclusions have been made:

- The primary source of AFFF contamination no longer exists, however secondary sources of AFFF contamination remain and include contaminated soil, surface water and groundwater.
- The soil dry weight and leachate results reported elevated PFAS concentrations exceeding the nominated ecological and human health criteria and continue to represent an ongoing source of PFAS. The soil PFAS impacts have not been vertically or laterally delineated onsite.
- The concrete walls of the dam are likely to be contributing dissolved PFAS concentrations to the retained water.
- The surface water and sediments provide a direct exposure mechanism to human and the environment and an immediate potential source for groundwater contamination.

Based on the findings of this investigation, the following conclusions have been made:

- The standing water levels recorded during the July 2021 investigation ranged from 11.528 m below the top of casing (mTOC, GW102) to 13.168 mTOC (GW104). Groundwater elevations across the assessment area ranged between 33.813 m Australian Height Datum (mAHD, GW105) and 34.128 mAHD (GW102).
- The groundwater was inferred to flow in a north-westerly direction towards the River Torrens.
- The results suggest that the historical use of PFAS foam at the site is contributing PFAS to groundwater, Elevated PFAS concentrations were reported for groundwater in all six on-site monitoring wells, with four wells exceeding the adopted the NEMP Health Drinking Water criteria.
- PFAS concentrations at GW101 and GW103 were one to three orders of magnitude higher than in the other wells and also exceeded the adopted health drinking water criterion for PFOA, the recreational criteria for PFHxS, PFOS and the Sum of PFHxS and PFOS and the ecological freshwater (95% species protection level) criterion for PFOS.
- The elevated PFAS concentrations at GW101 were consistent with the historical use of PFAS containing foam in firefighting training at the nearby washbay. The elevated PFAS concentrations at GW103 were consistent with a south-north flowing drain historically receiving runoff from the flushing of firefighting foam from hoses and pumps after their use at fire incidents.
- Given the inferred groundwater flow direction to the north-west, the reported PFAS concentrations at up-hydraulic gradient wells GW104 and GW106 could either represent impact from site activities or regional background PFAS concentrations in groundwater. .

- PFAS impacts in groundwater beneath the site associated with historical site activities have been practically delineated to the south and west by wells GW102 and GW105. The extent of PFAS concentrations in groundwater to the north, north-west down the inferred hydraulic gradient and east remains undelineated.
- The reported PFAS concentrations in groundwater beneath the site constitute harm to groundwater that is not trivial. A Section 83A notification was submitted in accordance with the South Australian Environment Protection Act 1993 (Gov SA 1993) to the SA Environment Protection Authority via email on 30 July 2021 (Appendix G).
- The CSM indicates that the use of groundwater for domestic irrigation and / or drinking purposes is unlikely in the vicinity of the Adelaide Fire Station. However, given that some domestic and irrigation bores were located within a 2 km radius of the site and TDS of 56 bores were below 1,200 mg/L, potable and irrigation use of groundwater cannot be ruled out.
- It is considered that the impacted groundwater is likely to eventually reach the River Torrens at concentrations above the adopted Tier 1 ecological assessment criteria for freshwater.

Based on the results of this investigation and the CSM data gaps, it is recommended that further investigations are undertaken to assess the extent of the PFAS contamination associated with the site.

Table of Abbreviations

Abbreviation	Full form
AFFF	Aqueous Film-Forming Foam
AHD	Australian Height Datum
ASC NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999*
ASLP	Australian Standard Leaching Procedure
COC	Chain of custody
CSM	Conceptual site model
DEW	South Australian Department for Environment and Water
DO	Dissolved Oxygen
DQOs	Data quality objectives
EC	Electrical conductivity
GAR	South Australian *Guidelines for the Assessment and Remediation of Site Contamination 2019*
GHD	GHD Pty Ltd
GME	Groundwater monitoring event
HEPA	Heads of Environment Protection Authorities Australia
IP	Oil/water interface probe
JSEA	Job safety and environment analysis
LOR	Limit of reporting
m bgl	metres below ground level
MFS	South Australian Metropolitan Fire Service
mg/L	milligrams / Litre
mTOC	metres below top of casing
mV	millivolt
NATA	National Association of Testing Authorities
NEMP	PFAS National Environmental Management Plan 2018
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
ORP	Oxidation Reduction Potential
PFAS	Per- and poly-fluoroalkyl substances
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
QA/QC	Quality assurance and quality control
SA EPA	South Australian Environment Protection Authority
SARIG	South Australian Resources Information Gateway
SFOP	Standard Field Operating Procedures
SHE	Standard hydrogen electrode
SWL	Standing water level
TDS	Total dissolved solids
TOC	Top of casing
WHS	Work Health and Safety
WQEPP	South Australian *Environmental Protection (Water Quality) Policy* 2015
µg/L	micrograms / Litre
µS/cm	microSiemens / centimetre

Contents

Table index (in text)

Table index (attached)

Figure index (attached)

Appendices

1. Introduction

The South Australian Metropolitan Fire Service (MFS) engaged GHD Pty Ltd (GHD) to undertake an environmental investigation at the Adelaide Fire Station (the site) to determine if per- and poly-fluoroalkyl substances (PFAS) associated with historical use of Aqueous Film-Forming Foam (AFFF) were present in groundwater beneath the site. This report documents the scope of work, methodology and findings of a groundwater monitoring event (GME) carried out by GHD on 20 July 2021.

This GME report follows previous environmental investigations undertaken by GHD between 2016 and 2017 including desktop site history investigation and limited soil, drain sediment and on-site water dam sampling and PFAS testing. This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.3.

1.1 Background

Historically the MFS used firefighting foam containing PFAS at the Adelaide Fire Station during firefighting training exercises and testing of delivery systems on firefighting appliances. Flushing of hoses and pumps after training exercises and incidents may have contributed to the transfer of PFAS into drains. GHD understands that foam containing PFAS has not been used at Adelaide Fire Station since 2016.

1.2 Objectives

The objective of this groundwater investigation was to assess the on-site presence, nature and extent of groundwater PFAS impacts associated with historical MFS site activities at the Adelaide Fire Station.

1.3 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 the South Australian Metropolitan Fire Service.*

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.

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

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

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

2. Site Information

2.1 Site Identification

Site information details are presented in Table 2.1 below. A site location plan is provided as Figure 1.

Table 2.1 Summary of general site identification information

Site Name:	Adelaide Fire Station
Site Address:	99 Wakefield Street, Adelaide, SA 5000
Certificate of Title:	CT6181/979, CT5943/887, CT5782/242, CT5943/888 CT5346/689, CT5761/799, CT5761/798
DP and Lot:	D112387AL80, F181546AL704, F181547AL705, F181532AL690, F16490AL7, F181510AL668, F181501AL659
Current Zoning	Capital City, City of Adelaide (mixed use of light industrial, commercial and residential)
Property Owner:	South Australian Metropolitan Fire Service
Current Site Use:	Operational Fire Station
Area:	9,900 m^2
Site Elevation	46 mAHD

The above information was obtained from the South Australia Property and Planning Atlas (SAPPA) current database.

2.2 Site Description

A site inspection undertaken by GHD on 20 July 2021. Key site features are outlined on Figure 2. A summary of the findings is provided below. The site is roughly a “L” shape, with the northern boundary facing Wakefield Street and the western portion extending through Angas Street. The Adelaide Fire Station includes the following key infrastructure:

- Main Building located north-east portion of the site.
- No. 2 Engine Room located in the central portion of the site.
- Washdown bay used for firetrucks with the drain connected to the oily waste separator adjacent to the wash bay in the bin compound.
- Three underground fuel tanks located to the north of the washdown bay.
- Special Operations building located in the north-west corner of the site.
- Training tower located south of Special Operations building.
- Comms Techs building located in the western portion of the site.
- Logistics Building located in the southern portion of the site.
- Chemical storage shed located north of the Logistics Building, along the western boundary wall.

2.3 Topography and Hydrology

Based on the surrounding topography sloping down to the west, captured surface water and/or stormwater on site flows to the west.

Surface water infrastructure on-site included the following:

- Concrete drain located between Main Building and the washdown bay running east-west towards Wakefield Street.
- East of Special Operations and Training Tower running north-south, connecting with the central drain, and leading out to Wakefield Street to the north.

– Two drain inlet between Special Operations and Training Tower, to receive runoff from Training Tower.
– Underground stormwater tank located on the northern boundary adjacent Wakefield Street.
– Underground sewer tank that receives subsoil collected in the basement ejector pits.

In addition, there are basement ejector pits for subsoil and building stormwater, located in the centre of basement carpark and south-eastern area of the carpark.

2.4 Surrounding Land Use

A summary of the current surrounding land uses / zoning information for the site is summarised in Table 2.2.

Table 2.2 Summary of surrounding land use / zoning

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 a dance studio and Torrens University. Hindmarsh Square is located approximately 500 m to the north of the site. The River Torrens (Karrawirra Parri) located approximately 1.3 km 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 875 m to the east and south of Pulteney Street. Victoria Park is located 1 km to the east of site.
South	The South Australian Police (SAPOL) Headquarters are located on Angas Street, immediately adjacent to the southern boundary of the site. The Calvary Adelaide Hospital borders the eastern boundary of the SAPOL Headquarters, and SW boundary of the Adelaide 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 beyond Chancery Lane, approximately 120 m west of the site. The City Park of Victoria Square (Tarntanyanga) is further afield, located approximately 500 m west of the Fire Station. Park 23 drain creek is located within the Parklands approximately 1.3 km west of the site.

Historically, a Mitsubishi service centre occupied the site of the SAPOL Headquarters and the Calvary Adelaide Hospital.

2.5 Regional Geology

A desktop search using the South Australian Resources Information Gateway (SARIG) map layers catalogue (1:100,000 Surface Geology Map: Adelaide update 2013) indicated that the regional surface geology is characterised by Pleistocene alluvial/fluvial sediments of the Keswick Clay formation consisting of smectite-rich, grey-green clays, with red or yellow mottling and rare sand lenses.

2.6 Regional Hydrogeology

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 mainly of thin layers of fine sand with low yield. Most of the Quaternary and Tertiary aquifers become 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 reported shallow groundwater in the area to range from 5 m below ground level (bgl) to 10 m bgl. Salinity in the area is reported to range from 1,500 mg/L to 3,000 mg/L total dissolved solids (TDS) indicating fresh to brackish water with a reported yield of 0.5 litres/second to 2.5 litres/second.

2.7 Registered Bore Survey

The WaterConnect (DEW 2021) was used in August 2021 to conduct a search of registered bores located within a 2 km radius of the site.

A total of 1,003 registered bores were recorded within 2.0 km of the survey area. Of these:

- 429 were identified as investigation bores
- 106 were identified as monitoring bores
- 96 were identified as drainage bores
- 56 were identified as observation bores
- 15 were identified as domestic bores
- 12 were identified as environmental bores
- five were identified as irrigation bores
- four were identified as recreational bores
- four were identified as town water supply bores
- two were identified as managed aquifer recharge bores
- one was identified as exploration bores
- one was identified as recharge bores.

Usage information was not registered for 272 bores.

TDS data was available for 208 bores within a 2 km radius. Of these bores, 56 reported TDS values below 1,200 mg/L. The lowest TDS value of 171 mg/L was reported for well number 6628-329, located approximately 420 m south-west of the site.

The closest registered extractive bores were:

- Well number (6628-31358) monitoring bore, approximately 30 m to the north-west of the site
- Well number (6628-31356) monitoring bore, approximately 100 m to the south-west of the site
- Well number (6628-31357) monitoring bore, approximately 40 m to the west of the site
- Well number (6628-31077) investigation bore, approximately 200 m to the east of the site
- Well number (6628-20252) monitoring bore, approximately 200 m to the north-east of the site.

A plan showing the registered bores within a 2 km radius of the site and the corresponding WaterConnect Groundwater Data Report are presented in Appendix AA0.

2.8 Previous investigations

The results of the previous environmental investigations undertaken by GHD between 2016 and 2017 were documented in the following reports:

- GHD (2017a), South Australian Metropolitan Fire Service, Preliminary Site Investigation (PSI), 99 Wakefield Street Adelaide, Investigation of PFAS, January 2017, Job 3318366, Document 30740.
- GHD (2017b), South Australian Metropolitan Fire Service, PFAS Investigation (for 5 MFS sites: Angle Park, Wakefield Street, Royal SA Yacht Squadron, Port Augusta and Whyalla stations), June 2017, Job 3318366, Document 54735.
- GHD (2017c), South Australian Metropolitan Fire Service, PFAS Investigation – Additional Testing Wakefield Street Fire Station, December 2017. Job number 3318366, Document 62221.

Previous soil and sediment analytical results of the above investigations are summarised in Table 5 and soil ASLP Leachate results in Table 6. The historical results for the surface water collected from site drains and dams are summarised in Table 7.

2.8.1 GHD (2017a) PSI

The PSI scope included desktop review of current and historical information to assess potential areas of on-site PFAS contamination and the following targeted sampling and testing in October 2016:

- three subsurface soil samples BH1-BH3 collected below the bricked surface at approximately 0.08 – 0.38 m below ground level (bgl), adjacent to surface water inlets to assess surface water runoff impact to the soil: east of the chemical storage shed, south of Special Operations building and within the washdown bay, respectively
- two drain sediment samples: SED1 collected from the drain inlet of BH2 and SED2 collected from the washdown bay drain
- two surface water samples: SW01 collected from the surface water inlet east of the chemical storage shed and SW02 collected from the washdown bay drain.

The findings of the PSI are summarised as follows:

- Several potential sources of PFAS were identified:
    - The washdown bay for washing of vehicles and hoses, drainage associated with the training using AFFF at the fire station until 2007.
    - The training tower in the north-west corner of the site with random discharge of foam for historical training in this area.
    - Chemical storage shed located in the southern portion of the site with the storage of AFFF up to 2014.
- PFAS contamination was identified in all samples of soils, sediment and surface water collected and tested as part of the PSI.
- The assessment criteria used in 2017 PSI was the WA Government, Department of Environmental Regulation (WA, DER 2016) Interim Guideline on the Assessment and Management of PFAS. However, this guidance was superseded by the NEMP 2020 and NHMRC, 2019 guidelines (outlined in Section 5 and Table 5.2), which is adopted by GHD for 2017 PFAS result comparison.
- The subsurface soil results (Table 5) reported elevated PFAS concentrations exceeding either the NEMP 2020 ecological direct and/or indirect exposure criteria for PFOS in sample BH2_0.08-0.18 located adjacent to the surface water inlet running off from training tower. The soil PFAS impacts have not been vertically or laterally delineated.
- The soil leachate results (Table 6) in one soil sample analysed (BH1_0.08-0.18) reported high leachable concentrations of PFOS (1.98 µg/L) above the NEMP 2020 freshwater criteria for 95 % species protection - slightly to moderately modified ecosystems (PFOS),and for sum of PFOS and PFHxS (2.16 µg/L) exceeding the NEMP 2020 criteria for drinking water (0.07 µg/L) and NHMRC 2019 Recreational Water PFAS Guidelines (2 µg/L sum of PFOS and PFHxS).

- The surface water PFAS concentrations (sum of PFOS and PFHxS 25.4 µg/L in SW01 and 6.12 µg/L in SW02) exceeded the adopted NEMP 2020 human health criteria for drinking water and NHMRC 2019 Recreational Water (2 µg/L), indicating that water may present an unacceptable risk to human health and to ecological receptors.

Based on the above findings GHD (2017a) recommended the following:

- Conduct an inventory of the site to confirm the absence of any AFFF product.
- Conduct tests of fire truck tank water to assess whether residual AFFF resides in the trucks.
- Conduct further assessment of the nature and extent of groundwater contamination at the fire station through the installation of groundwater monitoring wells.
- Investigation of potential off-site surface water and groundwater contamination and potential risk to the identified receptors.

2.8.2 GHD (2017b) PFAS Investigations

GHD (2017b) investigations completed in May-June 2017 included the following sampling:

- Sediment sampled from wastewater drains: SED1 from the training tower stormwater drain inlet and SED2 from the washdown bay drain inlet.
- Surface water sampled from the water storage dam: from surface of dam (DAM_S) and from bottom of dam (DAM_B).

The results are summarised as follows:

- The drain sediment samples PFOS concentration exceeded the adopted NEMP 2020 ecological indirect exposure criteria for PFOS.
- The dam water samples sum of PFOS and PFHxS concentrations (2.63 - 2.83 µg/L) exceeded the adopted NEMP 2020 human health criteria for human health criteria for drinking water (0.07 µg/L) and the Recreational Water criteria (2 µg/L), as well as freshwater (95 % species protection - slightly to moderately modified ecosystems) criteria (0.13 µg/L for PFOS), indicating that water is likely to present an unacceptable risk to human health and to ecological receptors.

GHD (2017b) concluded that the dam water and sediments provide a direct exposure mechanism to human and terrestrial biota and an immediate potential source for groundwater contamination.

2.8.3 GHD (2017c) PFAS Investigations

GHD (2017c) investigations completed in September and October 2017 included the following sampling:

- Sediment sample collected from an on-site drain south of Training Tower: DRAIN_S.
- Water samples collected from the on-site dam after flushing / cleaning of the dam: shallow water sample (DAM_S) and the deeper bottom water sample (DAM_B), to assess whether cleaning of the dam had made any significant impact to the level of PFAS.

The results are summarised as follows:

- The drain sediment sample PFOS concentration exceeded the adopted NEMP 2020 ecological indirect exposure criteria for PFOS.
- The dam water samples PFAS concentrations (sum of PFOS and PFHxS) ranged from 1.56 and 1.94 µg/L exceeding the adopted NEMP 2020 human health criteria for drinking water (0.07 µg/L) and human health criteria for freshwater (95 % species protection - slightly to moderately modified ecosystems - 0.13 µg/L for PFOS), indicating that water may present an unacceptable risk to human health and to ecological receptors.
- In October sampling round after the cleaning of the dams water samples PFAS results were lower than before the cleaning and below the Recreational Water criteria (2 µg/L sum of PFOS and PFHxS), while before the cleaning (May and September 2017 sampling rounds) this criterion was exceeded (max of 3.85 µg/L).

It was concluded that the unsealed concrete walls of the dam were acting as an ongoing source of PFAS to the retained water. The TOPA PFAS results indicated an increasing trend of Sum of PFHxS and PFOS in shallow

water samples, indicating the presence of compounds which represent the potential for ongoing PFAS contamination.

3. Scope of Work

The following scope of the GME was completed by GHD:

– Preparation of a project-specific Job Safety and Environmental Analysis (JSEA) for the site works in accordance with Work Health and Safety (WHS) legislation and associated Codes of Practice.
– Gauging and sampling of six existing groundwater monitoring wells (GW101 – GW106, using no flow sampling techniques with high density polyethylene Hydrasleeve™ samplers.
– Laboratory analysis of primary groundwater samples and quality control samples for PFAS short suite.
– Production of a groundwater investigation report.

The locations description of groundwater wells is presented in Table 3.1 and well locations are shown in Figure 2.

Table 3.1 Groundwater Monitoring Wells Location and Relevance to Historical Activities Involving PFAS

Well ID	Location	Relevance to historical activities involving PFAS
GW101	Centre of the site near the washbay	Location most likely to be impacted by PFAS as the majority of foam training took place in the washbay to the east of GW101, with firefighting foam often washing out onto the paved area outside the washbay. Foam training has not occurred in the washbay for approximately 20 years.
GW102	South-west corner of the site in a carpark/garden area	Determine the extent of potential groundwater contamination within the site boundary. Determine the direction of groundwater flow across the site.
GW103	North-western site boundary in a paved area near the end of a drain running south to north	Location likely to be impacted by PFAS as the historical flushing of hoses / pumps after their use at incidents often resulted in foam being washed into the south-north travelling drain. Determine the direction of groundwater flow across the site to confirm that this location is downgradient of the main areas where PFAS containing foam was historically used.
GW104	Eastern site boundary in a carpark	Determine the extent of potential groundwater contamination within the site boundary. Determine the direction of groundwater flow across the site.
GW105	Western site boundary outside the electronics area	Determine the extent of potential groundwater contamination within the site boundary. Determine the direction of groundwater flow across the site as the site slopes from the potential source areas in the centre of the site towards the west.
GW106	Southern site boundary (just north of the Calvary Adelaide Hospital)	Determine the extent of potential groundwater contamination within the site boundary. Determine the direction of groundwater flow across the site to confirm that this location is upgradient of the main areas where PFAS containing foam was historically used. Foam has not been used in the vicinity of this well.

4. Methodology

4.1 Relevant Guidance

All field works were conducted by appropriately qualified and trained GHD environmental scientists, in accordance with GHD's Standard Field Operating Procedures (SFOP) and the following guidelines:

- National Environment Protection (Assessment of Site Contamination) Measure (1999) as amended 2013 (ASC NEPM).
- HEPA, 2020, PFAS National Environmental Management Plan (Version 2.0), Heads of Environment Protection Authorities Australia and New Zealand, January 2020, (PFAS NEMP)
- Australian/New Zealand Standard (1998) Water Quality – Sampling Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples. AS/NZS 5667.1:1998.
- Australian/New Zealand Standard (1998) Water Quality – Sampling Guidance on Sampling of Groundwaters. AS/NZS 5667.11:1998.
- EPA Victoria (2000) Groundwater Sampling Guidelines.
- SA EPA (2019b) Guidelines for Regulatory Monitoring and Testing – Groundwater Sampling.
- Hydrasleeve 2016, Standard Operating Procedure: Sampling Groundwater with a Hydrasleeve
- WA DER (2017) Interim Guideline of Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Version 2.1, Contaminated Sites Guidelines, Department of Environment Regulation, Western Australia, Perth, January 2017

4.2 Work Health and Safety

GHD prepared a project-specific Job Safety and Environmental Analysis (JSEA) for the site works in accordance with Work Health and Safety (WHS) legislation and associated Codes of Practice. The JSEA consisted of a summary of relevant site activities and specific job-related tasks; a hazard register that identifies all foreseeable hazards; risk ranking and risk management measures for each identified hazard; and procedures for monitoring and/or implementing remedial actions to manage all project-based risks. Prior to undertaking the fieldworks, the GHD field representatives held a pre-start meeting on site and completed a Pre-Work Assessment.

4.3 Groundwater Well Sampling Methodology

Groundwater sampling was undertaken on 20 July 2021. The groundwater sampling methodology is summarised in Table 4.1.

Table 4.1 Groundwater Monitoring and Sampling Methodology

Activity	Details
Well Gauging	Prior to sampling each well, the standing water level (SWL) and bore depth were gauged and recorded using a calibrated oil / water Interface Probe (IP). The measurements were taken from the top of the bore casing (TOC). SWL and bore depths were recorded on a gauging sheet presented in Appendix B. Equipment calibration certificates are presented in Appendix C.
Sampling	Sampling was conducted using a no-purge method via high density polyethylene HydraSleeve™ samplers dedicated for each well. The sampler was slowly lowered into the screened section of the well to minimise disturbance and then drawn up to open the valve. When the sampler was full it was slowly raised to ensure the valve was closed. Samples were obtained directly from the sampler sleeve into laboratory supplied bottles. The bottles were appropriately labelled with a unique GHD job number, sample identification and sampling date. All samples were collected in laboratory supplied containers suitable for PFAS. Water quality parameters (pH, dissolved oxygen, electrical conductivity, reduction/oxidation (redox) potential and temperature) were recorded via downhole readings after sampling using a multi parameter water meter. The groundwater was visually assessed for turbidity and evidence

Activity	Details
	of contamination, such as odour or visible sheen, foaming or discolouration. These parameters were recorded on field sheets provided in Appendix B.
Sampling preservation and transport	Post collection, samples were immediately stored in an insulated cooler prior to and during delivery to the laboratory. All samples were transported to the laboratory by GHD Field Staff under Chain of Custody (COC) documentation. COC documentation is presented in Appendix D
Decontamination	Decontamination of all non-disposable equipment (IP and multi parameter water quality meter) was undertaken through a three-stage approach. The first stage involved cleaning the equipment using a mixture of pH neutral phosphate and PFAS free detergent (Liquinox) in water, followed by washing with tap water and a final rinse stage with deionised water. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross contamination.
QA/QC	Quality control samples were collected at a minimum rate of one replicate pair per 10 primary samples. The replicate pair included one intra-laboratory sample and one inter-laboratory sample. Rinsate samples were collected from reusable equipment (IP) at a rate of one (1) per day sampling was conducted to assess the potential for cross contamination to occur from reusable sampling equipment.

4.4 Laboratory Analysis Program

4.4.1 Analytical Laboratories

GHD consigned all primary groundwater, rinsate, field blank and intra-laboratory field duplicate (blind) samples to Envirolab Group for analysis. The analysis of the inter-laboratory duplicate (split) sample, for quality control (QC) purposes, was undertaken by ALS Environmental. Both laboratories are accredited by the National Association of Testing Authorities (NATA).

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

4.4.2 Sample Analysis

Groundwater samples collected as part of this environmental investigation were analysed for PFAS (Short Suite).

Table 4.2 summarises the sampling and analysis undertaken for groundwater samples.

Table 4.2 Laboratory Analytical Schedule

Sample type	No. primary samples		No. QA duplicate samples		No. rinsate samples		Analytical suite
	Collected	Analysed	Collected	Analysed	Collected	Analysed	
Groundwater	6	6	2	2	1	1	PFAS – Short Suite

5. Assessment Criteria

PFAS was the key contaminant of enquiry in this environmental investigation. As such, the assessment criteria for this investigation were adopted from the following guideline documents:

- HEPA, 2020, PFAS National Environmental Management Plan (Version 2.0), Heads of Environment Protection Authorities Australia and New Zealand, January 2020, (PFAS NEMP)
- NHMRC, 2019, Guidance on Per and Polyfluoroalkyl (PFAS) in Recreational Water, National Health and Medical Research Council, Canberra 2019
- NHMRC/NRMMC, 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).

The assessment was also undertaken in general accordance with the following guidelines and policy:

- ANZG, 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, online resource www.waterquality.gov.au/anz-guidelines, Australian and New Zealand Governments, updated 26 July 2021, (AWQG)
- Gov SA, 2015, Environment Protection (Water Quality) Policy (WQEPP) 2015, Version 1.7.2020, Government of South Australia, updated 2020
- SA EPA, 2019a, Guidelines for the Assessment and Remediation (GAR) of Site Contamination, Environment Protection Authority, South Australia, November 2019
- SA EPA, 2019b, Guidelines for regulatory monitoring and testing – Groundwater sampling Environment Protection Authority, South Australia, revised 2019.

To assess the contamination status of groundwater at a site, the GAR (SA EPA 2019a) provides a four-step process to determine the environmental values of groundwater and to determine if actual or potential harm to groundwater that is not trivial has occurred. The four-step process described in the Guideline on the assessment and remediation of site contamination is described in Table 5.1.**Error! Reference source not found.**

Table 5.1 Four-step process for determining harm to groundwater

Process	Assessment
Step 1: Apply Table 3 of WQEPP 2015 Schedule 1 based on TDS ranges	Calculated TDS results for groundwater samples collected in July 2021 ranged between 6,269 mg/L and 8,903 mg/L, indicating saline groundwater beneath the site that is suitable for use by primary industries for livestock watering and aquaculture for human consumption, but not suitable for recreation, potable use or irrigation of crops (SA EPA 2019a). The groundwater data in the WaterConnect data base (Step 3) indicates that out of 228 bores with available TDS data, 56 bores reported TDS values below 1,200 mg/L.
Step 2: Assess and identify surface water bodies within a 2 km buffer of the site	The stormwater network discharges into the River Torrens (Karrawirra Parri) and the west parklands Park 23 creek, which are the closest water bodies located approximately 1.3 km to the north and the west of the Adelaide Fire Station (respectively)
Step 3: Review registered groundwater users in the WaterConnect database	The registered bore search identified 1,003 registered bores within a 2 km radius of the site. The registered bores consisted of 429 investigation, 106 monitoring, 96 drainage, 56 observation, 15 domestic, 12 environmental, 5 irrigation, 4 recreational, 4 town water supply, 2 managed aquifer recharge 1 exploration, 1 recharge, 272 bores had no listed purpose.
Step 4: Application of the EPA recognised criteria for the most sensitive environmental value	The most sensitive environmental values to be applied to the site are Health Recreational Water, Health Drinking Water and Aquatic Ecosystems (fresh).

Based on the assessment outlined in Table 5.1, the groundwater criteria were selected to protect the relevant environmental values identified for groundwater underlying the area of investigation.

For the purpose of this assessment, criteria have been included to:

- Assess the potential risk to people using groundwater for domestic and drinking purposes, i.e., potable use.
- Assess the potential risk to users of groundwater for irrigation of fruit trees and vegetable gardens.
- Assess the potential risk to freshwater systems. Given the Torrens River and the west parklands Park 23 creek receive various inputs from stormwater, it is considered to be a slightly to moderately modified ecosystem. Therefore, the 95% Species Protection value has been selected to assess the effects of PFAS chemicals on aquatic organisms.

The values for the adopted screening/investigation levels from this source, which are considered to protect potentially complete source receptor linkages, are summarised in Table 5.2.

Table 5.2 Adopted PFAS Interim Screening Criteria (Surface Water and Groundwater)

Exposure Scenario	PFHxS [1]	PFOS [2]	Sum of PFHxS & PFOS	PFOA [3]	Source
Health Recreational Water [4]	2.0 µg/L	2.0 µg/L	2.0 µg/L	10 µg/L	PFAS NEMP 2020
Health Drinking Water	0.07 µg/L	0.07 µg/L	0.07 µg/L	0.56 µg/L	PFAS NEMP 2020
Freshwater 95% Species Protection – Slightly to moderately modified ecosystems		0.13 µg/L	-	220 µg/L	PFAS NEMP 2020

Notes:
[1] PFHxS – perfluorohexane sulfonate
[2] PFOS – perfluorooctane sulfonate
[3] PFOA – perfluorooctanoic acid
[4] Based on NHMRC 2019

6. Groundwater Results

The following sections summarise the field observations and analytical results of the July 2021 groundwater monitoring event. Sampling locations are shown in Figure 2. Interpretation and discussion of the results is provided in Section 8.

All field notes collected as a part of this investigation can be found in Appendix B. Calibration certificates for the interface probe and water quality meter can be found in Appendix C. Laboratory reports and chain of custody documentation can be found in Appendix D. Results tables for field parameters and analytical data can be found at the end of this report.

6.1 Site Specific Geology

The site consisted of hard stand material (concrete pavers and bitumen). Based on the soil description in the well installation bore logs provided by the MFS (Appendix E) fill materials occurred at depths between 0.1 m bgl to 2 m bgl. Fill is underlain by natural soils consisting of brown clay or sandy clay, typically with a 1.5 m to 2 m thick, white or red sandy clay (sand for GW101) layer between 9 m below ground level (bgl) and 15 m bgl over brown clay. This was consistent with the regional geology.

6.2 Site Specific Hydrogeology

Groundwater gauging data collected on 20 July 2021 is presented in Table 6.1.

Table 6.1 Groundwater Gauging Data

Well ID	Top of casing (mAHD)	SWL (mTOC)	RSWL (mAHD)
GW101	46.463	12.529	33.934
GW102	45.656	11.528	34.128
GW103	45.911	12.097	33.814
GW104	47.070	13.168	33.902
GW105	45.933	12.120	33.813
GW106	46.463	12.508	33.955

Based on the gauging data presented in Table 6.1, a summary of the site-specific hydrogeology is provided in Table 6.2.

Table 6.2 Summary of Site-Specific Hydrogeology

Feature	Details
Groundwater Occurrence and Depth to Groundwater	The first regional aquifer is located at depths ranging between 11.528 mTOC (GW102) and 13.168 mTOC (GW104). Groundwater elevations across the site ranged between 33.813 mAHD (GW105) and 34.128 mAHD (GW102)
Groundwater Flow Direction	Groundwater flow direction was inferred to be in northerly to north-westerly direction towards the Torrens River. Groundwater elevation contours and inferred flow direction are shown in Figure 3.
Groundwater Gradient	The groundwater gradient between GW102 and GW105 was calculated to be 0.0045 m/m.
Effective Porosity	Based on literature, the effective porosity of the water bearing clay lithology was assumed to be 0.06. [1]
Hydraulic Conductivity	The hydraulic conductivity of the sandy clay aquifer (based on literature) was assumed to range between 8.64×10^{-7} m/day and 4.06×10^{-4} m/day. [2]

Feature	Details
Seepage Velocity	The seepage velocity of groundwater beneath the site was calculated, based on literature values, to range between 2.4 x 10^{-5} m/year and 1.1 x 10^{-2} m/year.
Groundwater Salinity	TDS within groundwater beneath the site, as an indicator of salinity, was calculated by applying a conversion factor of 0.65 to the electrical conductivity values at each well. The calculated TDS values ranged between 6,269 mg/L (GW101) and 8,903 mg/L (GW103), indicating saline groundwater beneath the investigation area. The calculated TDS values of the groundwater beneath the site indicate that groundwater beneath the site may be suitable for use by primary industries for livestock watering and aquaculture for human consumption, but not suitable for recreation, potable use or irrigation purposes other contaminants not withstanding (SA EPA 2019a).

Notes:
[1] McWorter, D. and Sunada, D. 1977, Groundwater Hydrology and Hydraulics, Water Resources Publications Colorado, USA, Table 2-2, Page 31.
[2] McWorter, D. and Sunada, D. 1977, Groundwater Hydrology and Hydraulics, Water Resources Publications Colorado, USA, Table 3-1, Page 81.

Groundwater field physicochemical parameters (pH, electrical conductivity (EC), dissolved oxygen (DO), field redox potential and temperature) were recorded during the gauging and sampling process. The groundwater field physicochemical results are provided in Table 1 at the end of this report and summarised as follows:

- The groundwater pH results ranged between pH 6.57 (GW104) to pH 7.01 (GW101), indicating moderately acidic to neutral groundwater conditions.
- Field EC ranged from 9,645 µS/cm (GW101) to 13,697 µS/cm (GW103). The calculated TDS values indicated a minimum salinity of 6,269 mg/L and maximum of 8,903 mg/L at the respective wells, indicating saline water beneath the site.
- Dissolved oxygen ranged between 2.42 mg/L (GW104) and 3.12 mg/L (GW102) indicating oxidising groundwater conditions.
- The redox potential relative to the standard hydrogen electrode (SHE) was calculated by applying a conversion factor of 204 mV to the field redox readings and ranged between 424 mV (GW102) and 485 mV (GW104) indicating oxidising groundwater conditions.
- Temperatures ranged between 19.8°C (GW105) and 21.0°C (GW101), which were considered within normal ranges for winter.

6.3 Analytical Results

The tabulated analytical groundwater results are presented in Table 2 at the end of this report and the corresponding laboratory reports are provided in Appendix D. Six primary groundwater samples were submitted for laboratory analysis with the results, and details of samples exceeding criteria, summarised in Table 6.3.

A figure showing groundwater concentrations / exceedances for PFOA, PFHxS, PFOS, and the sum of PFHxS & PFOS is included as Figure 4.

Table 6.3 Summary of Groundwater Analytical Results

No. of primary samples	Analyte	Min conc. µg/L	Max conc. µg/L	Samples exceeding criteria		
				Health Drinking Water	Health Recreational Water	Freshwater 95% species protection
6	PFOA	<0.01	1.9	GW101 GW103	NIL	NIL
	PFHxS	<0.01	26	GW101 GW103	GW101 GW103	NIL
	PFOS	0.02	27	GW101 GW103 GW104	GW101 GW103	GW101 GW103

No. of primary samples	Analyte	Min conc. µg/L	Max conc. µg/L	Samples exceeding criteria		
				Health Drinking Water	Health Recreational Water	Freshwater 95% species protection
				GW106		
	PFHxS & PFOS	0.02	53	GW101 GW103 GW104 GW106	GW101 GW103	N/A

Note: N/A indicates no guideline value for this analyte.

7. Quality Assurance and Quality Control

Data Quality Indicators (DQIs), field and laboratory QA/QC requirements and results are provided in Appendix F. The field QA/QC results are presented in Table 3 (relative percentage difference (RPD) values for duplicate samples) and Table 4 (blank results).

Based on the review of the QA/QC results, GHD considers the data to be valid and of sufficient quality for the purposes of this Environmental Investigation.

8. Discussion

8.1 Presence and Distribution of PFAS in Soil and Groundwater

8.1.1 Historical Soil, Sediment and Surface Water Results

Limited soil and sediment sampling was undertaken at the site in 2016-2017. PFAS contamination was identified in the subsurface soil samples collected in three areas of potential concern adjacent to surface water inlets: east of the chemical storage shed, south of Special Operations building and within the washdown bay. The highest concentrations of PFAS were identified in the area adjacent to the surface water inlet running off from training tower in north-west part of the site.

Only one soil sample (BH1_0.08-0.18) was tested for leachable PFAS and reported concentrations exceeding the current human health and ecological criteria and indicating that PFAS were leaching from the soil under the simulated ASLP conditions.

Limited testing of the drains sediment and surface water was undertaken, and the results revealed existing PFAS contamination indicating an unacceptable risk to human health and to ecological receptors.

8.1.2 Groundwater Results

2021 GME reported elevated PFAS concentrations in all six groundwater monitoring wells. The PFOS and Sum of PFHxS and PFOS concentrations exceeded the adopted criteria in four wells (GW01, GW03, GW104 and GW106). The elevated PFAS concentrations at wells GW101 (in the centre of the site) and GW103 (most down-hydraulic gradient well) were one to three orders of magnitude higher than in the other four wells and also exceeded the adopted health drinking water criterion for PFOA, the recreational criteria for PFHxS, PFOS and the Sum of PFHxS and PFOS and the ecological freshwater (95% species protection level) criterion for PFOS.

Monitoring well GW101 reported the highest PFAS concentrations across the site, which was consistent with the historical use of PFAS containing foam in firefighting training at the nearby washbay. Elevated PFAS concentrations at GW103 were also consistent with a south-north flowing drain historically receiving runoff from the flushing of firefighting foam from hoses and pumps after their use at fire incidents and most down-hydraulic gradient location of this well.

Given the inferred groundwater flow direction to the north-west, the reported PFAS concentrations at GW104 and GW106 could either represent impact from site activities or regional background PFAS concentrations in groundwater.

Based on the results of this investigation, PFAS impacts in groundwater beneath the site, associated with historical site activities was practically delineated below the assessment criteria to the south and west. The extent of PFAS concentrations in groundwater to the north, north-west (down -hydraulic gradient) and east remains undelineated.

The reported PFAS concentrations in groundwater beneath the site constitute harm to groundwater that is not trivial. A Section 83A notification was submitted in accordance with the South Australian Environment Protection Act 1993 (Gov SA 1993) to the SA Environment Protection Authority via email on 30 July 2021 (Appendix G).

8.2 Conceptual Site Model

8.2.1 General

A conceptual site model (CSM) is a qualitative analysis tool which identifies the contamination sources, transport mechanisms, exposure pathways and receptors considered in a site-specific risk assessment.

For an identifiable risk to exist, an exposure pathway must be present which requires each of the following to be identified:

– Presence of substances that may cause harm (SOURCE)
– Presence of a receptor which may be harmed (RECEPTOR)
– Existence of a means of exposing a receptor to the source (EXPOSURE PATHWAY) and whether exposure pathways are complete or incomplete.

A site specific CSM has been developed based on GHDs understanding of the site setting, including geology, hydrogeology and surrounding land use in order to identify potentially significant source-pathway-receptor (SPR) linkages in respect to the potential risks in relation to the PFAS impacts at the site.

A tabular Conceptual Site Model (CSM) is presented in Table 8.1.

8.2.2 CSM Data Gaps

The following data gaps to the CSM remain:

– Limited soil sampling indicated that the soil was impacted beneath site, however, the vertical and lateral extent of PFAS contamination in soil across the site has not been undertaken.
– PFAS contamination in concrete/pavers and the associated PFAS flux from these materials has not been assessed.
– The downgradient extent of PFAS in the groundwater has not been delineated.

Table 8.1 Conceptual Site Model (CSM)

Potential source	Receptor	Pathway	Pathway present?
PFAS impacted soil and sediment. PFAS impacted surface water (from drains)	Firefighters, workers and visitors to the MFS site exposed to contaminated soil, sediment or dust	Inhalation of contaminated soil. Direct dermal contact with contaminated concrete or soil. Incidental ingestion of contaminated soil	No PFAS concentrations detected in soil and sediment on-site to date were below the adopted Tier 1 human health assessment criteria. Possible Limited on-site surface water testing has identified PFAS concentrations exceeding human health criteria for drinking water and recreational water criteria indicating that water may present an unacceptable risk to human health. PFAS concentrations in concrete is not known.
	Ecosystem at the MFS site	Rainwater runoff from site to discharge to fresh water environments.	Possible PFAS concentrations detected in soil and sediment exceeded the adopted Tier 1 interim ecological criteria for direct and/or indirect exposure. Unlikely Limited on-site surface water testing has identified PFAS concentrations exceeding ecological criteria, indicating that water may present an unacceptable risk to ecological receptors.
	Groundwater beneath the site	Migration through porous media	Yes While water used during training activities and rainfall is collected as surface runoff and transferred into the storage dams, some water may also infiltrate the ground and leach PFAS from the soil into the groundwater. PFAS impacts in soil and sediment resulted in harm to groundwater shown by the groundwater results.
	Ecosystem of the River Torrens and the west parklands Park 23 creek	Migration through porous media and discharge to water bodies.	Possible The River Torrens (Karrawirra Parri) and the west parklands Park 23 creek are located approximately 1.3 km to the north (down-hydraulic gradient) and west of the site. The reported PFAS concentrations in soil and sediment exceeded the adopted ecological criteria and the impacted soil contamination resulted in groundwater impact.
PFAS impacted groundwater	People using groundwater for: domestic and drinking purposes.	Consumption of contaminated groundwater.	Possible Although it is considered unlikely that groundwater would currently be used for potable use within the Adelaide CBD due to presence of reticulated water supply, 15 domestic bores were located within a 2 km radius of the site. The available TDS data indicated that 56 out of 208 bores reported TDS values below 1,200 mg/L within a 2 km radius so that off-site potable use cannot be ruled out.

Potential source	Receptor	Pathway	Pathway present?
	People using groundwater for: irrigation of vegetable gardens and / or fruit trees with which they grow produce for consumption.	Consumption of fruit and vegetables irrigated by contaminated groundwater.	Possible Although it is considered unlikely that groundwater would currently be used for irrigation purposes within the Adelaide CBD due to presence of reticulated water supply, 15 domestic and 5 irrigation bores were located within a 2 km radius of the site. The available TDS data indicated that 190 out of 208 bores reported TDS values below 3,000 mg/L within a 2 km radius so that off-site use for irrigation purposes cannot be ruled out.
	People growing fruit and / or vegetables in open soil which may interact with groundwater.	Consumption of PFAS impacted fruit and / or vegetables.	No The depth of groundwater precludes the possibility that fruit or vegetables in the nearby vicinity would interact with impacted groundwater.
	People using groundwater for recreational purposes such as filling of swimming pools.	Incidental ingestion of contaminated groundwater.	Unlikely Groundwater use for recreational purposes such as filling of swimming pools is considered unlikely (Gov SA, 2015). The closest water body is the River Torrens, which is not used for recreational swimming. Other on water activities undertaken on the River Torrens are unlikely to result in consumption of impacted water at volumes that would pose a health risk from PFAS.
	Down gradient off-site maintenance workers that contact PFAS contaminated groundwater.	Direct dermal contact or incidental ingestion of contaminated groundwater.	Unlikely Whilst it is possible that off-site maintenance workers could incidentally ingest contaminated groundwater, it is unlikely that they'll ingest quantities detrimental to their health.
	Ecosystem of the River Torrens and the west parklands Park 23 creek	Migration through porous media and discharge to water bodies / marine environments.	Possible The River Torrens (Karrawirra Parri) and the west parklands Park 23 creek are located approximately 1.3 km to the north (down-hydraulic gradient) and west of the site. The reported PFAS concentrations in groundwater beneath the site exceeded the adopted Tier 1 ecological criteria by more than two orders of magnitude.

9. Conclusions

Based on the findings of 2016-2017 limited soil, drains sediment and surface water investigations, the following conclusions have been made:

- The primary source of AFFF contamination no longer exists, however secondary sources of AFFF contamination remain and include contaminated soil, surface water and groundwater.
- The soil dry weight and leachate results reported elevated PFAS concentrations exceeding the nominated ecological and human health criteria and continue to represent an ongoing source of PFAS. The soil PFAS impacts have not been vertically or laterally delineated onsite.
- The concrete walls of the dam are likely to be contributing dissolved PFAS concentrations to the retained water.
- The surface water and sediments provide a direct exposure mechanism to human and the environment and an immediate potential source for groundwater contamination.

Based on the findings of this investigation, the following conclusions have been made:

- The standing water levels recorded during the July 2021 investigation ranged from 11.528 mTOC (GW102) to 13.168 mTOC (GW104). Groundwater elevations across the assessment area ranged between 33.813 mAHD (GW105) and 34.128 mAHD (GW102).
- The groundwater is inferred to flow in a north-westerly direction towards the River Torrens.
- The results suggest that the historical use of PFAS foam at the site is contributing PFAS to groundwater. Elevated PFAS concentrations were reported for groundwater in all six on-site monitoring wells, with four wells exceeding the adopted the NEMP Health Drinking Water criteria.
- PFAS concentrations at GW101 and GW103 were one to three orders of magnitude higher than in the other wells and also exceeded the adopted health drinking water criterion for PFOA, the recreational criteria for PFHxS, PFOS and the Sum of PFHxS and PFOS and the ecological freshwater (95% species protection level) criterion for PFOS.
- The elevated PFAS concentrations at GW101 were consistent with the historical use of PFAS containing foam in firefighting training at the nearby washbay. The elevated PFAS concentrations at GW103 were consistent with a south-north flowing drain historically receiving runoff from the flushing of firefighting foam from hoses and pumps after their use at fire incidents.
- Given the inferred groundwater flow direction to the north-west, the reported PFAS concentrations at up-hydraulic gradient wells GW104 and GW106 could either represent impact from site activities or regional background PFAS concentrations in groundwater.
- PFAS impacts in groundwater beneath the site associated with historical site activities have been practically delineated to the south and west by wells GW102 and GW105. The extent of PFAS concentrations in groundwater to the north, north-west down the inferred hydraulic gradient and east remains undelineated.
- The reported PFAS concentrations in groundwater beneath the site constitute harm to groundwater that is not trivial. A Section 83A notification was submitted in accordance with the South Australian Environment Protection Act 1993 (Gov SA 1993) to the SA Environment Protection Authority via email on 30 July 2021 (Appendix G).
- The CSM indicates that the use of groundwater for domestic irrigation and / or drinking purposes is unlikely in the vicinity of the Adelaide Fire Station. However, given that some domestic and irrigation bores were located within a 2 km radius of the site and TDS of 56 bores was below 1,200 mg/L, potable and irrigation use of groundwater cannot be ruled out.
- It is considered that the impacted groundwater is likely to eventually reach the River Torrens and the west parklands Park 23 creek at concentrations above the adopted Tier 1 ecological assessment criteria for freshwater.

Based on the results of this investigation and the CSM data gaps, it is recommended that further soil and groundwater investigations are undertaken to assess the on-site soil contamination and off-site extent and stability of the PFAS plume in groundwater.

10. References

ANZG, 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, online resource www.waterquality.gov.au/anz-guidelines, Australian and New Zealand Governments, updated 26 July 2021, (AWQG)

Australian/New Zealand Standard 1998, Water Quality – Sampling Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples. AS/NZS 5667.1:1998

Australian/New Zealand Standard 1998, Water Quality – Sampling Guidance on Sampling of Groundwaters. AS/NZS 5667.11:1998, Standards Australia

DEW 2021, WaterConnect online data base for groundwater and surface water, Department for Environment and Water, South Australia, accessed August 2021 via www.waterconnect.sa.gov.au

EPA Victoria 2000, Groundwater Sampling GuidelinesGerges, N. 2006, Overview of the hydrogeology of the Adelaide metropolitan area, South Australia, Department of Water, Land and Biodiversity Conservation, DWLBC Report 2006/10, June 2010

Gov SA 1993, Environment Protection Act 1993, Version 1.4.2021, Government of South Australia

Gov SA 2015, Environment Protection (Water Quality) Policy 2015 (WQEPP), Version 1.7.2020, Government of South Australia, updated 2020

HEPA, 2020, PFAS National Environmental Management Plan (Version 2.0), Heads of Environment Protection Authorities Australia and New Zealand, January 2020, (PFAS NEMP)

Hydrasleeve 2016, Standard Operating Procedure: Sampling Groundwater with a Hydrasleeve

McWorter, D. and Sunada, D. 1977, Groundwater Hydrology and Hydraulics, Water Resources Publications Colorado, USA, 1977

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

NHMRC, 2019, Guidance on Per and Polyfluoroalkyl (PFAS) in Recreational Water, National Health and Medical Research Council, Canberra 2019

NHMRC/NRMMC, 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, 2019a, Guidelines for the Assessment and Remediation (GAR) of Site Contamination, Environment Protection Authority, South Australia, November 2019

SA EPA, 2019b, Guidelines for regulatory monitoring and testing – Groundwater sampling Environment Protection Authority, South Australia, revised 2019

SAPPA, 2021, South Australia Property and Planning Atlas, Plan SA, Government of South Australia, accessed July 2021 via https://sappa.plan.sa.gov.au

SARIG 2021, South Australian Resources Information Gateway, Government of South Australia, accessed August 2021 via https://map.sarig.sa.gov.au/

WA DER (2017) Interim Guideline of Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Version 2.1, Contaminated Sites Guidelines, Department of Environment Regulation, Western Australia, Perth, January 2017

Tables

Groundwater Samples

Client: South Australian Metropolitan Fire Service (MFS)
Project: Adelaide Station Groundwater Investigation July 2021
Job No.: 3319080
Location: Adelaide Station
WL Meter Type: Int.Fce

Location ID	TOC (mAHD)	Sample Date	SWL (mTOC)	Depth of Well (mTOC)	RWL (mAHD)	pH	EC (µs/cm)	TDS (mg/L)	DO (mg/L)	Redox (mV)	Redox SHE (mV)	Temperature	Sample Description
GW101	46.463	20/07/21	12.529	13.50	33.934	7.01	9,645	6,269	2.90	272	476	21.0	Pale brown, high turbidity, no sheen, no odour
GW102	45.656	20/07/21	11.528	15.00	34.128	6.74	12,139	7,890	3.12	220	424	20.8	Pale brown, high turbidity, no sheen, no odour
GW103	45.911	20/07/21	12.097	12.50	33.814	6.75	13,697	8,903	2.62	268	472	20.6	Pale yellow, low turbidity, no sheen, no colour
GW104	47.070	20/07/21	13.168	-	33.902	6.57	11,480	7,462	2.42	281	485	20.5	Pale brown, high turbidity, no sheen, no odour
GW105	45.933	20/07/21	12.120	14.00	33.813	6.75	9,982	6,488	2.62	240	444	19.8	Pale brown, high turbidity, no sheen, no odour
GW106	46.463	20/07/21	12.508	15.00	33.955	6.65	11,425	7,426	2.81	270	474	20.7	Pale brown, medium-high turbidity, no sheen, no odour

TOC denotes Top of Casing
AHD denotes Australian Height Datum
SWL denotes standing water level
RWL denotes relative water level
EC denotes electric conductivity
TDS denotes total dissolved solids; TDS values were calculated by multiplying the EC values with a conversion factor of 0.65.
Redox SHE denotes redox potential relative to the standard hydrogen electrode; redox potential (SHE) = field redox potential (Ag/AgCl electrode with saturated KCl solution) + 204 mV.

			PFAS (short suite in water)							
			Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	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 Recreational Water			10	2	2			2		
PFAS NEMP 2.0 2020 Health Drinking Water			0.56	0.07	0.07			0.07		
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems			220		0.13					
Location Code	**Date**	**Field ID**								
GW101	20/07/2021	GW101	1.9	26	27	1.2	<0.02	53	29	56
GW102	20/07/2021	GW102	<0.01	<0.02 *	0.03 *	<0.05 *	<0.05 *	0.03 *	0.03 *	0.03 *
GW103	20/07/2021	GW103	0.87	11	16	1.5	<0.02	27	17	29
GW104	20/07/2021	GW104	<0.01	0.04	0.099	<0.01	<0.02	0.14	0.1	0.14
GW105	20/07/2021	GW105	<0.01	<0.01	0.02	<0.01	<0.02	0.02	0.02	0.02
GW106	20/07/2021	GW106	<0.01	0.02	0.11	<0.01	<0.02	0.13	0.11	0.13

* Higher value adopted from QA/QC analysis

				PFAS (short suite in water)							
				Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	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
Location Code	**Date**	**Field ID**	**Lab Report Number**								
GW102	20/07/21	GW102	274494	<0.01	<0.01	0.01	<0.01	<0.02	0.01	0.01	0.01
		FD03	274494	<0.01	<0.01	0.02	<0.01	<0.02	0.02	0.02	0.02
RPD						67			67	67	67
GW102	20/07/21	GW102	274494	<0.01	<0.01	0.01	<0.01	<0.02	0.01	0.01	0.01
		FS03	ES2126808	<0.01	<0.02	0.03	<0.05	<0.05	0.03	0.03	0.03
RPD						100			100	100	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: 1000 (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 (short suite in water)							
			Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	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
Date	**Sample Type**	**Lab Report Number**								
20/07/21	Field_B	274494	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	Rinsate	274494	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01

		Moisture Content	Per- and Polyfluoroalkyl Substances (PFAS) by LCMS							Per- and Polyfluoroalkyl Substances (PFAS) by LCMS													
		Moisture (%)	Sum of PFHxS and PFOS	PFAS (Sum of Total)	Perfluorobutane sulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	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)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoropentanoic acid (PFPeA)	PFAS (Sum of Total)(WA DER List)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctane sulfonamide (FOSA)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Perfluorononanoic acid (PFNA)
		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		1	0.0002	0.0002	0.0002	0.001	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002
PFAS NEMP 2.0 2020 Ecological direct exposure																			1	10		
PFAS NEMP 2.0 2020 Ecological indirect exposure																			0.01			
PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)			20											20					20	50		
Date	**Field ID**																					
13/10/2016	BH1_0.08-0.18	10.8	0.0215		0.0002	<0.001	<0.0005	0.0043	0.0039	<0.0005		0.0003	0.0315	0.0021	0.0011		<0.0002		0.0194	0.0002		
	BH2_0.08-0.18	7	1.49		0.0005	<0.001	<0.0005	0.0111	0.0012	<0.0005		0.0004	1.52	0.186	0.005		0.0009		1.3	0.0204		
	BH3_0.08-0.18	7.7	0.49		<0.0002	<0.001	<0.0005	0.0088	0.0015	0.0005		0.0006	0.505	0.0055	0.0017		0.0005		0.485	0.0011		
	SED1	48.5	0.0569		0.0003	<0.001	<0.0005	<0.0005	<0.0005	<0.0005		<0.0002	0.0588	0.0057	0.0012		<0.0002		0.0512	0.0004		
	SED2	27.3	0.0477		<0.0002	<0.001	<0.0005	<0.0005	<0.0005	<0.0005		<0.0002	0.0479	0.0051	0.0002		<0.0002		0.0426	<0.0002		
17/05/2017	SED1	31.3	0.0381	0.0648	<0.0002	<0.001	<0.0005	0.0043	0.0021	0.0133	<0.0002	<0.0002	0.0467	0.0026	0.0014	0.0007	<0.0002	0.0016	0.0355	0.0008	<0.0005	<0.0002
	SED2	55.2	0.0721	0.135	0.0002	<0.001	<0.0005	0.0284	0.0169	0.0072	0.0007	<0.0002	0.123	0.005	0.0035	0.0015	0.0004	0.0008	0.0671	0.0017	<0.0005	0.0008
17/10/2017	DRAIN_S	3.4	0.0284	0.0453	0.0003	<0.001	<0.0005	0.0040	0.0049	0.0037	0.0002	0.0008	0.0405	0.0027	0.0013	0.0004	<0.0002	0.0005	0.0257	0.0008	<0.0005	<0.0002

		Per- and Polyfluoroalkyl Substances (PFAS) by LCMS											PFAS by LCMSMS after oxidation (TOP)									
		Perfluorodecanesulfonic acid (PFDS)	Perfluorodecanoic acid (PFDA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Perfluoroundecanoic acid (PFUnDA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorododecanoic acid (PFDoDA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	Sum of PFHxS and PFOS	PFAS (Sum of Total)	Perfluorobutane Sulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	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)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoropentanoic acid (PFPeA)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.001	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002
PFAS NEMP 2.0 2020 Ecological direct exposure																						
PFAS NEMP 2.0 2020 Ecological indirect exposure																						
PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)													20									
Date	**Field ID**																					
13/10/2016	BH1_0.08-0.18																					
	BH2_0.08-0.18																					
	BH3_0.08-0.18																					
	SED1																					
	SED2																					
17/05/2017	SED1	0.0003	0.0003	<0.0005	0.0003	<0.0002	0.0003	<0.0005	0.0005	0.0008	<0.0005	<0.0002	0.0052	0.0161	<0.0002	0.003	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	0.0015
	SED2	<0.0002	0.0005	<0.0005	0.0005	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	0.0154	0.0743	<0.001	0.033	<0.001	<0.001	<0.001	<0.001	<0.001	0.015
17/10/2017	DRAIN_S	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	0.0189	0.0642	<0.0025	<0.002	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0225

		PFAS by LCMSMS after oxidation (TOP)																					
		Perfluorohexane sulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Sum of TOP C4 - C14 as Fluorine	Perfluoroheptane sulfonic acid (PFHpS)	Perfluoroheptanoic acid (PFHpA)	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates	Perfluorooctane sulfonamide (FOSA)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Perfluorononanoic acid (PFNA)	Perfluorodecanesulfonic acid (PFDS)	Perfluorodecanoic acid (PFDA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Perfluoroundecanoic acid (PFUnDA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorododecanoic acid (PFDoDA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0002
PFAS NEMP 2.0 2020 Ecological direct exposure									1	10													
PFAS NEMP 2.0 2020 Ecological indirect exposure									0.01														
PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)		20							20	50													
Date	**Field ID**																						
13/10/2016	BH1_0.08-0.18																						
	BH2_0.08-0.18																						
	BH3_0.08-0.18																						
	SED1																						
	SED2																						
17/05/2017	SED1	0.0007	0.003		<0.0002	0.0012	0.0161	<0.0002	0.0045	0.0011	<0.0005	0.0005	<0.0002	0.0003	<0.0005	<0.0002	<0.0002	0.0003	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002
	SED2	0.0014	0.0067		<0.001	0.0029	0.0743	<0.001	0.014	0.0013	<0.0025	<0.001	<0.001	<0.001	<0.0025	<0.001	<0.001	<0.001	<0.0025	<0.001	<0.0025	<0.0025	<0.001
17/10/2017	DRAIN_S	<0.0025	0.0192	0.0420	<0.0025	<0.0025	0.0642	<0.0025	0.0189	0.0036	<0.0062	<0.0025	<0.0025	<0.0025	<0.0062	<0.0025	<0.0025	<0.0025	<0.0062	<0.0025	<0.0062	<0.0062	<0.0025

		Total Mercury by FIMS	Total Metals by ICP-AES								Total Organic Carbon
		Mercury	Aluminium	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Nickel	Zinc	Total Organic Carbon
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL		0.1	50	5	1	2	5	5	2	5	0.02
PFAS NEMP 2.0 2020 Ecological direct exposure											
PFAS NEMP 2.0 2020 Ecological indirect exposure											
PFAS NEMP 2.0 2020 Industrial/ commercial (HIL D)											
Date	**Field ID**										
13/10/2016	BH1_0.08-0.18	<0.1	1,910	<5	<1	5	6	17	<2	13	0.03
	BH2_0.08-0.18										
	BH3_0.08-0.18										
	SED1										
	SED2										
17/05/2017	SED1										
	SED2										
17/10/2017	DRAIN_S										

		ASLP for Non & Semivolatile Analytes				Per- and Polyfluoroalkyl Substances (PFAS) by LCMS													
		pH (aqueous extract)	pH (Initial)	pH (after HCL)	pH (Final)	Sum of PFHxS and PFOS (filtered)	Perfluorobutane sulfonic acid (PFBS) (filtered)	Perfluorobutanoic acid (PFBA) (filtered)	4:2 Fluorotelomer sulfonic acid (4:2 FTS) (filtered)	6:2 Fluorotelomer Sulfonate (6:2 FTS) (filtered)	8:2 Fluorotelomer sulfonic acid (8:2 FTS) (filtered)	10:2 Fluorotelomer sulfonic acid (10:2 FTS) (filtered)	Perfluoropentanoic acid (PFPeA) (filtered)	PFAS (Sum of Total)(WA DER List) (filtered)	Perfluorohexane sulfonic acid (PFHxS) (filtered)	Perfluorohexanoic acid (PFHxA) (filtered)	Perfluoroheptanoic acid (PFHpA) (filtered)	Perfluorooctane sulfonic acid (PFOS) (filtered)	Perfluorooctanoic acid (PFOA) (filtered)
		pH units	pH units	pH units	pH units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.1	0.1	0.1	0.1	0.01	0.02	0.1	0.05	0.05	0.05	0.05	0.02	0.01	0.02	0.02	0.02	0.01	0.01
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems																		0.13	220
PFAS NEMP 2.0 2020 Health Drinking Water						0.07									0.07			0.07	0.56
PFAS NEMP 2.0 2020 Recreational Water						2									2			2	10
Date	**Field ID**																		
13/10/2016	BH1_0.08-0.18	5	9.8	1.5	5.1	2.16	0.03	<0.1	<0.05	0.44	0.22	<0.05	0.06	3.1	0.18	0.15	<0.02	1.98	0.04

		Alkalinity by PC Titrator				Chloride by Discrete Analyser	Ionic Balance by PCT DA and Turbi SO4 DA			Major Cations - Dissolved				Per- and Polyfluoroalkyl Substances (PFAS) by LCMS								
		Alkalinity (Carbonate as CaCO3)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Hydroxide as CaCO3)	Alkalinity (total as CaCO3)	Chloride	Cations Total	Anions Total	Ionic Balance	Calcium (filtered)	Magnesium (filtered)	Potassium (filtered)	Sodium (filtered)	Sum of PFHxS and PFOS	PFAS (Sum of Total)	Perfluorobutane sulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	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)	Perfluoropentane sulfonic acid (PFPeS)
		mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		1	1	1	1	1	0.01	0.01	0.01	1	1	1	1	0.01	0.01	0.02	0.1	0.05	0.05	0.05	0.05	0.02
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems																						
PFAS NEMP 2.0 2020 Health Drinking Water														0.07								
PFAS NEMP 2.0 2020 Recreational Water														2								
Date	**Field ID**																					
13/10/2016	SW01	<1	57	<1	57	40	2.06	2.48		14	2	1	27	25.4		0.7	<0.1	<0.05	6.01	0.73	<0.05	
	SW02	<1	288	<1	288	107	7.8	9.65	10.6	61	20	18	61	6.12		<0.02	<0.1	<0.05	0.53	0.11	<0.05	
17/05/2017	DAM_B													3.83	8.17	0.06	<0.1	<0.05	2.1	0.88	<0.05	0.05
	DAM_S													3.85	8.29	0.07	<0.1	<0.05	2	1	<0.05	0.06
15/09/2017	DAM_B													2.63	3.55	<0.02	<0.1	<0.05	0.46	0.21	<0.05	<0.02
	DAM_S													2.83	3.82	<0.02	<0.1	<0.05	0.52	0.22	<0.05	<0.02
17/10/2017	DAM_B													1.94	4.13	0.03	<0.1	<0.05	0.91	0.49	0.13	0.03
	DAM_S													1.56	2.72	0.02	<0.1	<0.05	0.49	0.25	<0.05	0.03

		Per- and Polyfluoroalkyl Substances (PFAS) by LCMS																					
		Perfluoropentanoic acid (PFPeA)	PFAS (Sum of Total)(WA DER List)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctane sulfonamide (FOSA)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Perfluorononanoic acid (PFNA)	Perfluorodecanesulfonic acid (PFDS)	Perfluorodecanoic acid (PFDA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Perfluoroundecanoic acid (PFUnDA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorododecanoic acid (PFDoDA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.05	0.02	0.02	0.02	0.05	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.02
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to mod									0.13	220													
PFAS NEMP 2.0 2020 Health Drinking Water				0.07					0.07	0.56													
PFAS NEMP 2.0 2020 Recreational Water				2					2	10													
Date	**Field ID**																						
13/10/2016	SW01	0.78	35.4	2.64	1.3		0.12		22.8	0.32													
	SW02	<0.02	6.93	<0.02	0.1		0.02		6.12	0.05													
17/05/2017	DAM_B	0.31	8.02	0.76	0.5	0.06	0.12	0.04	3.07	0.22	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02
	DAM_S	0.3	8.11	0.78	0.55	0.07	0.12	0.05	3.07	0.22	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02
15/09/2017	DAM_B	<0.02	3.49	0.28	0.14	0.04	<0.02	0.02	2.35	0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02
	DAM_S	<0.02	3.75	0.29	0.13	0.04	<0.02	0.03	2.54	0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02
17/10/2017	DAM_B	0.16	3.90	0.29	0.20	0.04	0.08	0.03	1.65	0.09	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02
	DAM_S	0.09	2.66	0.22	0.15	0.03	0.04	<0.02	1.34	0.06	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02

		PFAS by LCMSMS after oxidation (TOP)																				
		Sum of PFHxS and PFOS	PFAS (Sum of Total)	Perfluorobutane sulfonic acid (PFBS)	Perfluorobutanoic acid (PFBA)	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)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoropentanoic acid (PFPeA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Sum of TOP C4 - C14 as Fluorine	Perfluoroheptane sulfonic acid (PFHpS)	Perfluoroheptanoic acid (PFHpA)	Sum of TOP C4-C14 Carboxylates & C4-C8 Sulfonates	Perfluorooctane sulfonamide (FOSA)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Perfluorononanoic acid (PFNA)
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.01	0.01	0.02	0.1	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.05	0.02
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to mod																			0.13	220		
PFAS NEMP 2.0 2020 Health Drinking Water		0.07										0.07							0.07	0.56		
PFAS NEMP 2.0 2020 Recreational Water		2										2							2	10		
Date	**Field ID**																					
13/10/2016	SW01																					
	SW02																					
17/05/2017	DAM_B	2.95	10.7	0.08	<0.1	<0.05	<0.05	<0.05	<0.05	0.05	4.62	0.62	1.92		0.06	0.65	10.7	<0.02	2.33	0.35	<0.05	0.02
	DAM_S	3.01	9.92	0.08	<0.1	<0.05	<0.05	<0.05	<0.05	0.05	4.13	0.65	1.66		0.06	0.61	9.92	<0.02	2.36	0.3	<0.05	0.02
15/09/2017	DAM_B	2.87	6.06	0.03	<0.1	<0.05	<0.05	<0.05	<0.05	0.03	0.90	0.27	1.37	3.96	0.04	0.39	6.06	<0.02	2.60	0.37	<0.05	0.04
	DAM_S	3.19	5.92	0.02	<0.1	<0.05	<0.05	<0.05	<0.05	0.03	0.66	0.29	1.31	3.86	0.04	0.30	5.92	<0.02	2.90	0.34	<0.05	0.03
17/10/2017	DAM_B	2.00	2.00	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.29	<1.00	<1.00	2.00	<1.00	2.00	<1.00	<2.50	<1.00
	DAM_S	1.90	1.90	<1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.23	<1.00	<1.00	1.90	<1.00	1.90	<1.00	<2.50	<1.00

		PFAS by LCMSMS after oxidation (TOP)											Sulfate (Turbidimetric) as SO4 2- by Discrete Anal	Total Oxidised Sulfur as S
		Perfluorodecanesulfonic acid (PFDS)	Perfluorodecanoic acid (PFDA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Perfluoroundecanoic acid (PFUnDA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorododecanoic acid (PFDoDA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	Sulfate (filtered)	Total Oxidised Sulfur (as S)
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
EQL		0.02	0.02	0.05	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.02	1	1
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to mod														
PFAS NEMP 2.0 2020 Health Drinking Water														
PFAS NEMP 2.0 2020 Recreational Water														
Date	**Field ID**													
13/10/2016	SW01												10	17
	SW02												42	36
17/05/2017	DAM_B	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02		
	DAM_S	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02		
15/09/2017	DAM_B	<0.02	0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02		
	DAM_S	<0.02	<0.02	<0.05	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.02		
17/10/2017	DAM_B	<1.00	<1.00	<2.50	<1.00	<1.00	<1.00	<2.50	<1.00	<2.50	<2.50	<1.00		
	DAM_S	<1.00	<1.00	<2.50	<1.00	<1.00	<1.00	<2.50	<1.00	<2.50	<2.50	<1.00		

Figures

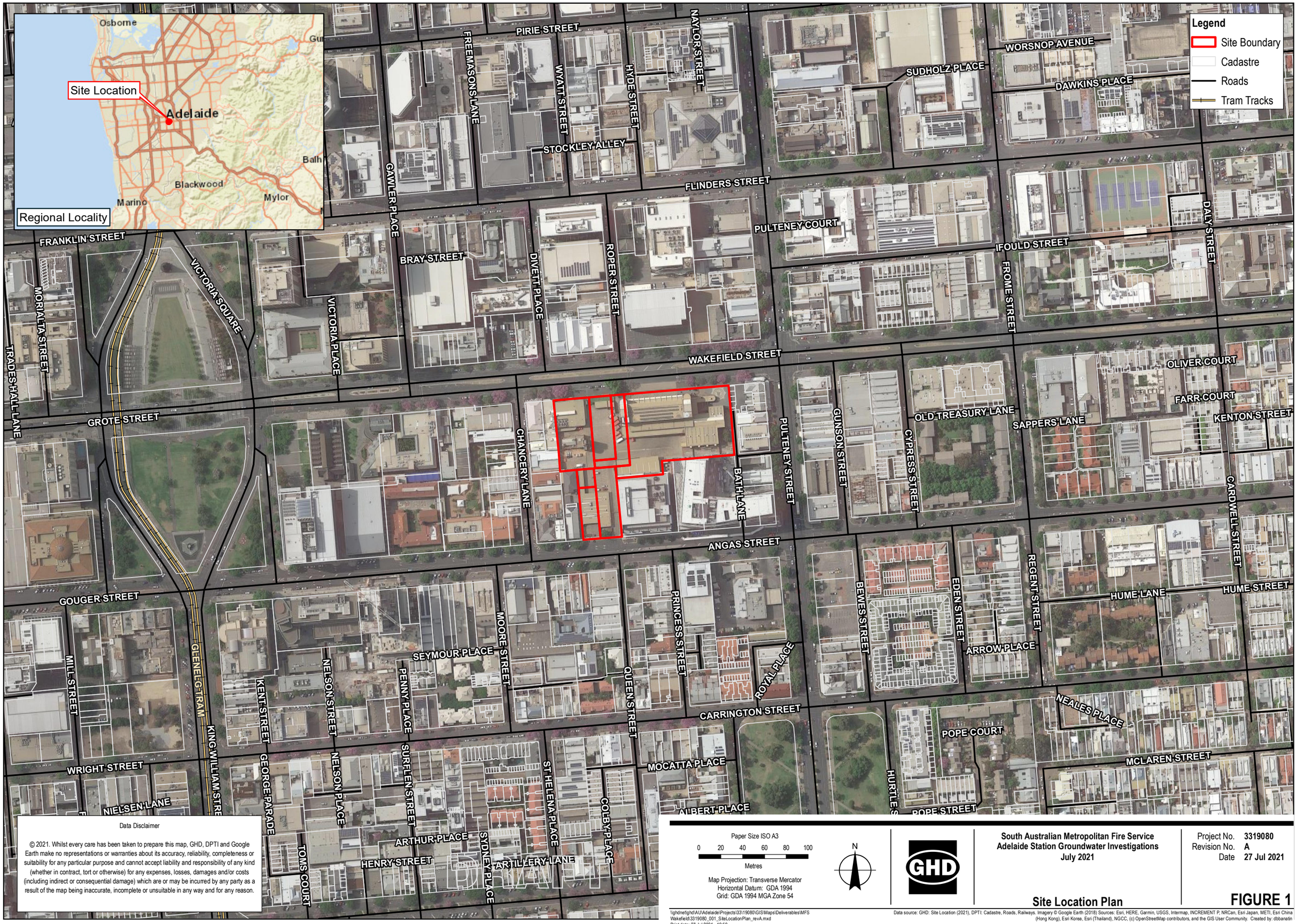
Figure 1 – Site Location Plan

Figure 2 – Groundwater Monitoring Well Locations Plan

Figure 3 – Groundwater Contours and Inferred Flow Direction Plan (July 2021)

Figure 4 – Groundwater PFAS Concentrations Exceedances Plan

Historical Figures 2-4 from GHD (2017a) PSI



Paper Size ISO A3

0 20 40 60 80 100

Metres

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

N

GHD

South Australian Metropolitan Fire Service
Adelaide Station Groundwater Investigations
July 2021

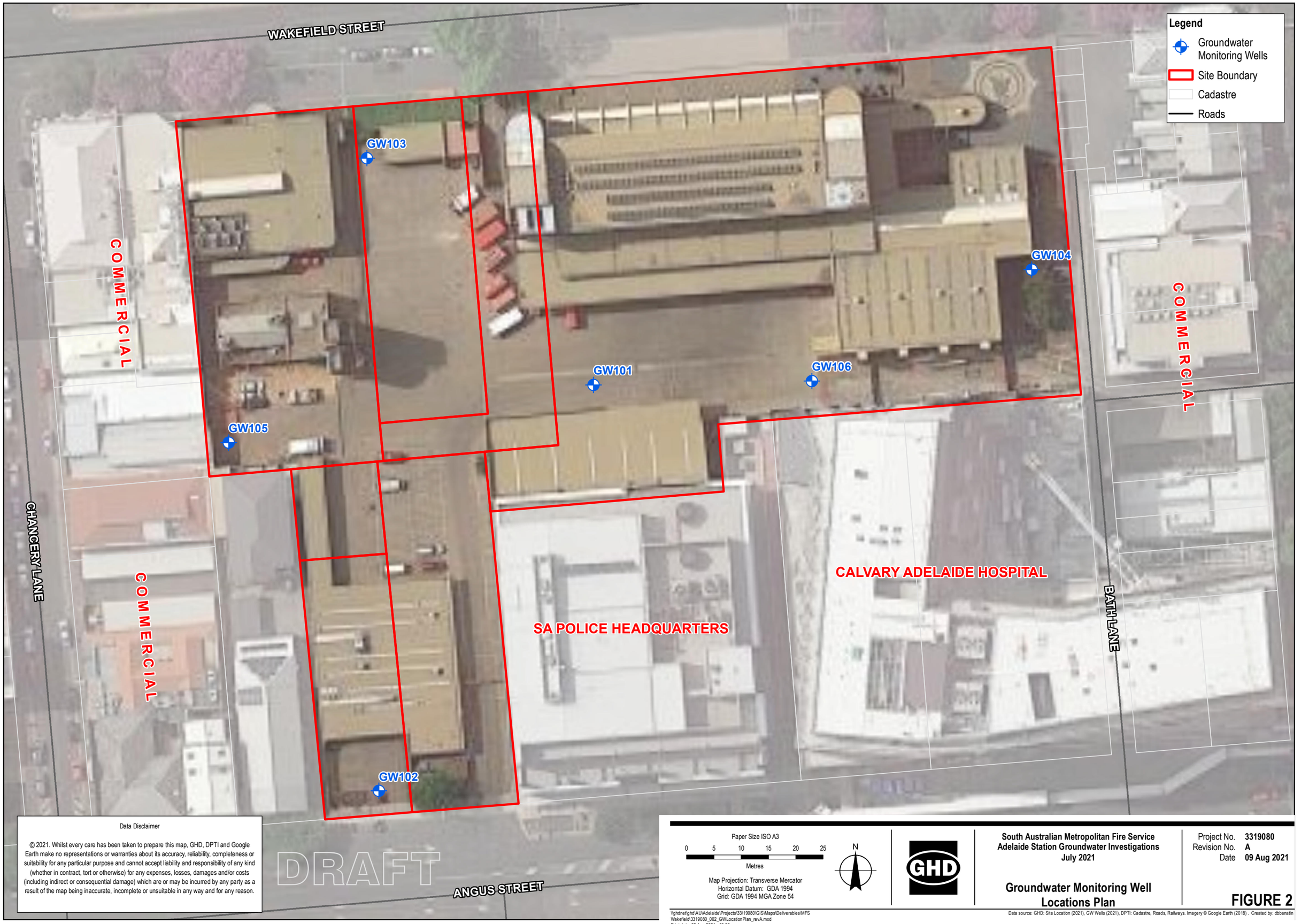
Site Location Plan

Project No. **3319080**
Revision No. **A**
Date **27 Jul 2021**

FIGURE 1

\\ghdnetghd\AU\Adelaide\Projects\33\19080\GIS\Maps\Deliverables\MFS Wakefield\3319080_001_SiteLocationPlan_revA.mxd
Print date: 27 Jul 2021 - 19:59

Data source: GHD: Site Location (2021), DPTI: Cadastre, Roads, Railways. Imagery © Google Earth (2018) Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community. Created by: dbbanatin



Paper Size ISO A3

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Metres

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

N

GHD

South Australian Metropolitan Fire Service
Adelaide Station Groundwater Investigations
July 2021

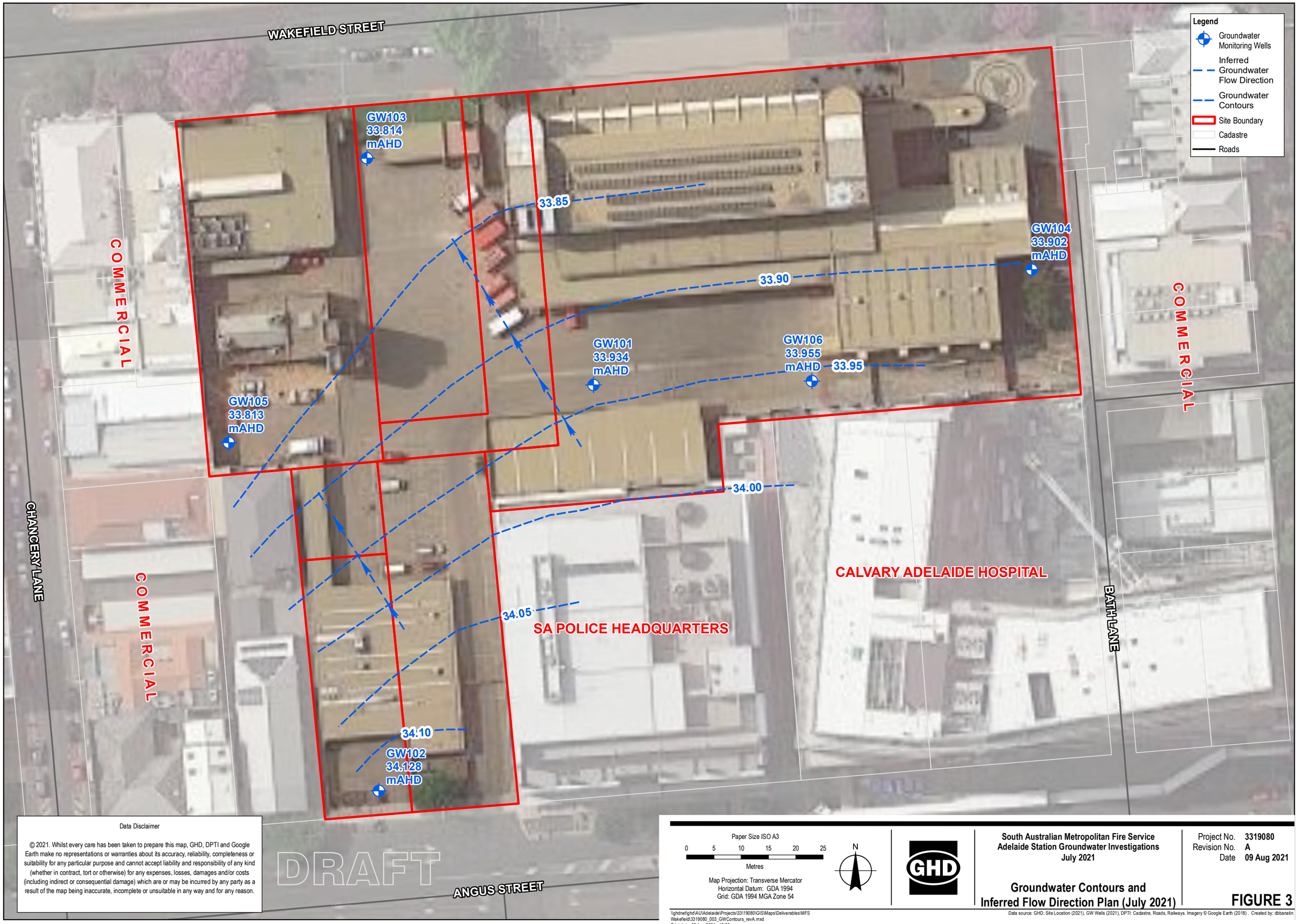
Groundwater Monitoring Well Locations Plan

Project No. **3319080**
Revision No. **A**
Date **09 Aug 2021**

FIGURE 2

\\ghdnet\ghd\AU\Adelaide\Projects\33\19080\GIS\Maps\Deliverables\MFS Wakefield\3319080_002_GWLocationPlan_revA.mxd
Print date: 09 Aug 2021 - 13:09

Data source: GHD: Site Location (2021), GW Wells (2021), DPTI: Cadastre, Roads, Railways. Imagery © Google Earth (2018) . Created by: dbbanatin



Data Disclaimer

Paper Size ISO A3

0 5 10 15 20 25

Metres

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

N

GHD

South Australian Metropolitan Fire Service
Adelaide Station Groundwater Investigations
July 2021

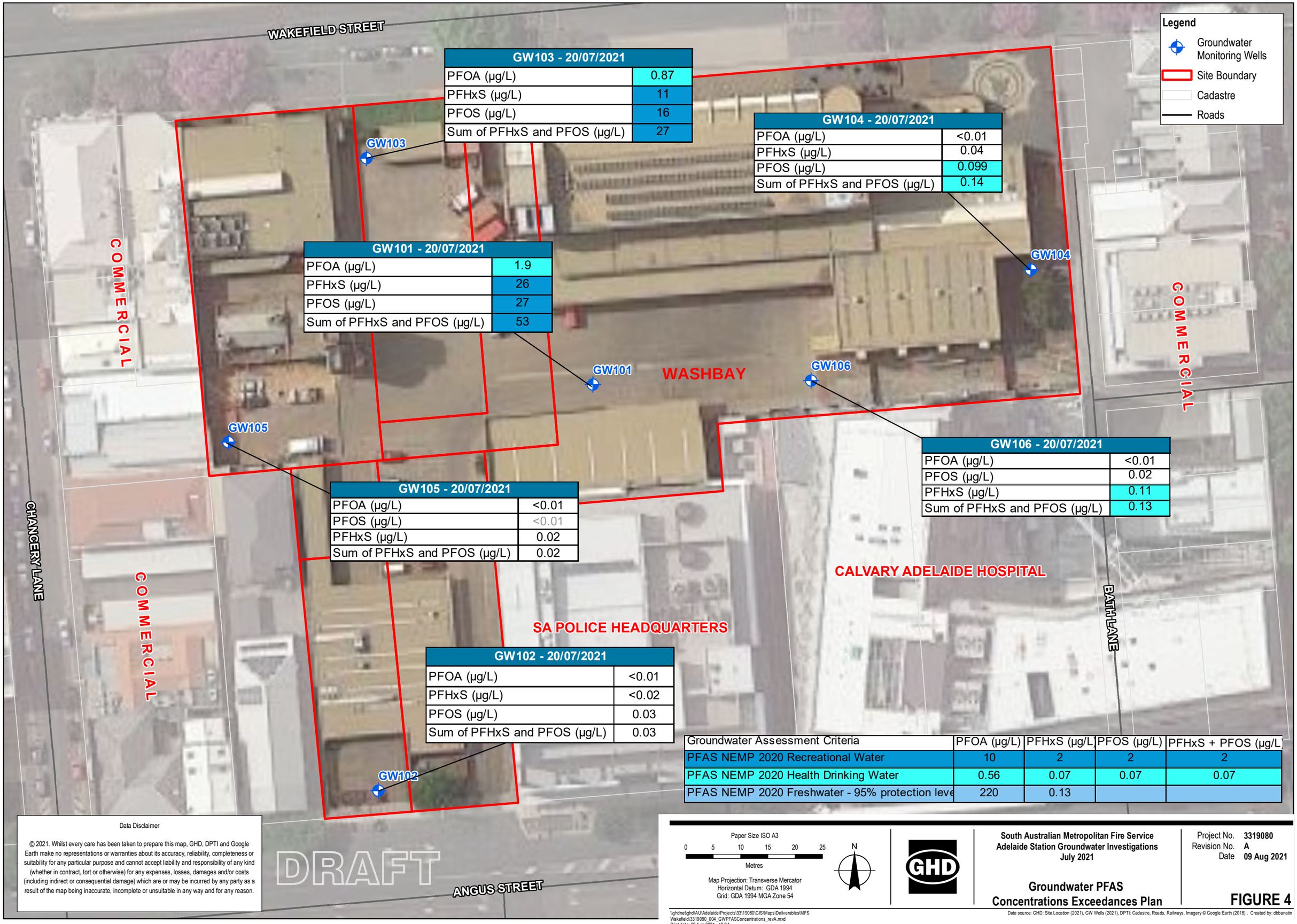
Groundwater Contours and Inferred Flow Direction Plan (July 2021)

Project No. **3319080**
Revision No. **A**
Date **09 Aug 2021**

FIGURE 3

\\ghdnet\ghd\AU\Adelaide\Projects\33\19080\GIS\Maps\Deliverables\MFS Wakefield\3319080_003_GWContours_revA.mxd
Print date: 09 Aug 2021 - 16:38

Data source: GHD: Site Location (2021), GW Wells (2021), DPTI: Cadastre, Roads, Railways. Imagery © Google Earth (2018) . Created by: dbbanatin



Groundwater Assessment Criteria	PFOA (µg/L)	PFHxS (µg/L)	PFOS (µg/L)	PFHxS + PFOS (µg/L)
PFAS NEMP 2020 Recreational Water	10	2	2	2
PFAS NEMP 2020 Health Drinking Water	0.56	0.07	0.07	0.07
PFAS NEMP 2020 Freshwater - 95% protection leve	220	0.13		

Paper Size ISO A3

0 5 10 15 20 25

Metres

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

N

GHD

South Australian Metropolitan Fire Service
Adelaide Station Groundwater Investigations
July 2021

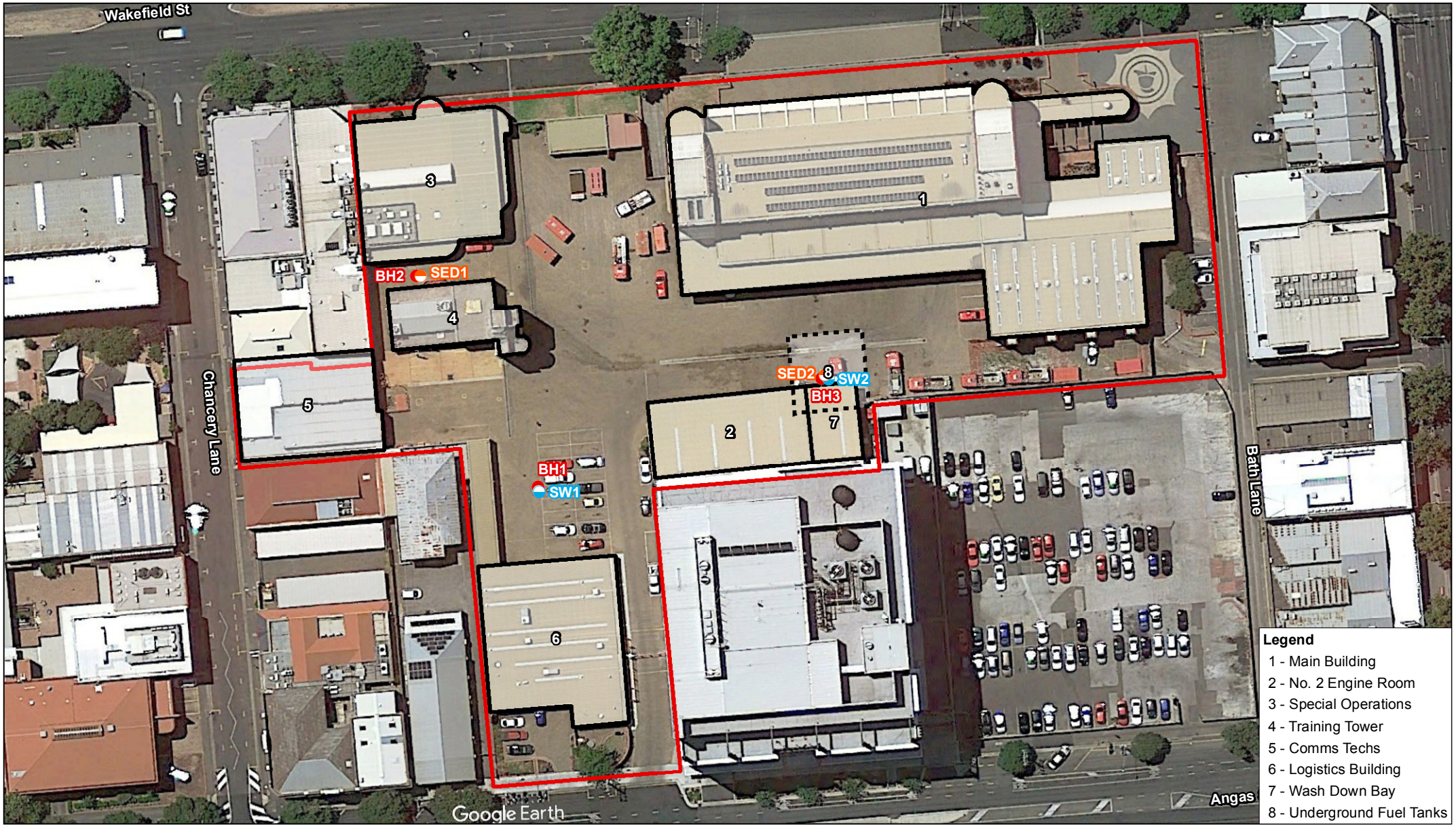
Groundwater PFAS Concentrations Exceedances Plan

Project No. 3319080
Revision No. A
Date 09 Aug 2021

FIGURE 4

\\ghdnet\ghd\AU\Adelaide\Projects\33\19080\GIS\Maps\Deliverables\MFS Wakefield\3319080_004_GWPFASConcentrations_revA.mxd
Print date: 09 Aug 2021 - 18:04

Data source: GHD: Site Location (2021), GW Wells (2021), DPTI: Cadastre, Roads, Railways. Imagery © Google Earth (2018) . Created by: dbbanatin



Paper Size A4

0 3.5 7 14 21 28

Metres

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

N

LEGEND

- Site Boundary
- Building Footprint
- Underground Fuel Tank
- Borehole Location
- Sediment Sample Location
- Surface Water Sample Location

SA Metropolitan Fire Service
Preliminary Site Investigation
99 Wakefield Street Adelaide SA 5000

Job Number 33-18366
Revision A
Date 21 Nov 2016

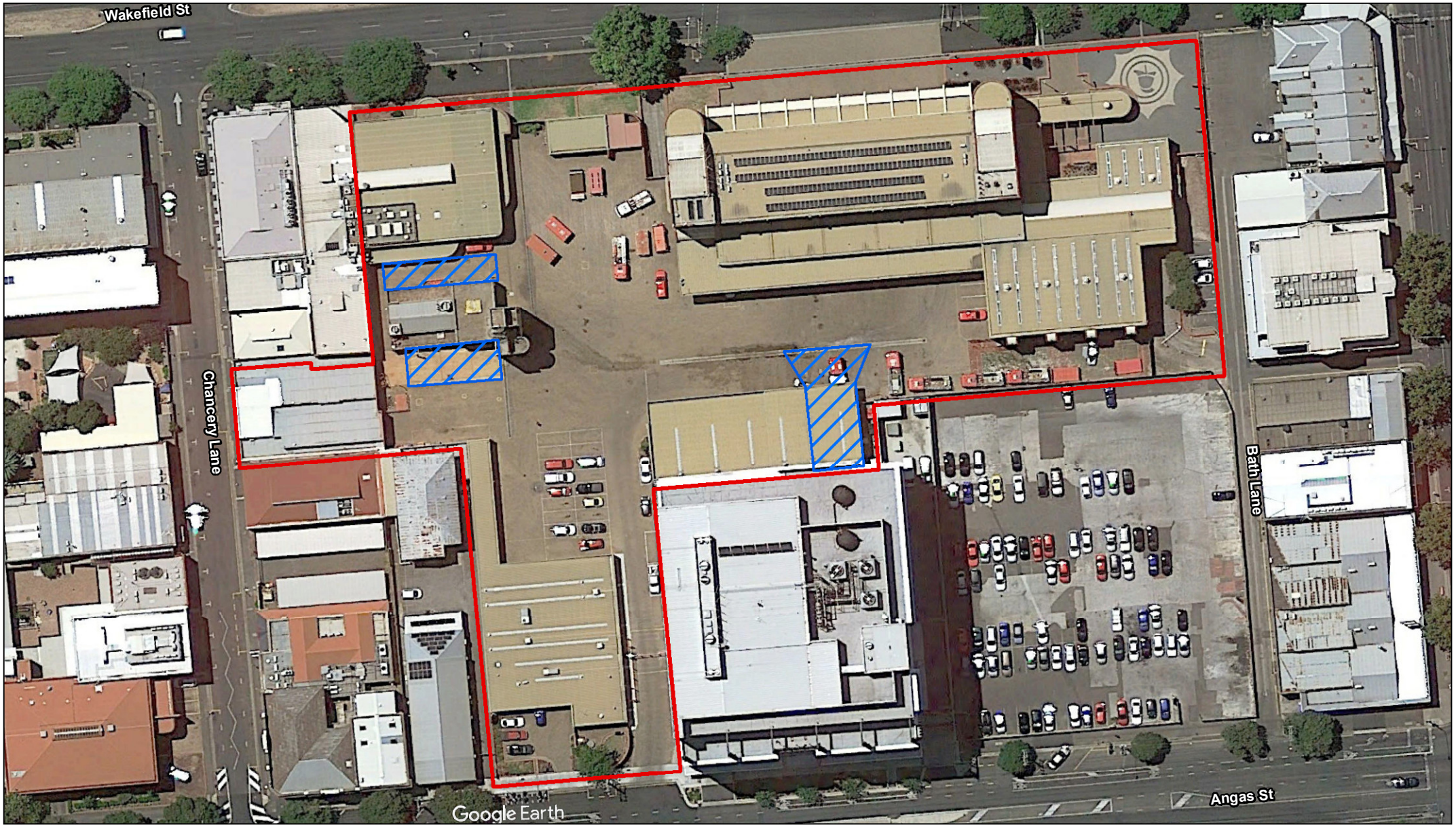
Adelaide Fire Station
Site Layout

Figure 2

N:\AU\Adelaide\Projects\33\18366\GIS\Maps\Deliverables\Adelaide Fire Station\33_18366_Z002_ADELAIDE_SiteLayout.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: Imagery - Google Earth (Image Extracted: 1/11/2016); Streets - DPTI. Created by:mweber



Paper Size A4

0 3.5 7 14 21 28

Metres

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

N

LEGEND

Site Boundary

Areas of Potential Contamination

SA Metropolitan Fire Service
Preliminary Site Investigation
99 Wakefield Street Adelaide SA 5000

Job Number 33-18366
Revision A
Date 21 Nov 2016

Adelaide Fire Station
Areas of Potential Contamination

Figure 3

N:\AU\Adelaide\Projects\33\18366\GIS\Maps\Deliverables\Adelaide Fire Station\33_18366_Z003_ADELAIDE_AOC.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: Imagery - Google Earth (Image Extracted: 1/11/2016); Streets - DPTI. Created by:mweber

A4 size paper

0 15 30

Scale (metres)

LEGEND

- Site boundary
- Areas of potential release of PFAS
- PFAS storage area (historical)
- Surface water drainage from site

N

SA MFS
Adelaide Fire Station, PFAS Investigation
99 Wakefield Street, Adelaide 5000

Conceptual Site Model

Job Number	33-18366
Revision	A
Date	31 Oct 2016

Figure 4

GHD\Launceston\Projects\33\18366\3318366_LTN_02.cdr

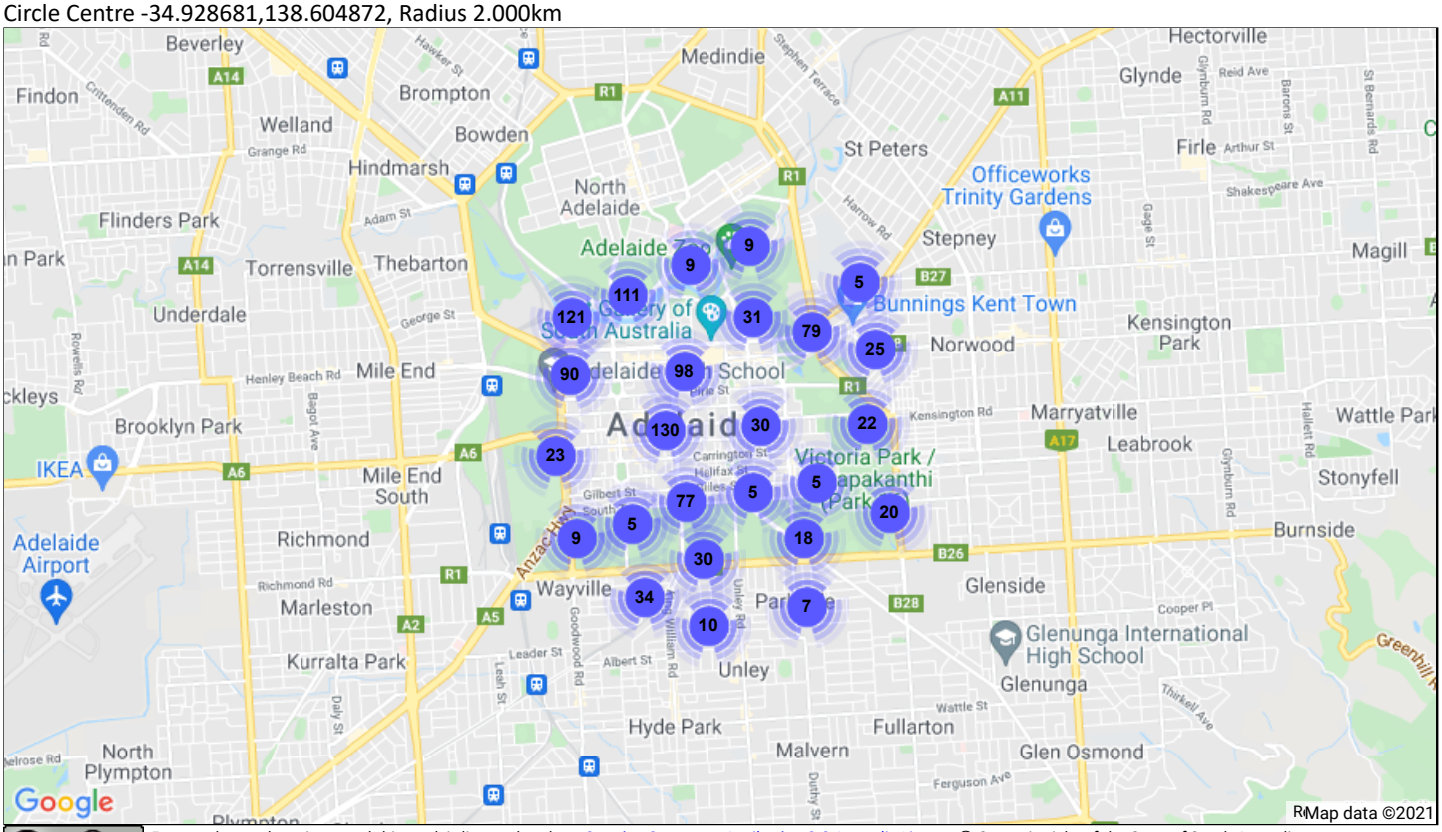
Appendices

Appendix A

Registered Bore Search

Government of South Australia WaterConnect

Circle Centre -34.928681,138.604872, Radius 2.000km



WaterConnect

Groundwater Data Report

Government of South Australia
Department for Environment and Water

Circle Centre -34.928681,138.604872, Radius 2.000km

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-2	01/11/1934	9.14	9.14	2470	19/11/1934	Qa											
6628-3		12.19	12.19	956	29/01/1935	Qa	7.62	29/01/1935	9.47	29/01/1935	ABD						
6628-4		11.58	11.58			Qa											
6628-5	12/12/1881	125.27	125.27	1671	12/12/1881	N	13.11	12/12/1881									
6628-6	01/10/1914	6.86	6.86	942	01/10/1949	Qa	3.66	01/10/1949	3.79	01/10/1949							
6628-7		6.71	6.71			Qa											
6628-33	28/02/1963	21.31	21.31														
6628-80		29.87	29.87														
6628-82	01/01/1915	31.7	31.7				31.09	01/01/1915									
6628-84		18.29	9.52	1760	27/01/1967	Qpah	4.98	27/01/1967									
6628-85		6.4	6.4	2780	27/01/1967	Qpah	4.57	27/01/1967	2.02	27/01/1967							
6628-86	15/06/1934	21.34	21.34	2385	23/07/1934	Qpah	10.67	17/07/1934	6.31	17/07/1934							
6628-98		6.71	6.71	1257	09/10/1914	Qpah											
6628-99	01/06/1938	30.33	30.33	785	18/06/1938	Qpac	9.14	18/06/1938	3.79	18/06/1938	BKF						
6628-100		10.06	10.06	1499	10/12/1914	Qpah						N	N				
6628-101		15.24	15.24	1100	28/10/1914	Qpah											
6628-108	08/11/1967	12.8	11.58	1658	21/03/2006	Qa	6.4	08/11/1967	4.42	07/11/1967	OPR			9.96	RCL		
6628-113		60.96	60.96	1971			3.1										
6628-114	10/09/1935	28.35	28.35						0.88	10/09/1935	OPR			19.07	DRN		
6628-129											NL						
6628-137	30/10/1975	16.46	16.46	1005	31/10/1971	Qa	7.62	31/10/1975	4	31/10/1975	OPR			11.58	RCL		
6628-138				1742	02/10/1914	Qa											
6628-139				1299	20/10/1914	Qa											
6628-140				1213	06/03/1914	Qa											
6628-141				1271	02/10/1944	Qa											
6628-143	01/01/1964	13.72	13.72	350	05/04/1976	Qpah			2.5	01/01/1976				13.72	OBS		
6628-144	01/01/1955	39.62	0						0.76	01/01/1976	BKF					282363	
6628-145	01/01/1971	22.86	22.86	1245	15/01/1992	Qpah	7.95	21/09/1991			NIU	H	N	22.86			ADE051
6628-162	19/08/1947	51.21	0	1385	19/08/1947	Qa	9.3	19/08/1947	4.42	19/08/1947	BKF						
6628-201	22/02/1968	112.78	112.78			Tes(T3-4)	17.37	22/02/1968	0.25	22/02/1968	ABD						
6628-202	01/01/1972	121.92	69	1496	30/01/1990	Tes(T3-4)	17.16	14/03/1997	11.37	25/10/1972		H	H	42.67	OBS		ADE089
6628-224	01/01/1915	137.77	137.77				24.38	03/03/1915									
6628-225	01/03/1915	52.43	52.43				19.81	03/03/1915	1.26	03/03/1915							
6628-226	01/02/1915	30.48	30.48				3.66	03/03/1915									
6628-227	01/07/1939	23.77	23.77	2798	01/07/1939	Qpac(Q4)											
6628-228	01/03/1938	21.34	21.34	3184	31/03/1938	Qpac(Q4)	17.98	01/03/1938									
6628-229	01/05/1938	22.86	22.86	2984	01/05/1938	Qpac(Q4)	19.81	01/05/1938									

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-230	01/01/1905	83.82	83.82	1856	16/11/1914		17.98	16/11/1914	3.16	16/11/1914							
6628-232	01/01/1921	15.24	15.24						1.64	01/01/1921							
6628-233		17.07	17.07														
6628-235	19/06/1914	27.43	27.43	1456	19/06/1914	Tes(T3-4)	21.34	19/06/1914	1.52	19/06/1914							
6628-236		20.88	20.88			Qpah	19.51		1.01						DRN		
6628-237		32.61	32.61												DRN		
6628-240		19.36	19.36			Qpah	15.54		4.55						DRN		
6628-244		21.03	21.03	882	01/06/2002	Qpah	19.51		1.01						DRN		
6628-245		22.1	22.1			Qpah	19.05		3.41						DRN		
6628-246	01/01/1936	9.14	9.14	2390	27/07/1967	Qpah									DRN		
6628-247		22.86	22.86			Qpah	20.12		3.03						DRN		
6628-248	24/03/1960	21.95	21.95												DRN		
6628-278	04/11/1966	24.38	24.38			Qpah	16.15	04/11/1966	0.51	04/11/1966				21.34	DRN		
6628-279	06/09/1966	24.38	24.38			Qpah	17.98	06/09/1966						19	DRN		
6628-280	25/10/1966	24.38	24.38			Qpah	18.59	25/10/1966	0.57	25/10/1966				20.73	DRN		
6628-287	27/10/1914	34.14	34.14				18.29	27/10/1914	1.26	27/10/1914							
6628-291	10/03/1970	36.42	36.42								WWT			29.26	DRN		
6628-300	03/10/1934	23.09	23.09	1014	06/06/2006	Qpah			0.51	03/10/1934							
6628-313	12/04/1965	21.34	21.34			Qpah	16.76	12/04/1965							DRN		
6628-315	04/05/1965	22.86	22.86			Qpah	16.61	04/05/1965	0.45	04/05/1965				18.77	DRN		
6628-316	15/04/1965	10.67	10.67												DRN		
6628-317	22/04/1965	21.34	21.34			Qpah	16.76	22/04/1965							DRN		
6628-318	31/05/1965	21.34	21.34			Qpah	16.46	31/05/1965						19.41	DRN		
6628-319	25/05/1965	23.47	23.47			Qpah	16.46	25/05/1965	0.45	25/05/1965				19.2	DRN		
6628-320	17/05/1965	21.34	21.34			Qpah	16.76	17/05/1965	0.45	17/05/1965				18.69	DRN		
6628-321	11/05/1965	22.86	22.86			Qpah	16.56	11/05/1965	0.45	11/05/1965				19.2	DRN		
6628-322	03/06/1965	6.1	6.1												DRN		
6628-323	03/06/1965	6.1	6.1												DRN		
6628-324	01/06/1965	6.1	6.1												DRN		
6628-325	02/06/1965	6.4	6.4												DRN		
6628-326	05/05/1965	4.88	4.88												DRN		
6628-327	07/05/1965	7.01	7.01												DRN		
6628-328	14/05/1965	6.1	6.1												DRN		
6628-329		18.82		171	01/01/1934	Qpah									DRN		
6628-330		21.59		4426	01/01/1935	Qpah									DRN		
6628-331	07/04/1965	21.34	21.34			Qpah	16.46	07/04/1965	0.03	07/04/1965					DRN		
6628-332	04/06/1965	6.1	6.1												DRN		
6628-333	07/06/1965	6.1	6.1												DRN		
6628-334	08/06/1965	6.1	6.1												DRN		
6628-335	08/06/1965	6.1	6.1												DRN		
6628-336	10/06/1965	6.1	6.1												DRN		
6628-337	09/06/1965	6.1	6.1												DRN		

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-338	11/06/1965	9.4	9.4			Qpah	4.88	11/06/1965			BKF				DRN		
6628-339	15/06/1965	12.8	12.8			Qpah	2.59	15/06/1965			BKF				DRN		
6628-340	16/06/1965	0.61	0.61												DRN		
6628-341		33.53	33.53														
6628-346	24/11/1914	43.59	43.59	929	24/11/1914												
6628-349		11.58	11.58	10839	03/11/1914	Qpah											
6628-350	09/10/1914	10.67	10.67			Qpah	9.75	09/10/1914			ABD						
6628-367	16/06/1965	12.8	12.8												DRN		
6628-368	13/09/1976	113	113	2802	29/09/1976	Tes(T3-4)	40	13/09/1976			BKF				OBS	186	
6628-405		9.75	9.75	1213	13/12/1935	Qa	6.71	13/12/1935									
6628-406		8.53	8.53	1056	15/09/1914	Qa											
6628-419	01/01/1914	10.36	10.36	2130	16/10/1914	Qa											
6628-420	01/01/1919	40.84	40.84											21.77	DRN		
6628-439	02/08/1966	5.79	5.79														
6628-452	29/01/1959	17.07	17.07			Tomw(T1)	14.33	29/01/1959	0.45	29/01/1959	OPR			12.6	DRN		
6628-480	09/03/1966	9.6	9.6			Qpah	7.62	09/03/1966						9.6	DRN		
6628-481	10/03/1966	9.14	9.14			Qpah	8.38	10/03/1966						9.14	DRN		
6628-488	28/03/1966	9.45	9.45			Qpah	7.92	28/03/1966						9.45	DRN		
6628-489	29/03/1966	10.06	10.06			Qpah	8.53	29/03/1966							DRN		
6628-490	01/04/1966	8.53	8.53			Qpah	7.92	01/04/1966							DRN		
6628-491	14/03/1966	6.71	6.71			Qpah	5.18	14/03/1966						6.71	DRN		
6628-492	31/03/1966	10.06	10.06			Qpah	8.69	31/03/1966							DRN		
6628-493	01/01/1904	40.84	40.84	1270	01/01/1939									21.03	DRN		
6628-494		18.29	18.29														
6628-495		33.53	33.53														
6628-506	16/06/1965	0.61	0.61												DRN		
6628-514	01/01/1912																
6628-515	07/10/1926	29.57	29.57														
6628-527																	
6628-529																	
6628-530																	
6628-531																	
6628-532																	
6628-533																	
6628-534				1351	06/12/2000												
6628-535											NL						
6628-536																	
6628-543	04/03/1976	6.7	6.7											6	DRN		
6628-544	16/03/1976	8.53	8.53											8.23	DRN		
6628-545	23/03/1976	5.18	5.18											5	DRN		
6628-546	03/04/1976	9.14	9.14											9	DRN		
6628-551	01/01/1949	141.73	141.73	1671	01/01/1949	Toc(T2)	17.07	01/01/1949	1.89	01/01/1949	UKN			71.32			

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-552	01/09/1934	32	32	800	25/10/1954		8.84	25/10/1954	2.53	01/09/1934	OPR			18.29	TWS		
6628-553	04/08/1913	40.23	40.23	742	18/11/1914		18.29	18/11/1914									
6628-554		135	135	1224	24/09/2015	Tes(T3-4)	18.15	09/03/2021	0.83	27/03/1983		C	C	132	OBS	92469	ADE059
6628-555		29.26	29.26	1166	19/08/2001	Tomw(T1)					OPR			18.29	IRR		
6628-556		6.1	6.1	736	23/03/2005	Qpah	1.98	28/07/1970									
6628-558		9.75	9.75	800	21/11/1967	Qpah	7.92	21/11/1967									
6628-559		6.1	6.1	3385	24/01/1968	Qpah											
6628-568		4.88	4.88	3242	03/09/1958	Qpah	3.35	03/09/1958									
6628-569		3.35	3.35	1699	01/01/1959	Qpah	1.52	01/01/1959									
6628-570				4883	30/09/1914	Qpah											
6628-571		7.62	7.62	385	30/09/1914	Qpah											
6628-572		52.43	52.43	757	13/11/1914	T(T1)	14.33	13/11/1914	1.51	13/11/1914							
6628-573		6.1	0	2271	26/10/1914	Qpah					BKF						
6628-574		6.1	6.1	3570	28/08/1914	Qpah											
6628-575	22/09/1914	7.31	7.31			Qpah	5.18	22/09/1914	0.19	22/09/1914							
6628-576	09/09/1914	7.77	7.77			Qpah	5.18	09/09/1914	0.15	09/09/1914							
6628-577	01/01/1934	9.14	7.31	2030	20/11/1967	Qpah	3.66	20/11/1967									
6628-578	14/03/1914	7.31	7.31	1985	26/03/1914	Qpah	3.35	26/03/1914	0.32	26/03/1914							
6628-601	01/01/1934	30.48	0	1442	18/10/1945	Qpac	7.62	18/10/1945			BKF						
6628-602		15.24	15.24	1985	27/11/1914	Qpah											
6628-603		10.36	10.36	1514	12/01/1915	Qpah											
6628-604	01/01/1915	95.1	95.1	971	15/01/1915	Toc(T2)	18.29	15/01/1915									
6628-605	06/05/1968	27.43	0	1105	18/12/1974	Qpah(Q1)	7.05	21/11/1979	2.27	06/05/1968	BKF	H	H				ADE026
6628-606		20.73		1318		Qpah			1.51		OPR			16.46	DRN		
6628-607		21.03	21.03						7.58		OPR				DRN		
6628-608		22.25	22.25			Qpah	17.98										
6628-609		63.7	63.7														
6628-610		32	0								BKF						
6628-611		32.92	32.92								OPR				DRN		
6628-613	01/01/1908	21.34															
6628-614		60.96	60.96								ABD				DRN		
6628-633		42.67	42.67	1157	01/01/1962	Qpah											
6628-634				1160	01/01/1962												
6628-635		22.9		5118	25/07/1975	Qpah	13.7	25/06/1975	0.06	25/06/1975							
6628-636				4869	13/11/1914	Qpah											
6628-637		10.36	10.36	5155	16/10/1914	Qpah											
6628-638		10.06	10.06	3584	20/10/1914	Qpah											
6628-640	22/10/1962	26.52	26.52	8482	22/10/1962	Qpah	11.43	18/01/1963	0.3	18/01/1963	OPR			26.52	DRN		
6628-641		22.86	22.86	1656	08/06/1939		12.19	08/06/1939			OPR				DRN		
6628-642		26.12	26.12								ABD				DRN		
6628-643	19/09/1914	31.85	31.85	1485	19/09/1914		18.29	09/10/1914	0.63	09/10/1914							
6628-647		18.59	0	1685	06/11/1914	Qpah					BKF						

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-648		8.23	8.23														
6628-654		18.9	0	1128	17/10/1934	Qpah	8.53	17/10/1934			BKF						
6628-655		12.19	12.19	1885	20/11/1914	Qpah											
6628-656		9.14	9.14	1499	19/11/1914	Qpah											
6628-704		55	55	1995	17/09/1996	Toc(T2)	15.75	21/09/1991				H	H				ADE091
6628-705		23.47	23.47	3817	06/10/1914	Qpah	15.24	06/10/1914									
6628-706				2713	20/01/1937	Qpah											
6628-707	01/09/1934	11.58	11.58	742	13/09/1934	Qpah	8.53	13/09/1934									
6628-708		44.81	44.81	2860	13/10/1914												
6628-709	01/10/1914	14.94	14.94	2860	01/10/1914	Qpah	8.23	01/10/1914									
6628-710	01/01/1954	11.28	11.28	2044	03/12/1956	Qpah	4.88	14/06/1955						10.97			
6628-711		9.14	9.14	2545	28/10/1914	Qpah											
6628-712	01/09/1934	9.45	9.45	2313	24/08/1945	Qpah	6.4	24/08/1945									
6628-713				2216	09/10/1934	Qpah											
6628-714		18	18	2356	05/11/1934	Qpah											
6628-718		12.19	12.19	2030	12/02/1968	Qpah	5.49	12/02/1968	1.14	12/02/1968				12.19			
6628-732	02/07/1976	123	26	2835	10/07/1998	Tomw(T1)		18/03/2001				H	H	26	OBS		ADE033
6628-762		9.14	9.14	2159	16/11/1914	Qa											
6628-6881	28/03/1978	100	0	2404	28/03/1978	Teb	18	28/03/1978	0.38	28/03/1978	BKF			63.8		2798	
6628-11098															DRN		
6628-11099															DRN		
6628-11101	14/08/1979	15.06	11.7			Qpah	11.04	01/03/1980			ABD	H	N	8.9	INV		ADE052
6628-11102	13/09/1979	19.8	19.8			Qpah	18.05	01/03/1980				H	N		OBS		ADE053
6628-11103	13/09/1979	30	30			Toc(T2)	17.92	06/01/1984				H	N		OBS		ADE054
6628-11105	20/08/1979	31.65	31.65			Toct	19.09	06/01/1984			ABD	H	N		INV		ADE055
6628-11107	13/09/1979	22.25	22.25			Qpah	16.97	06/01/1984				H	N		OBS		ADE056
6628-11108	13/09/1979	19.2	19.2			Qpah	16.96	06/01/1984				H	N		OBS		ADE057
6628-11113	02/08/1979	16	16	994	16/11/1982	Qpah	11.76	08/08/1982				H	H		OBS		ADE058
6628-11489	30/06/1978	28		1272	30/06/1978	Qa	6.7	13/08/1980	3.18	13/08/1980	OPR				IRR	3884	
6628-11490	11/04/1972	18.3	17.37	1250	08/03/1988	Qa	6.66	21/09/1991	3.56	13/08/1980		H	H	10.7	OBS		ADE063
6628-11726	11/05/1981	17.5	17.5	1804	11/05/1981	Qpah	15	11/05/1981			OPR			17.5	DRN	8778	
6628-11727	13/05/1981	17	17	1810	12/05/1981	Qpah	14.5	13/05/1981			OPR			17	DRN	8779	
6628-11728	13/05/1981	16	16	1832	12/05/1981	Qpah	13.5	13/05/1981			OPR			16	DRN	8780	
6628-11729	13/05/1981	16.5	16.5	1832	13/05/1981	Qpah	14	13/05/1981			OPR			16.5	DRN	8781	
6628-11730	13/05/1981	16	16	1832	12/05/1981	Qpah	13.5	13/05/1981			OPR			16	DRN	8782	
6628-11731	12/05/1981	18	18	1832	12/05/1981	Qpah	15.5	12/05/1981			OPR			18	DRN	8783	
6628-11732	13/05/1981	19	19	1804	13/05/1981	Qpah	16.5	13/05/1981			OPR			19	DRN	8784	
6628-11733	13/05/1981	19	19	1804	13/05/1981	Qpah	16.5	13/05/1981			OPR			19	DRN	8785	
6628-11734	13/05/1981	19	19	1804	13/05/1981	Qpah	16.5	13/05/1981			OPR			19	DRN	8786	
6628-11735	13/05/1981	14.5	14.5	1810	13/05/1981	Qpah	12	13/05/1981			OPR			14.5	DRN	8787	
6628-11736	13/05/1981	19	19	1810	13/05/1981	Qpah	16.5	13/05/1981			OPR			19	DRN	8788	
6628-11737	13/05/1981	19.5	19.5	1815	13/05/1981	Qpah	17	13/05/1981			OPR			19.5	DRN	8789	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-11738	14/05/1981	16.5	16.5	1821	14/05/1981	Qpah	14	14/05/1981			OPR			16.5	DRN	8790	
6628-11739	14/05/1981	19	19	1776	14/05/1981	Qpah	17.5	14/05/1981			OPR			19	DRN	8791	
6628-11740	14/05/1981	15	15	1776	14/05/1981	Qpah	12.5	14/05/1981			OPR			15	DRN	8792	
6628-11741	14/05/1981	15	15	1776	14/05/1981	Qpah	12.5	14/05/1981			OPR			15	DRN	8793	
6628-11742	14/05/1981	15	15	1788	14/05/1981	Qpah	12.5	14/05/1981			OPR			15	DRN	8794	
6628-11743	15/05/1981	19	19	1776	15/05/1981	Qpah	16.5	15/05/1981			OPR			19	DRN	8795	
6628-11744	15/05/1981	15	15	1776	15/05/1981	Qpah	12.5	15/05/1981			OPR			15	DRN	8796	
6628-11745	15/05/1981	15	15	1776	15/05/1981	Qpah	12.5	15/05/1981			OPR			15	DRN	8797	
6628-11746	15/05/1981	15.1	15.1	1776	15/05/1981	Qpah	12.5	15/05/1981			OPR			15	DRN	8798	
6628-11753		12.55	12.55	882	03/09/1981	Qpah	6.35	03/09/1981			ABD						
6628-11754		5.25	5.25	1552	03/09/1981	Qpah(Q1)	5.82	06/01/1984			ABD	H	H		OBS		ADE099
6628-12542	11/11/1983	15	15				7.6	11/11/1983	1.26	11/11/1983	OPR				IRR		
6628-12882	23/03/1984	8.5	8.5								BKF				OBS	93472	
6628-12883	26/03/1984	8	8								BKF			3	OBS	93473	
6628-12884	26/03/1984	3	3								BKF			3	OBS	93474	
6628-12885	26/03/1984	1.5	1.5								BKF				OBS	93475	
6628-12886	26/03/1984	1.5	1.5								BKF				OBS	93476	
6628-12887	26/03/1984	3	3								BKF			3	OBS	93477	
6628-12888	27/03/1984	4	4								BKF				OBS	93478	
6628-12889	27/03/1984	3	3								BKF			3	OBS	93479	
6628-12890	27/03/1984	6	6								BKF				OBS	93480	
6628-12891	28/03/1984	3	3								BKF				OBS	93481	
6628-12892	28/03/1984	3	3								BKF				OBS	93482	
6628-12893	28/03/1984	4	4								BKF				OBS	93483	
6628-12924	14/02/1984	27	27	1160	14/02/1984	Qpac	5.4	14/02/1984	1.38	14/02/1984	OPR			17.5	TWS	13790	
6628-12925	13/02/1984	94.4	15.5	1306	11/02/1984	Qpah	8.4	13/02/1984	0.75	13/02/1984	OPR			11	TWS	13789	
6628-13126	20/11/1984	8	8	1418	20/11/1984	Qpah			0.45	20/11/1984	OPR			8	DRN	15596	
6628-13227	01/01/1985	9	9								OPR			9	DRN	15892	
6628-13242	15/01/1985	11	11	1272	14/01/1985	Qpah	6.7	15/01/1985	0.63	15/01/1985	OPR			11	DOM	15838	
6628-13307	16/04/1985	19	18	1199	25/09/2014	Qa	4.47	03/03/2021	3	16/04/1985	OPR	C	C	16.5	OBS	94001	ADE185
6628-13444	29/11/1984	160	160			Tomw(T2)	20	29/11/1985	2					29		14718	
6628-13528	22/11/1985	18	18			Qa	5	22/11/1985	0.5	22/11/1985				13	EXP	94201	
6628-13529	27/11/1985	18	18	1334	27/11/1985	Qa	5	12/12/1985	1	27/11/1985				11	OBS	94202	
6628-13943	03/03/1987	11.5	11.5	1390	12/05/1987	Qpah	6	12/05/1987	0.44	03/03/1987				11.5		19168	
6628-14078	01/01/1980	12.25	12.25			Qpah	0		0					0	OBS		
6628-14079	01/01/1980	10.1	10.1			Qpah	0		0					0	OBS		
6628-14080	01/01/1980	10.1	10.1			Qpah	0		0					0	OBS		
6628-14081	01/01/1980	9.6	9.6			Qpah	0		0					0	OBS		
6628-14082	01/01/1980	9.9	9.9			Qpah	0		0					0	OBS		
6628-14083	01/01/1980	7.7	7.7			Qpah	0		0					0	OBS		
6628-14084	01/01/1980	7.15	7.15			Qpah	0		0					0	OBS		
6628-14085	01/01/1982	9.7	9.7			Qpah	0		0					0	OBS		

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-14287	22/07/1988	17	17	2234	25/09/2001	Qpah	0	19/10/1988	1	22/07/1988	OPR			17	DOM	21362	
6628-15257	10/05/1990	30	0			Qa	7.2	10/05/1990			BKF					24176	
6628-15330	08/06/1990	17.4	17.4	1407	08/06/1990	Qa	7	08/06/1990	3	08/06/1990				17.4		24176	
6628-15664	19/10/1991	15	15	1049	19/10/1991	Qpah	5.2	19/10/1991			OPR			15	DOM	26311	
6628-15709	17/10/1991	16.7	16.7	1178	17/10/1991	Qpah	7.1	17/10/1991	2.75	17/10/1991	OPR			16.7	DOM	26081	
6628-15726	09/11/1991	54	54	972	08/11/1991	Toc(T2)	12.5	09/11/1991	2.5	09/11/1991	OPR			47	RCL	95663	
6628-15727	20/09/1991	13.8	13.8			Qpah	6.1	20/09/1991	0.75	20/09/1991	OPR			13.8	DOM	25887	
6628-15783	27/11/1991	12	12	1861	27/11/1991	Qpah	3.1	27/11/1991	1	27/11/1991	OPR			12	RCL	25196	
6628-16014	14/02/1992	16	0	989	23/06/1992	Qpac	5.7	23/06/1992			ABD			13	DOM	57114	
6628-16087	29/07/1992	16.76	16.76	1894	30/07/1992	Qa					OPR			16.76	REC	27905	
6628-16182	09/09/1992	92	92								BKF					27701	
6628-16183	09/09/1992	24	0	1851	09/09/1992	Qa	2.3	09/09/1992	0.5	09/09/1992	BKF					27701	
6628-16184	10/09/1992	20	20	1765	09/09/1992	Qa	1.7	10/09/1992	1.6	10/09/1992	OPR			8	TWS	27701	
6628-16364	17/12/1992	15	15	1010	06/01/1993	Qpah								15	DOM	27539	
6628-16453	14/09/1993	21	21	1917	29/09/1993	Qpah			0.2	14/09/1993				21	DRN	29973	
6628-16636	19/11/1993	16	16	337	29/03/1994	Qpah			1.2	19/11/1993				16	DOM	28637	
6628-16727	19/07/1994	39.1	0								BKF				INV	32173	
6628-16728	21/07/1994	40.4	40.4			Tes(T3-4)								36	INV	32174	
6628-16817	13/07/1994	40	0								BKF				INV	32171	
6628-16818	15/07/1994	39	0								BKF				INV	32172	
6628-16973	19/01/1995	24	24	1597	19/01/1995	Qpah								24	DOM	33495	
6628-17121	29/01/1995	6.2	6.2			Qpah								6.2	INV	34057	
6628-17122	29/01/1995	7	7			Qpah								7	INV	34058	
6628-17123	29/01/1995	8	8			Qpah								8	INV	34059	
6628-17124	28/01/1995	10	10			Qpah	4.3	28/01/1995						10	INV	34060	
6628-17125	29/01/1995	7.7	7.7			Qpah								7.7	INV	34061	
6628-17280	06/05/1994	21.6	21.6			Qpah								21.6	DRN	31584	
6628-17370	23/06/1995	22	22	1317	23/06/1995	Qpah			2	23/06/1995				22	DOM	35365	
6628-17483	22/09/1995	30	30	1575	22/09/1995	Qpah			0.5	22/09/1995				30	DOM	35833	
6628-17804	04/03/1996	24	24	1188	04/03/1996	Qpah			0.5	04/03/1996				24	DOM	36330	
6628-18011	10/06/1996	7.5	7.5												OBS	38022	
6628-18012	10/06/1996	7.2	7.2												OBS	38044	
6628-18266	28/10/1996	19.8	18	2238		Qa	8	28/10/1996	2	28/10/1996					ENV	37984	
6628-18268	16/10/1996	20	20			Tomw(T1)								16.5	OBS	39025	
6628-18269	16/10/1996	20	0								ABD				INV	39030	
6628-18270	17/10/1996	18.5	18.5											18.5	OBS	39027	
6628-18271	15/10/1996	20	0								ABD				INV	39028	
6628-18272	17/10/1996	18.2	0								ABD				INV	39029	
6628-18401	29/01/1996	22	22			Qpah	17	29/01/1996						22	OBS	36995	
6628-18402	30/01/1996	26	26			Qpah	21	30/01/1996						26	OBS	36996	
6628-18403	31/01/1996	23	23			Qpah	18	31/01/1996						23	OBS	36997	
6628-18415	06/08/1996	3.8	3.8			Qpah	3.32	06/08/1996						3.8	OBS	40777	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-18416	06/08/1996	3.8	3.8			Qpah	2.18	06/08/1996						3.8	OBS	40778	
6628-18417	20/03/1997	4.5	4.5											4.5	OBS	40779	
6628-18418	20/03/1997	4.5	4.5											4.5	OBS	40780	
6628-18419	20/03/1997	4.5	4.5											4.5	OBS	40781	
6628-18420	20/03/1997	3.5	3.5											3	OBS	40782	
6628-18512	10/04/1997	29	29	1776	10/07/1998	Qpah	10	10/04/1997	4	10/04/1997				21	INV	41076	
6628-18667	24/10/1997	9	9	1423	24/10/1997	Qa	4.7	24/10/1997						9	INV	42815	
6628-18670	22/10/1997	9	9	2892	22/10/1997	Qpah	0.5	22/10/1997						9	INV	42816	
6628-18671	23/10/1997	9	9	3046	23/10/1997	Qpah	2.83	23/10/1997						9	INV	42816	
6628-18672	05/11/1997	30	30	1496	03/03/2005	Tomw(T1)			2	05/11/1997	ABD			26	INV	41080	
6628-18673	05/11/1997	30	26											26	INV	41080	
6628-18674	05/11/1997	30	26											26	INV	41080	
6628-18675	05/11/1997	30	26											26	INV	41080	
6628-19033	01/11/1992	23	23	2200	01/11/1992	Qpah			3.79	01/11/1992				17		28176	
6628-19241	21/08/1998	15	15			Qpah	10.17	21/08/1998						9	MON	46120	
6628-19547	06/09/1996	7	7	1625	06/09/1996	Qa	3.15	16/09/1996						7	MON	38608	
6628-19548	05/09/1996	9	9	1205	05/09/1996		7.45	16/09/1996						9	MON	38610	
6628-19549	05/09/1996	10	10	1233	05/09/1996		7.79	16/09/1996						10	MON	38611	
6628-19550	05/09/1996	12.5	12.5				12.5	16/09/1996						12.5	MON	38612	
6628-19551	05/09/1996	15	15	1027	05/09/1996		12.52	16/09/1996						15	MON	38613	
6628-19552	05/09/1996	11	11	1804	05/09/1996	Qa	9.61	16/09/1996						11	MON	38614	
6628-19653	17/04/1999	10.8	10.8			Qpah	9.6	17/04/1999	0.02	17/04/1999				10.8	MON	48415	
6628-19654	17/04/1999	10.8	10.8			Qpah	9.6	17/04/1999	0.02	17/04/1999				10.8	MON	48540	
6628-19655	17/04/1999	10.8	10.8			Qpah	9.6	17/04/1999	0.02	17/04/1999				10.8	MON	48541	
6628-20105	23/12/1999	90	30	320	06/03/2005	Qpah	9	23/12/1999	2.5	23/12/1999				27	IRR	50384	
6628-20143	17/05/2000	10	10			Qpah	5.5	17/05/2000	0.01	17/05/2000				10	MON	52410	
6628-20242	13/04/2000	13	13											5	MON	52351	
6628-20243	13/04/2000	12	12											6	MON	52353	
6628-20244	13/04/2000	12	12											12	MON	52354	
6628-20245	17/04/2000	13	13											13	MON	52355	
6628-20246	20/04/2000	13	13											13	MON	52356	
6628-20252	27/05/2000	13	13											13	MON	53255	
6628-20256	29/06/2000	17	0			Qpah	14.5	29/06/2000			ABD				ENV	52890	
6628-20257	30/06/2000	21	0								BKF				ENV	52891	
6628-20258	01/07/2000	15	0								BKF				ENV	52892	
6628-20259	03/07/2000	19.5	0								BKF				ENV	52893	
6628-20260	04/07/2000	20	0								BKF				ENV	52894	
6628-20261	05/07/2000	20	0								BKF				ENV	52895	
6628-20262	05/07/2000	19	0								BKF				ENV	52896	
6628-20325	24/03/2000	12	12			Qpah	9.5	24/03/2000						5.75	MON	52358	
6628-20423	24/08/2000	15.3	15.3			Qpah	11.38	24/08/2000						15	INV	53485	
6628-20424	25/08/2000	23	23			Qpah	17.33	25/08/2000						22.5	INV	53484	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-20425	25/08/2000	20	20			Qpah	17	25/08/2000						20	INV	53486	
6628-20664	09/07/2001	17.5	17.5	2358	24/08/2001	Qpah	3	09/07/2001	0.75	09/07/2001				17.5	DRN	55698	
6628-20686	15/06/2001	154	150	2290	15/06/2001	Nnt								152	MON	55431	
6628-20795	22/12/2001	22.5	20.5	1005	21/12/2001	Qpac	7	22/12/2001	1	22/12/2001				20.5	DOM	57113	
6628-20981	30/06/2002	3	3			Qpah									DRN	58670	
6628-20983	30/06/2002	3	3			Qpah									DRN	58669	
6628-21102	14/10/2002	18	18			Qpah	10	14/10/2002						13	DRN	59676	
6628-21139	19/02/2002	17	17	1457	19/02/2002	Qpah	4	19/02/2002	0.8	19/02/2002				6	DOM	57081	
6628-21176	30/09/2002	25	25			Qpah	19.66	30/09/2002						16.9	MON	59191	
6628-21230	07/01/2003	11	11			Qpah	8	07/01/2003						11	MON	60544	
6628-21370		12	12			Qpah	10.6	14/03/2003	0.01	14/03/2003				9	MON	61445	
6628-21371	14/03/2003	12	12			Qpah	10.6	14/03/2003	0.01	14/03/2003				9	MON	61446	
6628-21372	14/03/2003	12	12			Qpah	10.6	14/03/2003	0.01	14/03/2003				6	MON	61447	
6628-21373	14/03/2003	12	12			Qpah	10.6	14/03/2003	0.01	14/03/2003				9	INV	61448	
6628-21374	14/03/2003	12	12			Qpah	10.6	14/03/2003	0.01	14/03/2003				9	MON	61449	
6628-21423	01/08/2003	4	4			Qpah	1	01/08/2003						1	MON	62298	
6628-21424	01/08/2003	13.2	13.2			Qpah	8	01/08/2003						10	MON	62297	
6628-21425	01/08/2003	5.4	5.4			Qpah	3	01/08/2003						2.4	MON	62296	
6628-21525	19/09/2003	18	18			Qpah	15.8	19/09/2003	0.01	19/09/2003				15	MON	63333	
6628-21526	09/09/2003	18	18			Qpah	16.2	09/09/2003	0.01	09/09/2003				13.5	INV	63209	
6628-21566	13/11/2003	78	78	2138	10/01/2019	Tes(T3-4)	30	13/11/2003	7.8	13/11/2003				60	IRR	63762	
6628-21704		12	12			Qpah	7.07	09/06/2004						4.5	MON	65798	
6628-21866		19	0			Qpah					ABD					63887	
6628-21869	05/02/2004	18	18				17.5	05/02/2004						14.7	INV	64603	
6628-21870	24/11/2003	8	8			Qpah								3	INV	63944	
6628-21940	24/08/2004	21.9	0			Qpah	17.7	24/08/2004			BKF				MON	120237	
6628-21941	23/08/2004	20.3	19.5			Qpah	17.2	23/08/2004						16.4	MON	100822	
6628-21942	23/08/2004	19.2	0			Qpah	17	23/08/2004			BKF				MON	120238	
6628-21943	26/08/2004	19.6	0			Qpah	17.7	26/08/2004			BKF				MON	120236	
6628-21944	28/08/2004	22	19.7			Qpah	17.4	28/08/2004						16.6	MON	100828	
6628-21953	24/12/2004	22.4	22.4													104015	
6628-21954	23/12/2004	22.7	22.7													104016	
6628-21955	23/12/2004	26.55	26.55													104017	
6628-22020	23/02/2005	24.9	24.9											15.7		104592	
6628-22130	30/05/2005	12	0	8870	30/05/2005	Qpah	10.2	30/05/2005	0	30/05/2005	BKF					107282	
6628-22151	10/03/2005	224	192	2932	24/09/2015	N			8	10/03/2005	UKN			174	INV	102083	
6628-22152	08/03/2005	186	186	2460	02/10/2008	N	3.4	08/03/2005			NIU			115	MON	102084	ADE220
6628-22153	13/05/2005	128	128	13795	25/09/2014		0.4	09/03/2009			OPR	H	H		INV	101577	YAT134
6628-22178	05/07/2005	7	7	979	05/07/2005	Qa	3.8	05/07/2005						2.5	MON	108314	
6628-22179	05/07/2005	7	7	1337	05/07/2005	Qa	3.8	05/07/2005						2.5	MON	108316	
6628-22180	04/07/2005	7	7	1580	04/07/2005	Qa	3.8	04/07/2005						2.5	MON	108311	
6628-22181	04/07/2005	7	7	1434	04/07/2005	Qa	4	04/07/2005						2.5	MON	108313	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-22182	04/07/2005	7	7	1064	04/07/2005	Qa	4	04/07/2005						2.5	MON	108312	
6628-22183	05/07/2005	7	7	1031	05/07/2005	Qa	4	05/07/2005						2.5	MON	108317	
6628-22235	19/08/2005	11	11			Qpah	8.25	19/08/2005						8		109679	
6628-22243	18/07/2005	15	15					18/07/2005			DRY			12	MON	105758	
6628-22244	19/07/2005	21	21			Qpah	19	19/07/2005						17	MON	105759	
6628-22245	21/02/2005	15	15					21/02/2005			DRY			12	MON	105761	
6628-22246	20/07/2005	22	21			Qpac(Q4)	19	20/07/2005						18	MON	105762	
6628-22247	15/07/2005	22	0			Qpac(Q4)	19	15/07/2005			BKF				MON	141477	
6628-22259		15	15			Qpah	9	05/09/2005							MON	103299	
6628-22260	06/09/2005	20	20	2245	06/09/2005	Qpah	13	06/09/2005						11	MON	107946	
6628-22261	06/09/2005	19	19	2194	06/09/2005		13	06/09/2005						10	MON	107947	
6628-22265	11/08/2005	6	6			Qa								3	MON	109421	
6628-22266	11/08/2005	6	6			Qa								3	MON	109422	
6628-22267	12/08/2005	5.7	5.7			Qa									MON	109423	
6628-22268	11/08/2005	6	6			Qa								3	MON	109424	
6628-22269	11/08/2005	6	6			Qa								3	MON	109425	
6628-22270	12/08/2005	6	6			Qa								3	MON	109426	
6628-22271	12/08/2005	6	6			Qa								3		109427	
6628-22277	25/09/2005	30	24	1452	30/09/2005		11	25/09/2005	0.25	25/09/2005				24		110160	
6628-22278		60	50	1005	04/10/2005		13	29/09/2005	1.5	29/09/2005				42		110160	
6628-22336	21/10/2005	30	24	1384	20/10/2005	Tomw(T1)	12	21/10/2005	8	21/10/2005				17		111023	
6628-22581	09/06/2006	16	16			Qpah	14.9	09/06/2006						10	INV	119144	
6628-22619	26/07/2006	8.5	8.5			Qpah	5.2	26/07/2006						8.5	INV	119364	
6628-22620	26/07/2006	9	9			Qpah	5.2	26/07/2006						6	INV	119365	
6628-22621	27/07/2006	6.2	6.2			Qpah	3.6	27/07/2006						3.2	INV	119366	
6628-22622	06/09/2006	18	18			Qpah	15.25	06/09/2006						12	INV	122148	
6628-22623	06/09/2006	18	18			Qpah	15.12	06/09/2006						12	INV	122149	
6628-22652	14/09/2006	10.1	10.1			Qpah	9.1	14/09/2006						6.9	INV	122421	
6628-22653	21/11/2006	11	11			Qpah	9.25	21/11/2006						11	INV	122420	
6628-22654	20/11/2006	11	11			Qpah	9.1	20/11/2006						7.5	INV	122419	
6628-22663	03/11/2005	20	20			Qpah	19	03/11/2005						14	MON	111427	
6628-22747	09/02/2007	6	6				5.1	09/02/2007						3	INV	126967	
6628-22752	29/01/2007	7.1	7.1				4.5	29/01/2007						3.5		124569	
6628-22753	25/01/2007	7.1	7.1			Qpah	4	25/01/2007						2	INV	124570	
6628-22754	25/01/2007	7.5	7.5				4.8	25/01/2007						3.8	INV	124571	
6628-22755	25/01/2007	7.5	7.5				5	25/01/2007						4	INV	124572	
6628-22756	25/01/2007	9	9			Qpah	6.4	25/01/2007						5.4	INV	124575	
6628-22757	18/02/2007	9	9				6.4	18/02/2007						5.4	INV	122796	
6628-22758	29/01/2007	7	7				4.4	29/01/2007						3.5	INV	122797	
6628-22759	18/02/2007	9	9				6.4	18/02/2007						5.4	INV	122798	
6628-22760		7.3	7.3				4.4	29/01/2007						3.4	INV	122799	
6628-22897	31/05/2007	12	12			Qpah	8.3	31/05/2007						6	INV	130865	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-22898	31/05/2007	12	12			Qpah	8.2	31/05/2007						6	INV	130864	
6628-22963		16.6	0								BKF			16.6		116884	
6628-22964		16.1	0								BKF			16.1		122102	
6628-22965		15.3	0								BKF			15.3		119812	
6628-22966	21/11/2006	11	11			Qpah	9.1	21/11/2006						8	INV	124723	
6628-22967	21/11/2006	11	11			Qpah	9.1	21/11/2006						8	INV	124722	
6628-22968	21/11/2006	11	11			Qpah	9.2	21/11/2006						8	INV	124720	
6628-22969	22/11/2006	11	11			Qpah	9.1	22/11/2006						8	INV	124719	
6628-22970	22/11/2006	11	11			Qpah	9.2	22/11/2006						8	INV	124718	
6628-22971	22/11/2006	11	11			Qpah	9.1	22/11/2006						8	INV	124717	
6628-22972	22/11/2006	11	11			Qpah	9.2	22/11/2006						8	INV	124716	
6628-22973	23/11/2006	11	11			Qpah	9.2	23/11/2006						8	INV	124715	
6628-22974	23/11/2006	11	11			Qpah	9	23/11/2006						11	INV	124713	
6628-22975	24/11/2006	11	11			Qpah	9.3	24/11/2006						7	INV	124712	
6628-22976	24/11/2006	11	11			Qpah	9.1	24/11/2006						7	INV	128196	
6628-22977	24/11/2006	11	11			Qpah	9.3	24/11/2006						7	INV	128197	
6628-22978	24/11/2006	11	11			Qpah	9.3	24/11/2006						7	INV	128198	
6628-22995	09/01/2007	15.6	15.6			Qpah	15.5	09/01/2007						12.6	INV	126243	
6628-23080	19/07/2007	17.3	17.3											8.1	INV	133323	
6628-23101	21/03/2006	14.5	14.5				12.3	21/03/2006						6.5	INV	115431	
6628-23102	16/03/2006	10	10			Teb	6.4	16/03/2006						6	INV	115432	
6628-23103	15/03/2006	10	10			Qa	6.9	15/03/2006						6	INV	115433	
6628-23104	17/03/2006	5	5			Qpah	3.5	17/03/2006						2	INV	115434	
6628-23105	16/03/2006	10	10				7.3	16/03/2006						6	INV	115435	
6628-23106	15/03/2006	10.5	10.5				7.3	15/03/2006						6.2	INV	115436	
6628-23107	19/04/2006	10.5	10.5			Teb	7.3	19/04/2006						6	INV	116657	
6628-23259	21/01/2008	6	6			Qa	3.7	21/01/2008						3	INV	140498	
6628-23260	21/01/2008	6	6			Qa	3.7	21/01/2008						3	INV	140497	
6628-23491	09/10/2007	24	0								BKF				INV	136337	
6628-23492	11/10/2007	24	0								BKF					136338	
6628-23493	08/10/2007	22.5	0								BKF				INV	136258	
6628-23526		8.5	0								BKF					205643	
6628-23685	28/04/2008	24	21	1490	28/04/2008	Qpah	8	28/04/2008	0.2	28/04/2008				19		140362	
6628-23687	07/05/2008	26	22	1117	07/05/2008	Qpah	6	07/05/2008	0.7	07/05/2008				18		136182	
6628-23715	27/03/2008	18.3	18.3			Qpah	17.2	27/03/2008						15.2	INV	144571	
6628-23716	27/03/2008	19.5	19.5			Qpah	18	27/03/2008						16.5		144568	
6628-23717	26/03/2008	20	20			Qpah	18	26/03/2008						17		144572	
6628-23718	23/03/2008	20	20			Qpah	18	23/03/2008						14		144573	
6628-23719	26/03/2008	20	20			Qpah	18	26/03/2008						16	INV	144570	
6628-23731	07/12/2007	32	32	1839	07/12/2007	Qpac	17	07/12/2007	0.5	07/12/2007				17		130863	
6628-23757	04/03/2008	32	32	634	04/03/2008	Tomw(T1)	12	04/03/2008	1.2	04/03/2008				26	DRN	137447	
6628-23758	29/02/2008	36	36	611	29/02/2008	Tomw(T1)	12	29/02/2008	1.2	29/02/2008				30		137448	

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-23786	22/08/2008	19	19			Qpah	16	22/08/2008						13	INV	153089	
6628-23787	22/08/2008	19	19			Qpah	16	22/08/2008						13	INV	153090	
6628-23798	10/07/2008	14	14			Qpah	12	10/07/2008						8	INV	149098	
6628-23799	10/07/2008	14	14			Qpah	12	10/07/2008						8	INV	149097	
6628-23800	11/07/2008	14	14			Qpah	12	11/07/2008						8	INV	149096	
6628-23801	11/07/2008	14	14			Qpah	12	11/07/2008						8	INV	149095	
6628-23802	11/07/2008	14	14			Qpah	12	11/07/2008						8	INV	149094	
6628-23803	11/07/2008	14	14			Qpah	12	11/07/2008						8		149093	
6628-23865	18/12/2008	25	25	1799	04/02/2009	Qpah	12	18/12/2008	3	18/12/2008				18	INV	149998	
6628-23867	24/09/2008	26	26			Qpah	15	24/09/2008						18.5	INV	149997	
6628-24329	27/11/2008	17.5	17.5			Qpah	11	27/11/2008						15	INV	157810	
6628-24566	06/02/2009	130	130	3218	25/02/2009	Nnt	5.6	29/06/2012	15	29/06/2012	OPR			119.1	MAR	209799	
6628-24567	26/02/2009	183	173	2824	21/03/2013	Nnt	6.1	26/02/2009	12	26/02/2009	OPR			114	MAR	158341	
6628-24568	02/04/2009	15	15											9	INV	161312	
6628-24602	02/02/2009	14	14			Qpah	11.4	02/02/2009						14	INV	158647	
6628-24603	02/02/2009	14	14			Qpah	9.4	02/02/2009						8	INV	158648	
6628-24604	03/02/2009	14	14			Qpah	11.2	03/02/2009						8	INV	158649	
6628-24605	03/02/2009	14	14			Qpah	10.1	03/02/2009						8	INV	158650	
6628-24606	03/02/2009	14	14			Qpah								14	INV	158651	
6628-24607	04/02/2009	14	14			Qpah	8	04/02/2009						8	INV	158652	
6628-24608	04/02/2009	14	14			Qpah	11.4	04/02/2009						8	INV	158653	
6628-24609	04/02/2009	14	14			Qpah	11.3	04/02/2009						8	INV	158654	
6628-24610	05/02/2009	14	14			Qpah	11	05/02/2009						8	INV	158655	
6628-24611	05/02/2009	14	14			Qpah	10.8	05/02/2009						8	INV	158656	
6628-24612	05/02/2009	14	14			Qpah	11	05/02/2009						8	INV	158657	
6628-24624	06/03/2008	20.2	20.2												INV	143589	
6628-24717	06/09/2008	25	24	603	06/09/2008	Qpah	7.5	06/09/2008	0.67	06/09/2008				18		135666	
6628-24903	08/07/2008	20	20												INV	143591	
6628-24909	07/07/2008	20.1	20.1			Qpah									INV	143590	
6628-24914	29/09/2009	10	10			Qpah	8	29/09/2009						5	INV	181940	
6628-24927	07/10/2009	21	21											18	INV	182302	
6628-24928	06/10/2009	25	25											19	INV	182301	
6628-24929	08/10/2009	20.5	20.5											17.5	INV	182303	
6628-24932	14/08/2009	23	23			Qpah	16	14/08/2009						11	INV	170431	
6628-24933	14/08/2009	21	21			Qpah	17	14/08/2009						15	INV	170432	
6628-24934	17/08/2009	20	20			Qpah	16.5	17/08/2009						11	INV	170433	
6628-24935	17/08/2009	20	20			Qpah	16.5	17/08/2009						11	INV	170434	
6628-24938	20/05/2009	10	10			Qpah	5	20/05/2009						4		165399	
6628-24939	20/05/2009	10	10			Qpah	7	20/05/2009						7	INV	165400	
6628-24940	20/05/2009	10	10			Qpah	6	20/05/2009						5.5	INV	165401	
6628-25018	21/11/2009	5.5	5.5	1052	20/11/2009	Qa	2.4	22/12/2009						2.5	MON	181980	YAT145
6628-25019	23/11/2009	9.55	9.55	874	23/11/2009	Qa	6.65	22/12/2009						6.55	MON	181979	YAT146

Unit No	Date	Max Depth (m)	Latest Depth (m)	TDS (mg/L)	TDS Date	Aquifer	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	Status	SWL Status	Salinity Status	Cased To (m)	Purpose	Permit No	Obs No
6628-25020	23/11/2009	11.87	11.87	1754	23/11/2009	Qa	7.43	22/12/2009						8.87	MON	181978	YAT147

500 records

78 records

Appendix B

Groundwater Sampling Records

GHD CLIENTS|PEOPLE|PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 3319080	
Job Name:		Date: 20-07-2021	
GHD Representative: Vera Biermann		Arrival Time: 8.35	Departure Time: 12.00
Weather Conditions: (Please circle) Fine (Overcast) (Light Rain) Heavy Rain Other_____			
Works Being Undertaken: GME			

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Pantju Nam GHD			
Kelly Nam GHD			

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

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
GW103		Location GW103 was partially covered by a shipping container but still accessible for gauging & sampling
GW102 & GW104		accessible externally the other for wells use inside the MFS yard and require access/visitor cards

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:

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: 3319080	**Date:** 20, 07, 21
Job No.:	**Time:**
Location: Adelaide Station	**Sampler:** VB

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW101	–	12.529	–	
GW102	–	11.528	–	
GW103	–	12.097	–	well cap damaged
GW104	–	13.168	–	
GW105	–	12.120	–	
GW106	–	12.508	–	

Hydrasleeve Sampling Record

Project number:	32190880	Sampler initials	
Client:	MFS	PM initials	
Site location:	Adelaide Station		

Well ID	GW102	Depth to Groundwater (mBTOC)	11.528
Date	20-07-21	Depth to top of sampler (mBTOC)	≈15m
QC sample	FS03 FD03	Well depth (mBTOC)	18.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
9.35	6.74	20.8	12134	220.4	3.12

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no odour colour: pale brown High turbity, no sheen

Well ID	GW103	Depth to Groundwater (mBTOC)	12.097
Date	20-7-21	Depth to top of sampler (mBTOC)	~12.50
QC sample		Well depth (mBTOC)	14.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.20	6.75	20.6	13697	267.7	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no sheen. no odour pale yellow low turbidity well cap damaged

Well ID	GW106	Depth to Groundwater (mBTOC)	12.508
Date	20-7-21	Depth to top of sampler (mBTOC)	~~17.976~~ ≈15m
QC sample		Well depth (mBTOC)	17.97

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.51	6.65	20.7	11425	270.2	2.81

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	medium-high turbidity, no sheen, pale brown

Hydrasleeve Sampling Record

Project number:	32190 80	**Sampler initials**	VB
Client:	MFS	**PM initials**	DV
Site location:	Adelaide Station		

Well ID	GW 105	**Depth to Groundwater (mBTOC)**	12.120
Date	20 - 07 . 21	**Depth to top of sampler (mBTOC)**	≈ 14.00
QC sample		**Well depth (mBTOC)**	16.39

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10:00	6.75	19.6	9982	240.2	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no ~~odour~~ odour no sheen. clear low turbity

Well ID	GW101	**Depth to Groundwater (mBTOC)**	12.529
Date	20.07.21	**Depth to top of sampler (mBTOC)**	≈ 13.5
QC sample		**Well depth (mBTOC)**	14,9

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.15	7.01	21.0	~~670~~ 9645	271.5	2.9

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	. high turbidity . no sheen. . pale brown . no odour.

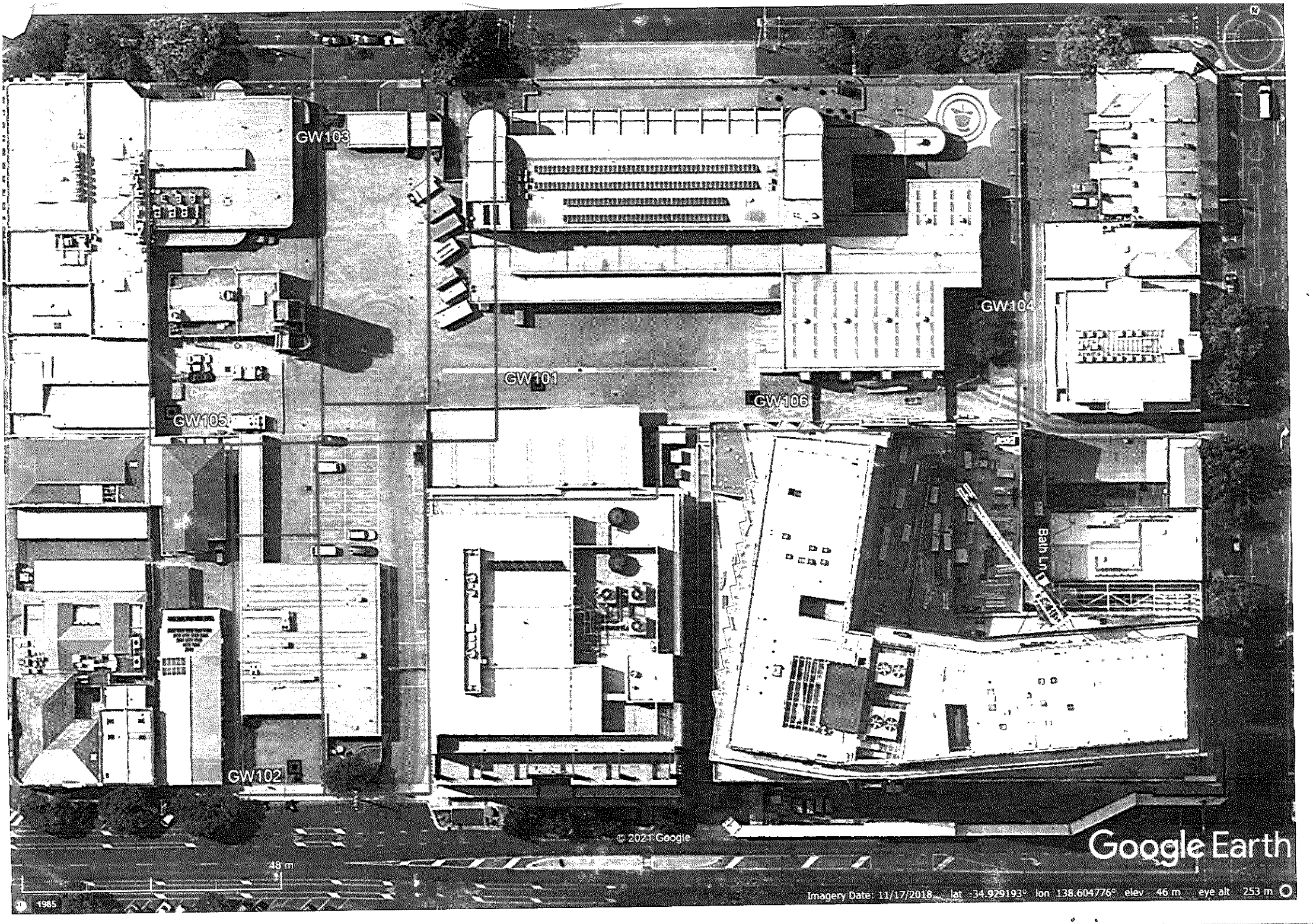
Well ID	GW104	**Depth to Groundwater (mBTOC)**	13.168
Date	20-07-21	**Depth to top of sampler (mBTOC)**	
QC sample	RB03 off IP ; FB03	**Well depth (mBTOC)**	16.60

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.36	~~20~~ 6.57	20.5	11480	281.4	~~2.47~~ 2.42

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	pale brown no sheen high turbidity no odour FB03 collected at end of sampling


GW103
GW104
GW101
GW106
GW105
GW102
Bath
© 2021 Google
48 m
Google Earth
1985
Imagery Date: 11/17/2018 lat -34.929193° lon 138.604776° elev 46 m eye alt 253 m

Groundwater Gauging Sheet

Client: MFS	**WL Meter Type: Dip / Fox / Int.Fce / Gge**
Project: 3319080	**Date:** 20, 07, 21
Job No.:	**Time:**
Location: Adelaide Station	**Sampler:** VB

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW101	–	12.529	–	
GW102	–	11.528	–	
GW103	–	12.097	–	well cap damaged
GW104	–	13.168	–	
GW105	–	12.120	–	
GW106	–	12.508	–	

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 33/9080	
Job Name:		Date: 20-07-2021	
GHD Representative:	Vera Biermann	Arrival Time: 8.35	Departure Time: 12.00
Weather Conditions:	(Please circle) Fine (Overcast) (Light Rain) Heavy Rain Other_____		
Works Being Undertaken:	GME		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Pantju Nam GHD			
Kelly Nam GHD			

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

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
GW103		Location GW103 was partially covered by a shipping container but still accessible for gauging & sampling
GW102 & GW104		accessible externally the other four wells are inside the MFS yard and require access / visitor cards

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:

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

Hydrasleeve Sampling Record

Project number:	3219080	Sampler initials	
Client:	MFS	PM initials	
Site location:	Adelaide Station		

Well ID	GW102	Depth to Groundwater (mBTOC)	11.528
Date	20-07-21	Depth to top of sampler (mBTOC)	≈15m
QC sample	FS03 FD03	Well depth (mBTOC)	18.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
9.35	6.74	20.8	12139	220.4	3.12

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no odour colour: pale brown High turbidity, no sheen

Well ID	GW103	Depth to Groundwater (mBTOC)	12.097
Date	20-7-21	Depth to top of sampler (mBTOC)	≈12.50
QC sample		Well depth (mBTOC)	14.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.20	6.75	20.6	13697	267.7	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no sheen. pale yellow low turbidity no odour well cap damaged

Well ID	GW106	Depth to Groundwater (mBTOC)	12.508
Date	20-7-21	Depth to top of sampler (mBTOC)	~~17.970~~ ≈15m
QC sample		Well depth (mBTOC)	17.97

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.51	6.65	20.7	11425	270.2	2.81

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	medium-high turbidity, no sheen, pale brown

Hydrasleeve Sampling Record

Project number:	3219080	**Sampler initials**	VB
Client:	MFS	**PM initials**	DV
Site location:	Adelaide Station		

Well ID	GW 105	**Depth to Groundwater (mBTOC)**	12.120
Date	20 - 07 . 21	**Depth to top of sampler (mBTOC)**	≈ 14.00
QC sample		**Well depth (mBTOC)**	16.39

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10:00	6.75	19.6	9982	240.2	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no ~~odour~~ odour no sheen. clear low turbity

Well ID	GW101	**Depth to Groundwater (mBTOC)**	12.529
Date	20.07.21	**Depth to top of sampler (mBTOC)**	≈ 13.5
QC sample		**Well depth (mBTOC)**	14,9

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.15	7.01	21.0	~~670~~ 9645	271.5	2.9

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	. high turbidity . no sheen. . pale brown . no odour.

Well ID	GW104	**Depth to Groundwater (mBTOC)**	13.168
Date	20-07-21	**Depth to top of sampler (mBTOC)**	
QC sample	RB03 off IP ; FB03	**Well depth (mBTOC)**	16.60

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.36	~~20~~. 6.57	20.5	11480	281.4	~~2.47~~ 2.42

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	pale brown no sheen high turbidity no odour FB03 collected at end of sampling

Appendix C

Calibration Certificates

ECO Environmental

Environmental monitoring
& sampling equipment
Rentals and sales.

Tel: +61 8 9328 2900
fax: +61 8 9328 2677
eco@ecoenvironmental.com.au
www.ecoenvironmental.com.au
214 Lord St Perth WA 6000

Equipment Information

Instrument: HIM1002A
Serial Number: SN#01-5377

Equipment Check

	Enclosed	Returned	Comment
Heron Interface Level Meter	☑	☐	
Heron Carry Bag	☑	☐	
Spare 9V. Battery	☑	☐	

Inspection Details

	Pass	Fail	Comment
De-con wash of tape (100m)	☑	☐	
De-con wash of reel	☑	☐	
Inspection for faults, corrosion, damage	☑	☐	
Meter in good working order, clean and ready for use	☑	☐	
Check that threaded nut on probe is tight	☑	☐	

This is to certify that where possible, this instrument has been cleaned in accordance with the manufacturer's general maintenance procedure as recommended in the instrument service manual.

ECO Standard Rental Terms & Conditions apply to all equipment calibrations.

Regards

Dave McGraw 15/7/21

Equipment Specialist
ECO Environmental

ECO Environmental

Environmental monitoring
& sampling equipment
Rentals and sales.

Tel: +61 8 9328 2900
fax: +61 8 9328 2677
eco@ecoenvironmental.com.au
www.ecoenvironmental.com.au
214 Lord St Perth WA 6000

Equipment Information

Instrument: YSIPP3A
Serial Number: 10C101428 (Display)
20G100798 (Sonde)

Equipment Check

	Enclosed	Returned	Comment
YSI Pro Plus Display	☑	☐	
YSI Quatro Sonde	☑	☐	
- YSI 1001 pH Probe *(LN: 12F)*	☑	☐	
- YSI 1002 ORP Probe *(LN: 11G)*	☑	☐	
- YSI 5560 Cond/Temp Probe *(LN: 12J)*	☑	☐	
- YSI Polarographic DO Sensor *(LN: 13D)*	☑	☐	
Flow Cell & Attachments (x2)	☑	☐	
Probe Guard	☑	☐	
Rubber Storage/Calibration Sleeve	☑	☐	
Calibration Cup + Cap	☑	☐	
YSI Cable Management Kit	☑	☐	
YSI Pro Series ProComm II Kit	☑	☐	
User Manual + Flow Cell Manual + CD-Rom	☑	☐	
Spare Batteries (x 2) & Screwdriver	☑	☐	
Laminated Quick Start Guide	☐	☐	

Sensor Calibration Details

	Calibration Undertaken	Accuracy	Pass	Fail
Temperature	Factory Calibrated	±0.2°C	☑	☐
Dissolved Oxygen	☑ 100% Saturation	±2%	☑	☐
	Pressure Compensation	1014 hPa	☑	☐
Conductivity	☑ 12.88mS/cm	±0.5%	☑	☐
	☐ Check linearity at 1.413mS/cm	±0.5%	☐	☐
Salinity	Auto Calibrated	±1%	☐	☐
pH	☑ pH 7.00	± 0.2	☑	☐
	☐ pH 4.00	± 0.2	☐	☐
ORP	☑ 238 mV at 21 °C	±20mV	☑	☐

This is to certify that where possible, this instrument has been calibrated in accordance with the manufacturer's calibration procedure as recommended in the instrument service manual.

ECO Standard Rental Terms & Conditions apply to all equipment calibrations.

Regards

Dave McGraw 24/5/21
Checked DM 15/7/21

Equipment Specialist
ECO Environmental

Appendix D

Chain of Custody Documentation and Laboratory Reports

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 274494

Client Details

Client	GHD Pty Ltd
Attention	Dilara Valiff
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**3319080**
Number of Samples	9 Water
Date samples received	21/07/2021
Date completed instructions received	21/07/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

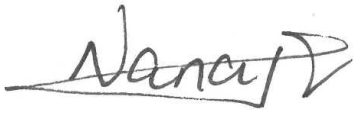
Date results requested by	28/07/2021
Date of Issue	26/07/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Josh Williams, LC Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

PFAS in Waters Short						
Our Reference		274494-1	274494-2	274494-3	274494-4	274494-5
Your Reference	UNITS	GW101	GW102	GW103	GW104	GW105
Date Sampled		20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Date analysed	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	26	<0.01	11	0.04	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	27	0.01	16	0.099	0.02
Perfluorooctanoic acid PFOA	µg/L	1.9	<0.01	0.87	<0.01	<0.01
6:2 FTS	µg/L	1.2	<0.01	1.5	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	96	94	98	97	100
Surrogate $^{13}C_2$ *PFOA*	%	94	93	94	94	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	95	96	96	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	80	102	79	99	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	101	95	104	99
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	72	88	77	93	86
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	91	100	93	108	98
Total Positive PFHxS & PFOS	µg/L	53	0.01	27	0.14	0.02
Total Positive PFOA & PFOS	µg/L	29	0.01	17	0.1	0.02
Total Positive PFAS	µg/L	56	0.01	29	0.14	0.02

PFAS in Waters Short					
Our Reference		274494-6	274494-7	274494-8	274494-9
Your Reference	UNITS	GW106	FD03	RB03	FB03
Date Sampled		20/07/2021	20/07/2021	20/07/2021	20/07/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Date analysed	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.02	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.11	0.02	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	96	98	95	98
Surrogate $^{13}C_2$ *PFOA*	%	95	94	97	95
Extracted ISTD $^{18}O_2$ *PFHxS*	%	92	93	98	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	97	98	101	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	100	107	105
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	85	89	144	140
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	105	108	147	145
Total Positive PFHxS & PFOS	µg/L	0.13	0.02	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	0.11	0.02	<0.01	<0.01
Total Positive PFAS	µg/L	0.13	0.02	<0.01	<0.01

Method ID	Methodology Summary
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	274494-2
Date prepared	-			21/07/2021	1	21/07/2021	21/07/2021		21/07/2021	21/07/2021
Date analysed	-			21/07/2021	1	21/07/2021	21/07/2021		21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	26	25	4	111	114
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	27	28	4	103	106
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	1.9	1.8	5	110	108
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	1.2	1.2	0	111	117
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	115	115
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	91	1	96	99	3	94	97
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	1	94	94	0	98	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	88	1	93	97	4	95	94
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	96	1	80	82	2	103	101
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	98	1	91	92	1	103	96
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	110	1	72	75	4	122	80
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	1	91	87	4	120	91

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	8	21/07/2021	21/07/2021		[NT]	[NT]
Date analysed	-			[NT]	8	21/07/2021	21/07/2021		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
6:2 FTS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
8:2 FTS	µg/L	0.02	Org-029	[NT]	8	<0.02	<0.02	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	8	95	94	1	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	8	97	94	3	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	8	98	92	6	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	8	101	103	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	8	107	109	2	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	8	144	138	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	8	147	137	7	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

CHAIN OF CUSTODY RECORD

GHD

GHD Adelaide
211 Victoria Square, Adelaide SA 5000
Telephone: 618 8111 6800 Facsimile: 618 8111 6899
Email: admail@ghd.com.au

GHD Mt Gambier
2A Helen St, Mt Gambier SA 5290
Telephone: 618 8721 0800 Facsimile: 618 8721 0899

GHD Roxby Downs
1/14 Tutop St, Roxby Downs SA
Telephone: 618 8671 4000 Facsimile: 618 8671 4099

Turnaround Requirement:
X STANDARD
☐ NON-STANDARD

Job Number: 3319080	GHD Office: Adelaide	Relinquished By: Vera Biermann	Received By: ELS Alex Stek
Project: 3319080		Date/Time: 20/07/21	Date/Time: 20/7/21 @ 1pm

Relinquished By:		Received By: ELS	
Date/Time:		Date/Time: 21-7-21 8:00	

GHD Project Manager: Dilara Valiff 0420959236	GHD Contact: Vera Biermann 0435981783
Email Reports to: GHDLabReports@ghd.com; vera.biermann@ghd.com; dilara.valiff@ghd.com	Quote

SEND TO:

☐ **ALS Laboratories**
2-4 Westall Rd, SPRINGVALE, VIC 3171
Ph: 03 8549 9600
Contact:

☐ **MGT LabMark**
2-5 Kingston Town Close, OAKLEIGH VIC 3166
Ph: 03 9564 7055
Contact:

☐ **SGS**
16/33 Maddox St, ALEXANDRIA NSW 2015
Ph: 02 8594 0400
Contact:

☐ **BUREAU VERTIAS AMDEL**
2/35 Cormack Rd, WINGFIELD SA 5013
Ph: 08 8440 7100
Contact:

Sample I.D.		Date	Time	Sample Matrix S: Soil SL: Sludge W: Water A: Air	Container Type J: Jar; B: Bag; V: Vial; G: Glass bottle; P: Plastic bottle	PFAS Short Screen (Std LOR)	Analyses Required	Remarks
GW101	1	20 July 2021		W	P	X		
GW102	2	20 July 2021		W	P	X		
GW103	3	20 July 2021		W	P	X		
GW104	4	20 July 2021		W	P	X		
GW105	5	20 July 2021		W	P	X		
GW106	6	20 July 2021		W	P	X		
FD03	7	20 July 2021		W	P	X		
FS03	—	20 July 2021		W	P	X		Please forward to ALS.
RB03	8	20 July 2021		W	P	X		
FB03	9	20 July 2021		W	P	X		

ENVIROLAB
Environmental Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 274494
Date Received: 21-7-21
Time Received: 8:00
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks:

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2126808**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VERA BIERMANN	Contact	: Sarah Mathew
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 3319080	Date Samples Received	: 21-Jul-2021 14:50
Order number	: 3319080	Date Analysis Commenced	: 26-Jul-2021
C-O-C number	: ----	Issue Date	: 27-Jul-2021 13:23
Sampler	: ----		
Site	:		
Quote number	: EN/005		
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*
Alex Rossi	Organic Chemist	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 Contact for details.

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

- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- 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	FS03	----	----	----	----
				Sampling date / time	20-Jul-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2126808-001	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**0.03**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.03**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**0.03**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**109**	----	----	----	----
13C8-PFOA	----	0.02	%		**88.8**	----	----	----	----

Surrogate Control Limits

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

CHAIN OF CUSTODY RECORD

GHD

GHD Adelaide
211 Victoria Square, Adelaide SA 5000
Telephone: 618 8111 6600 Facsimile: 618 8111 6699
Email: adlmail@ghd.com.au

GHD Mt Gambier
2A Helen St, Mt Gambier SA 5290
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GHD Roxby Downs
1/14 Tutop St, Roxby Downs SA
Telephone: 618 8671 4000 Facsimile: 618 8671 4099

Turnaround Requirement:
X STANDARD
☐ NON-STANDARD _____

Job Number	GHD Office
3319080	Adelaide
Project	
3319080	

Relinquished By: Vera Biermann
Date/Time: 20/07/21

Received By: GLS Alex Stark
Date/Time: 20/7/21 @ 1pm

Relinquished By:
Date/Time:

Received By: [illegible]
Date/Time: 21/7/21 1520

GHD Project Manager		GHD Contact	
Dilara Valiff	**0420959236**	**Vera Biermann**	**0435981783**

Email Reports to:
GHDLabReports@ghd.com
vera.biermann@ghd.com
dilara.valiff@ghd.com

Quote

SEND TO:

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Contact:

☐ **MGT LabMark**
2-5 Kingston Town Close, OAKLEIGH VIC 3166
Ph: 03 9564 7055
Contact:

☐ **SGS**
18/33 Maddox St, ALEXANDRIA NSW 2015
Ph: 02 8594 0400
Contact:

☐ **BUREAU VERITAS AMDEL**
2/35 Cormack Rd, WINGFIELD SA 5013
Ph: 08 8440 2100
Contact:

Sample ID		Date	Time	Matrix	Container Type	PFAS Short Screen (Std LOR)	Analyses Required	Remarks
GW101	1	20 July 2021		W	P	X		
GW102	2	20 July 2021		W	P	X		
GW103	3	20 July 2021		W	P	X		
GW104	4	20 July 2021		W	P	X		
GW105	5	20 July 2021		W	P	X		
GW106	6	20 July 2021		W	P	X		
FD03	7	20 July 2021		W	P	X		
FS03	—	20 July 2021		W	P	X		
RB03	8	20 July 2021		W	P	X		Please forward to ALS.
FB03	9	20 July 2021		W	P	X		

Environmental Division
Sydney
Work Order Reference
ES2126808

Telephone : + 61-2-8784 8555

Relinquished by: V. VEGA
21/7/21 @ 1422

Remarks:

Appendix E

Monitoring Well Bore Logs and Well Survey (provided by the MFS)

Job No: 1703073

Borehole Number: BH101

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

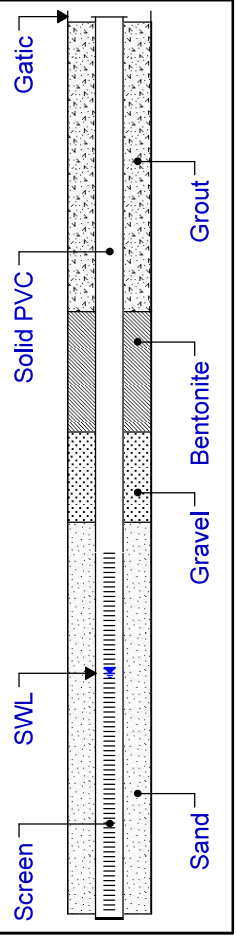
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers							
1.0			**FILL - SW** SAND: Paving							
1.5			**CL** Sandy CLAY							
2.0				Dry	MHP	C	0			
2.5										
3.0										
3.5										
4.0										
4.5										
5.0			**CH** CLAY							
5.5										
6.0										
6.5										
7.0										
7.5				Dry	HP	A	0			
8.0										
8.5										
9.0										
9.5										
10.0			**SC** SAND							
10.5				Wet	VLP	A	0			
11.0										
11.5			**CH** CLAY							
12.0										
12.5										
13.0				Wet	HP	A	0			
13.5										
14.0										
14.5										
15.0			~~End of Borehole~~							



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH102

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

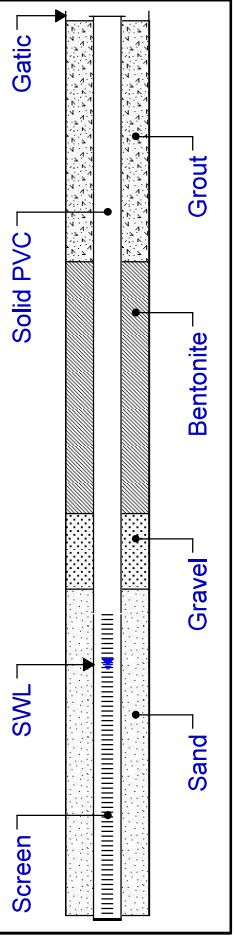
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.0			Concrete Pavers							
0.5			**FILL - SW** SAND: Paving							
1.0			**CH** CLAY							
1.5										
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										
6.0										
6.5				Dry	MHP	A	0			
7.0										
7.5										
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5										
13.0			**CL** Sandy CLAY							
13.5										
14.0				Wet	MP	A	0			
14.5										
15.0			**CH** CLAY							
15.5										
16.0										
16.5				Wet	HP	A	0			
17.0										
17.5										
18.0			~~End of Borehole~~							



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH103

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

Drill Method: Auger

Datum: See Figure

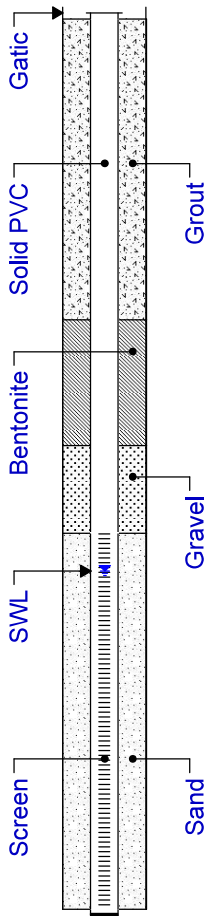
Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE

SAMPLE

Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)
0.0	Auger		~~Ground Surface~~						
0.0			Concrete Pavers						
0.5			**FILL - SW** SAND: Paving	Moist	MP	A	0		
1.0			**FILL - CL** Sandy CLAY						
1.5			**CH** CLAY: brown						
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									
5.5				Dry	MHP	A	0		
6.0									
6.5									
7.0									
7.5									
8.0									
8.5									
9.0			**CL** Sandy CLAY: white						
9.5									
10.0				Wet	MP	A	0		
10.5									
11.0			**CH** CLAY: brown						
11.5									
12.0									
12.5				Wet	VHP	A	0		
13.0									
13.5									
14.0									
14.5			~~End of Borehole~~						



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH104

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

Drill Method: Auger

Datum: See Figure

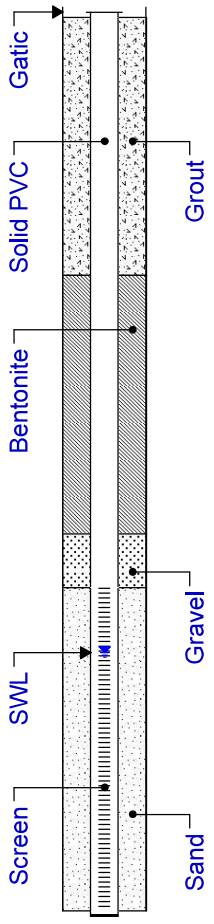
Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE

SAMPLE

Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)
0.0			~~Ground Surface~~						
0.0–0.5	Auger		Bitumen						
0.5–1.0			Road base: GRAVEL: grey	Dry	NP	A	1		
1.0–2.5			**FILL - SW** SAND: red						
2.5–11.5			**CL** Sandy CLAY	Dry	MP	A	0		
11.5–13.5			**CL** Sandy CLAY: red	Wet	LP	A	0		
13.5–14.5			**CH** CLAY: brown	Wet	MHP	A	0		
14.5–16.5			**CH** CLAY: brown	Wet	MHP	A	0		
16.5			~~End of Borehole~~						



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH105

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

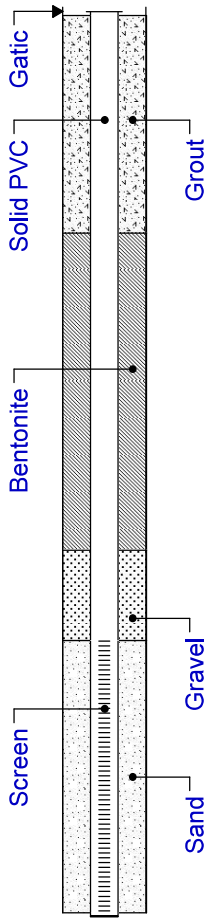
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers	Dry	MP	A	1			
1.0			SAND: paving sand							
1.5			**FILL -CL** CLAY: brown							
2.0										
2.5										
3.0			**CL** Sandy CLAY							
3.5										
4.0										
4.5										
5.0										
5.5										
6.0										
6.5										
7.0										
7.5				Dry	MP	A	0			
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5										
13.0										
13.5										
14.0			**CH** CLAY: brown							
14.5										
15.0										
15.5										
16.0										
16.5										
17.0				Dry	VHP	A	0			
17.5										
18.0										
18.5										
19.0										
19.5										
20.0			~~End of Borehole~~							



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH106

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

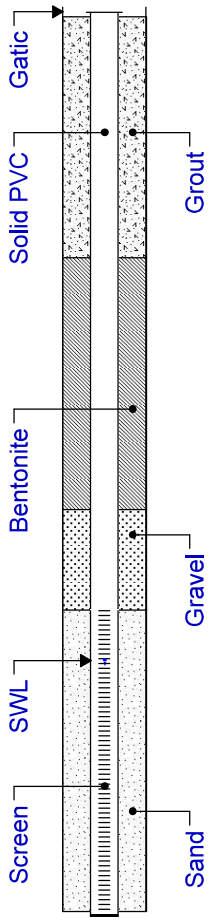
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers							
1.0			SAND: paving sand							
1.5			**CH** CLAY: brown							
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										
6.0				Dry	MHP	A	1			
6.5										
7.0										
7.5										
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5			**CL** Sandy CLAY: red	Dry Wet	MP	A	0			
13.0										
13.5										
14.0			**CH** CLAY: brown							
14.5										
15.0										
15.5										
16.0				Wet	VHP	A	0			
16.5										
17.0										
17.5										
18.0			~~End of Borehole~~							



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Wakefield St MFS Ground Water Well Locations					
Surveyed 16/07/2021, by Alexander Symonds Ref No. 21A2688					
POINT IDENTIFICATION	Easting (MGA2020)	Northing (MGA2020)	Elevation Top of PVC Casing (AHD)	Description	Elevation Natural Surface Level (AHD)
GW101	281201.880	6132198.962	46.463	NEW GROUNDWATER WELL	46.527
GW102	281160.454	6132128.549	45.656	NEW GROUNDWATER WELL	45.825
GW103	281158.996	6132239.960	45.911	NEW GROUNDWATER WELL	45.995
GW104	281285.412	6132211.558	47.070	NEW GROUNDWATER WELL	47.165
GW105	281136.744	6132191.064	45.933	NEW GROUNDWATER WELL	46.002
GW106	281240.387	6132200.760	46.463	NEW GROUNDWATER WELL	46.577
MP001	281209.182	6132203.204	46.332	EXISTING MONITORING POINT	46.405
MP002	281219.121	6132200.133	46.467	EXISTING MONITORING POINT	46.522

Appendix F

Quality Assurance and Quality Control

Data quality objectives and quality assurance / quality control

Data quality objectives

The data quality objectives (DQOs) and investigation strategy have been developed using the methodology discussed in the ASC NEPM Schedule B2 Guideline on Site Characterisation. The guideline nominates the implementation of the DQO process in Section 5 of AS4482.1-2005. The purpose of the DQO process is to ensure that the data collection activities are focused on collecting the information needed to make decisions, and answering the relevant questions leading up to such decisions.

The Data Quality Objectives (DQOs) establish a framework for contamination investigations which incorporates a seven stepped continuum that defines the problem at the site. A series of stages then optimises the design of the investigation. The seven steps are outlined below:

- Step 1: State the Problem
- Step 2: Identify the Principal Study Question
- Step 3: Inputs to the Decision
- Step 4: Boundaries of the Study
- Step 5: Decision Rules
- Step 6: Tolerable Limits on Decision Errors
- Step 7: Optimisation of the Data Collection Process

An overview of the DQOs for the investigation is presented below.

Step 1: State the problem

The presence, extent, nature and concentrations of PFAS in groundwater beneath the site has not been determined.

Step 2: Identify the principal study question

The objective of this groundwater investigation was to determine the on-site presence, nature and extent of groundwater PFAS impacts associated with historical MFS site activities at the Adelaide Fire Station.

Step 3: Inputs to the decision

The following inputs are required for the decision:

- Quantitative and qualitative data gained through groundwater sampling, analytical works and observations during investigations.
- Anecdotal information provided by MFS.

Step 4: Boundaries of the study

Spatial boundaries of this investigation were defined laterally by the extent of the on-site groundwater monitoring well network, as shown in Figure 2, and vertically by the maximum depth of the groundwater wells. The temporal boundaries ranged from the date of acceptance of this work until the final day of fieldwork.

Step 5: Decision rules

Groundwater analytical data was assessed against the criteria adopted from relevant guidance as discussed in the report.

Step 6: Tolerable limits on decision errors

Data generated as part of the Environmental Investigation must be appropriate to allow decisions to be made with confidence. Specific limits have been adopted in accordance with the appropriate guidance from the AS4482.1 which includes appropriate indicators of data quality. Data quality indicators (DQIs) were used to assess QA/QC and GHD's Standard Field Operating Procedures.

To assess the usability of the data prior to making decisions, the data were assessed against pre-determined DQIs. The DQIs including precision, accuracy, representativeness, comparability and completeness, were reviewed at the completion of the Environmental Investigation to assess for the presence of decision errors.

The pre-determined DQIs established for the investigation are discussed below and shown in Table 1.

- Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percentage Difference (RPD) of duplicate samples
- Accuracy - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this investigation is a measure of the closeness of the analytical results obtained by a method to the 'true' (or standard) value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards
- Representativeness - expresses the degree to which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy
- Comparability - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods
- Completeness - is defined as the percentage of measurements made which are judged to be valid measurements.

Table 1 Summary of quality assurance /quality control criteria

Data quality indicator	Frequency	Data quality acceptance criteria
Precision		
Duplicates (Intra-Laboratory)	1/10 samples	The RPD values were compared to the 30%–50% RPD acceptance criterion adopted from Australian Standard AS4482.1 (for non- and semi-volatiles). RPDs for results less than the laboratory practical quantitation limits (PQL) and in instances where results were greater than the PQL for the one sample, but below the PQL for the corresponding primary or duplicate sample, RPDs were not calculated.
Duplicates (Inter-Laboratory)	1/10 samples	
Accuracy		
Laboratory (Method) Blank	One sample per batch of 20 samples or fewer	Less than detection limit or limit of reporting (LOR) of the method used.
Laboratory Duplicates	One sample per batch of	Laboratory duplicate samples should have RPD's within the NEPM acceptance criteria of ±30%.

Data quality indicator	Frequency	Data quality acceptance criteria
	10 samples or fewer	The laboratory RPDs have been assessed using the following ranges: Results <10 times LOR: no limits. Results between 10 and 20 times LOR: 0% - 50%. Results >20 times LOR: 0-20%.
Field blank	One sample per batch of 20 samples or fewer	Less than detection limit or limit of reporting (LOR) of the method used.
Rinsate blank	One sample per batch of 10 samples or fewer	Less than detection limit or limit of reporting (LOR) of the method used.
Representativeness		
Sampling appropriate for media and analytes	All samples	-
Samples extracted and analysed within holding times	All samples	PFAS in water (14 days extraction for USEPA method and 28 days for AST Method) PFAS in soil (60 days extraction for USEPA method and 28 days for AST Method)
LORs appropriate and consistent	All samples	All samples
Comparability		
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Standard operating procedures for sample collection & handling	All samples	All samples
Standard analytical methods used for all analyses	All samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All samples	All samples
Appropriate documentation	All samples	All samples
Satisfactory frequency and result for QA/QC samples	All QA/QC sample	-
Data from critical samples is considered valid	-	Critical samples valid

Data quality indicator	Frequency	Data quality acceptance criteria
Notes: COC: Chain of Custody LOR: Limit of Reporting QA/QC: Quality assurance / quality control		

Step 7: Optimisation of the data collection process

To optimise the design of the investigation, the sampling and analytical program was developed in discussion with MFS staff based on the historical use of PFAS containing firefighting foam on site. The sampling plan was in accordance with standard industry practices, the HEPA NEMP 2020, and SA EPA guidelines.

Results (including QA/QC results) were reviewed as they were received from the laboratory and any inconsistencies or unexpected data were further investigated with the laboratory.

Field QA/QC

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

- Collection of QC Samples
- Use of standard sampling procedures
- Use of standard field sampling forms, including Chain of Custody (COC) forms
- Documenting the calibration and use of field equipment

All field works were conducted by appropriately qualified and trained GHD environmental scientists in accordance with GHD's *Standard Field Operating Procedures (SFOP)*.

QA/QC sampling

Field QA/QC samples were collected and analysed. Field QC sampling was conducted in reference to AS 4482.1:2005 and ASC NEPM 1999, as amended 2013 Schedule B2 requirements and included the analyses of the types of samples included in Table 2.

Table 2 Field QA/QC sample details

Field QA/QC sampl type	Details
Intra-Laboratory Duplicate (Blind)	Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the primary project laboratory. Blind duplicates provide an indication of the analytical precision of the laboratory but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity.
Inter-Laboratory Duplicate (Split)	Inter-Laboratory Duplicate (Split) samples are two separate samples collected at the same location and analysed by two separate laboratories to determine the analytical proficiency of the primary laboratory.
Rinsate	A sample of analyte free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples to assess the adequacy of the decontamination process.

Field QA/QC sampl type	Details
Field blank	A sample of analyte free water poured into the container in the field, preserved and shipped to the laboratory with field samples to assess contamination from field conditions during sampling.

GHD adopts the AS4482.1 acceptance criteria of 50% RPD for field duplicates of organics, including PFAS. Blind duplicate and split samples should have RPDs less than the criteria in each instance. However, it is noted that the criteria will not always be achieved, particularly in heterogeneous materials, or at low analyte concentrations. RPD acceptance criteria were not applied where analyte concentrations were less than ten times the laboratory LOR.

In the instance where samples and their corresponding duplicates have concentrations of target analytes less than the laboratory LOR, no quantitative comparison can be carried out and therefore the RPD is undefined.

Duplicate, split, field blank and rinsate sample results and Relative Percentage Difference (RPD) calculations are presented in Table 3 and Table 4 at the end of this report.

Sample handling and preservation

All samples were immediately placed in an insulated cooler containing ice for storage and were delivered by GHD Field Staff to the laboratory upon the completion of field work as promptly as possible.

All samples were received intact as per the Sample Receipt Notification.

Chain of custody

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

Laboratory QA/QC

The primary laboratory (Envirolab) and secondary laboratory (ALS) were both subcontracted by GHD to analyse samples are certified by the NATA for the required analysis. NATA certification provides for laboratory QA procedures to be in place and to be carried out on an on-going basis.

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

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

Laboratory QA/QC procedures

As part of NATA requirements, the laboratories incorporated a range of QA methods to ensure accuracy of data. This includes the analyses of internal laboratory QC samples, details of which have been provided in Table 3.

Table 3 Laboratory QC sample details

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

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

Field QC Results

The field QC results analysis below considers all sample types collected as part of the environmental investigation.

QA/QC sample frequency

A total of six primary groundwater samples were collected, submitted and analysed as part of the environmental investigation. In addition, QA/QC samples including one intra-laboratory duplicate (field duplicate), one inter-laboratory duplicate (field split duplicate), one field blank and one rinsate samples were collected and analysed as part of the investigation.

The target frequency for analysis of field duplicate QC samples is one intra-laboratory duplicate and one inter-laboratory duplicate per 10 primary samples (20%). In this instance, the frequency was acceptable. The target frequency for rinsate samples of one sample per batch of 10 primary samples was achieved. The target frequency for field blank samples of one sample per batch of 20 primary samples was achieved.

Duplicate samples

A total of six primary groundwater samples were collected, submitted and analysed as part of the environmental investigation. One intra-laboratory duplicate (field duplicate FD03) and one inter-laboratory duplicate (field split duplicate FS03) were collected and analysed as part of the investigation. The target frequency for analysis of field duplicate QC samples was one intra-laboratory duplicate and one inter-laboratory duplicate per 10 primary samples (20%). In this instance, the frequency was acceptable.

All calculated RPDs for the primary sample GW102 and the corresponding duplicate samples (FD03 and FS03) were within the acceptable range. There were no RPD exceedances. The results for all analytes were reported below the laboratory limit of reporting (LOR), except for PFOS. Primary and duplicate sample results with calculated RPDs are presented in Table 3 at the end of this report.

Rinsate blank

One rinsate sample was analysed as part of this investigation. The target frequency for rinsate samples of one sample per batch of 10 primary samples was achieved. The reported results were below the laboratory's LOR for all analytes tested. There was no evidence of cross contamination during sample collection. Rinsate blank results are presented in Table 4 at the end of the report.

Field blank

One field blank sample was analysed as part of this investigation. The target frequency for field blank samples of one sample per batch of 20 primary samples was achieved. The reported results were below the laboratory's LOR for all analytes tested. There was no evidence of cross contamination during sample collection. Field blank results are presented in Table 4 at the end of the report.

Recommended holding times compliance

Recommended holding times acceptance criteria are specified in Table 1. Based on the review of laboratory reports and QA/QC data evaluation, all samples were extracted and analysed within the recommended holding times.

Laboratory program

The NATA certified laboratories utilised for this assessment (Envirolab and ALS) undertook their own internal quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are provided in Appendix D. This data has met the specified requirements for this investigation.

Overall Assessment of Data Quality

GHD QA/QC parameters were within the specified requirements, therefore the data is considered to be valid and of sufficient quality for the purposes of this investigation.

Appendix G

Section 83A Notification

Site contamination – Section 83A notification form

Site contamination that affects or threatens underground water notification form pursuant to section 83A of the *Environment Protection Act 1993*

Notifier details

Name: Dilara Valiff	Telephone: (08) 8111 6527
Company: GHD Pty Ltd.	Email: Dilara.Valiff@ghd.com
Address: Level 4, 211 Victoria Square ADELAIDE SA 5000	○ the site owner ○ the site occupier ◉ the site contamination consultant ○ the site contamination auditor

Site details

Site or establishment name (if appropriate): South Australian Metropolitan Fire Service - Adelaide Fire Station

Owner(s) (please include contact details where known): South Australian Metropolitan Fire Service	Occupier(s) (where different to owner): N/A
Street address(es) (include lot or street number): Wakefield Street, ADELAIDE SA 5000	Certificate(s) of title (current): CT6181/979, CT5943/887, CT5782/242, CT5943/888

Location, nature and extent

Has a potentially contaminating activity been undertaken at the site, please describe…Historical use of AFFF……..

Does this notification relate to a change in the location, nature or extent of site contamination that has previously been notified to the EPA? ○ Yes ◉ No

If yes, please provide the date(s) of previous notification(s):..N/A……

Which group(s) do the chemical substance(s), identified as site contamination that affects or threatens groundwater, belong to?

☐ Metals & metalloids	☐ Non-metallic inorganics	☐ Organic alcohols/other organics
☐ Petroleum hydrocarbons	☐ Anilines	☐ Chlorinated alkanes
☐ Chlorinated alkenes	☐ Chlorinated benzenes	☐ Polychlorinated biphenyls
☐ Other chlorinated compounds	☐ Monocyclic aromatic compounds	☐ Polycyclic aromatic compounds
☐ Phenols	☐ Phthalates	☐ Pesticides/herbicides/fungicides
☐ Surfactants	☑ Other (please specify): PFAS(Per-and poly-fluoroalkyl substances	

Has an assessment of the environmental values of groundwater been undertaken? (●) Yes ( ) No

If yes, what is the TDS range in mg/L (lowest concentration for the site)? 9,645 ug/L - 13,697 u

What are the environmental values of groundwater for the site?

- [x] Drinking water
- [ ] Primary industries (irrigation and general water uses)
- [x] Recreation and aesthetics
- [ ] Aquatic ecosystems (marine)
- [x] Aquatic ecosystems (fresh)
- [ ] Primary industries (aquaculture)
- [ ] Primary industries (agriculture)

Where has the site contamination that affects or threatens groundwater been identified?

- [ ] Soil/soil vapour
- [x] Groundwater

Maximum depth: 20 ……..……m bgl Targeted aquifer(s): Q1 ……

What is the depth to groundwater (where known)? 12-13 ……m bgl

Has a non-aqueous phase liquid been identified or inferred? ( ) Yes (●) No

If yes, please provide details of measured thickness (in metres):……..

Has site contamination that affects or threatens groundwater been identified[1] offsite? ( ) Yes (●) No

If yes, please specify offsite certificate(s) of title or address(es):……

An accurate scaled site plan showing sampling locations has been included. [x]

This notification provides the following information to determine the existence of site contamination and the support notification of site contamination that affects or threatens groundwater at the site?

Monitoring well data[2]	(●) Yes	( ) No	Soil lithological data	( ) Yes	(●) No
Groundwater field data	(●) Yes	( ) No	Soil vapour bore data	( ) Yes	(●) No
Analytical laboratory data	(●) Yes	( ) No			
Quality assurance data	(●) Yes	( ) No			

Has the electronic data been assessed as reliable in meeting the objectives of the assessment? (●) Yes ( ) No

[1] Using direct evidence and not inferred information

[2] Not required where electronic information has previously been provided to the EPA and the data has not changed

Further assessment details	
Have chemical substances been identified that may represent background concentrations? ○ Yes ◉ No	
If yes, will a background concentration[3] assessment be undertaken within the next 3 months? ○ Yes ◉ No	
Is any further assessment being undertaken? ☐ Preliminary site investigation ☐ Detailed site investigation ☐ Groundwater monitoring event ☑ Other: Not at this point	Is the site subject to a current site contamination audit? ○ Yes ◉ No If yes, please specify the EPA reference number for the audit: ……..

Declaration	
It is an offence to provide false or misleading information to the Authority. Maximum penalties range from $30,000 for a natural person, to $60,000 for a body corporate, pursuant to section 119 of the Environment Protection Act 1993.	
I/We declare that the information provided in this form and any accompanying documents is not false or misleading in any material particular:	
Name: Dilara Valiff	Name:
Position: Senior Environmental Consultant	Position:
Signature:	Signature:
Date: 30/07/2021	Date:

[3] Carried out in accordance with the *EPA Guideline for the assessment of background concentrations (2018)*

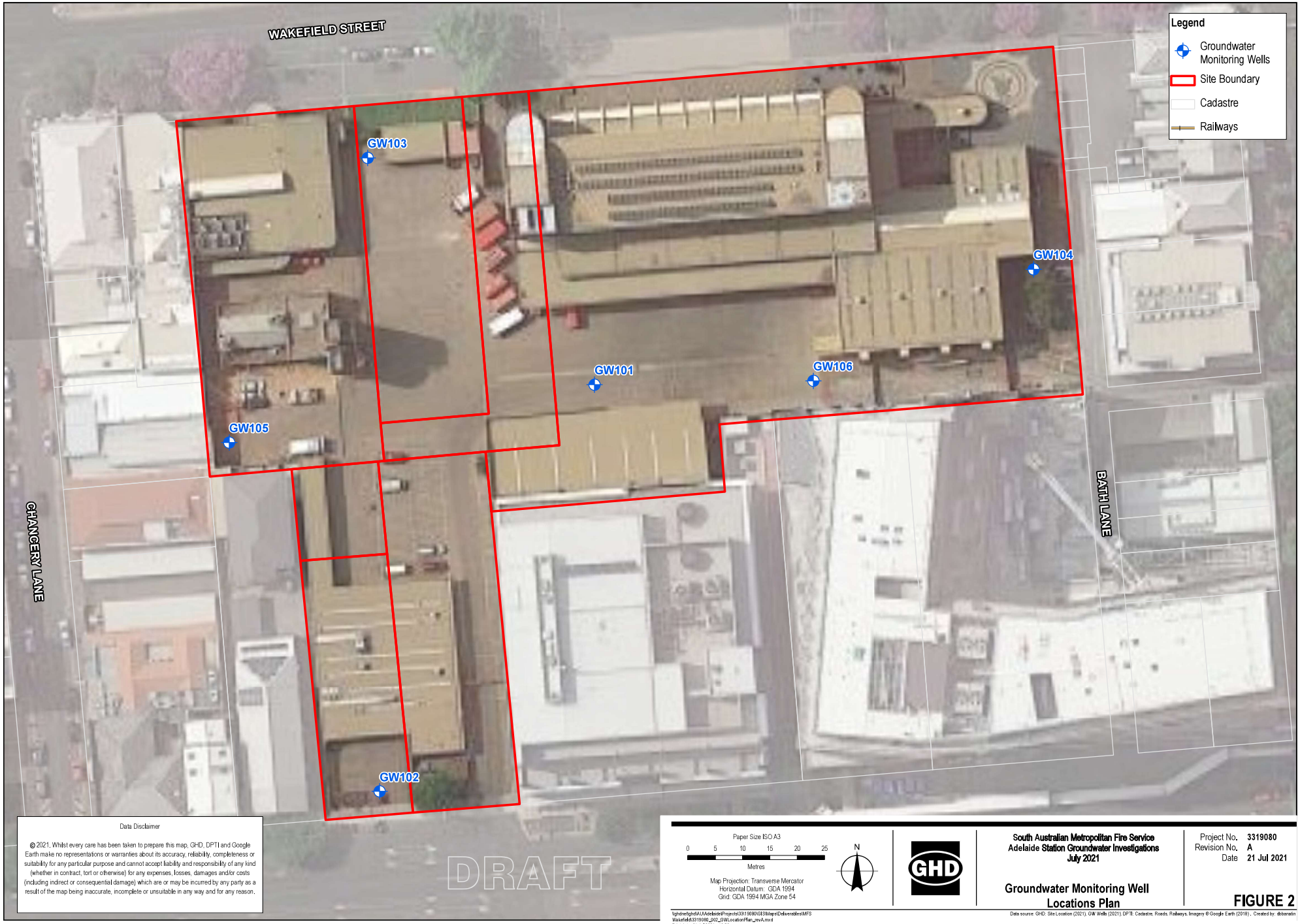
			PFAS (short suite in water)							
			Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
			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 Recreational Water			10	2	2			2		
PFAS NEMP 2.0 2020 Health Drinking Water			0.56	0.07	0.07			0.07		
PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems			220		0.13					
Location Code	**Date**	**Field ID**								
GW101	20/07/2021	GW101	1.9	26	27	1.2	<0.02	53	29	56
GW102	20/07/2021	GW102	<0.01	<0.02 *	0.03 *	<0.05 *	<0.05 *	0.03 *	0.03 *	0.03 *
GW103	20/07/2021	GW103	0.87	11	16	1.5	<0.02	27	17	29
GW104	20/07/2021	GW104	<0.01	0.04	0.099	<0.01	<0.02	0.14	0.1	0.14
GW105	20/07/2021	GW105	<0.01	<0.01	0.02	<0.01	<0.02	0.02	0.02	0.02
GW106	20/07/2021	GW106	<0.01	0.02	0.11	<0.01	<0.02	0.13	0.11	0.13

* Higher value adopted from QA/QC analysis

				PFAS (short suite in water)							
				Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	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
Location Code	**Date**	**Field ID**	**Lab Report Number**								
GW102	20/07/21	GW102	274494	<0.01	<0.01	0.01	<0.01	<0.02	0.01	0.01	0.01
		FD03	274494	<0.01	<0.01	0.02	<0.01	<0.02	0.02	0.02	0.02
RPD						67			67	67	67
GW102	20/07/21	GW102	274494	<0.01	<0.01	0.01	<0.01	<0.02	0.01	0.01	0.01
		FS03	ES2126808	<0.01	<0.02	0.03	<0.05	<0.05	0.03	0.03	0.03
RPD						100			100	100	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: 1000 (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 (short suite in water)							
			Perfluorooctanoic acid (PFOA)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	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
Date	**Sample Type**	**Lab Report Number**								
20/07/21	Field_B	274494	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	Rinsate	274494	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01



Data Disclaimer

© 2021. Whilst every care has been taken to prepare this map, GHD, DPTI and Google Earth make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Paper Size ISO A3

0 5 10 15 20 25

Metres

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

N

GHD

South Australian Metropolitan Fire Service
Adelaide Station Groundwater Investigations
July 2021

Groundwater Monitoring Well Locations Plan

Project No. **3319080**
Revision No. **A**
Date **21 Jul 2021**

FIGURE 2

\\ghdnet\ghd\AU\Adelaide\Projects\3319080\GIS\Maps\Deliverables\MFS Wakefield\3319080_002_GWLocationPlan_revA.mxd
Print date: 21 Jul 2021 - 19:52

Data source: GHD: Site Location (2021), GW Wells (2021), DPTI: Cadastre, Roads, Railways, Imagery © Google Earth (2018) . Created by: dobsmatin

Job No: 1703073

Borehole Number: BH101

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

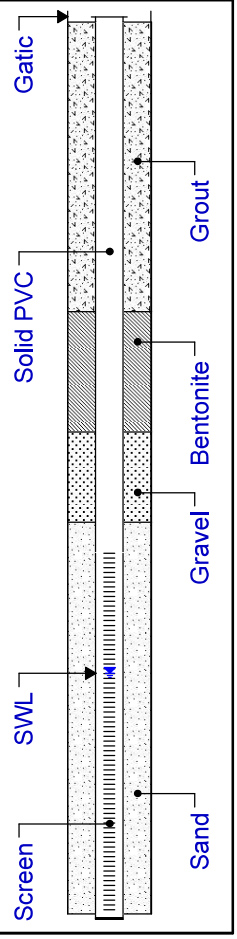
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers							
1.0			**FILL - SW** SAND: Paving							
1.5			**CL** Sandy CLAY							
2.0				Dry	MHP	C	0			
2.5										
3.0										
3.5										
4.0										
4.5										
5.0			**CH** CLAY							
5.5										
6.0										
6.5										
7.0										
7.5				Dry	HP	A	0			
8.0										
8.5										
9.0										
9.5										
10.0			**SC** SAND							
10.5				Wet	VLP	A	0			
11.0										
11.5			**CH** CLAY							
12.0										
12.5										
13.0				Wet	HP	A	0			
13.5										
14.0										
14.5										
15.0			~~End of Borehole~~							



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH102

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

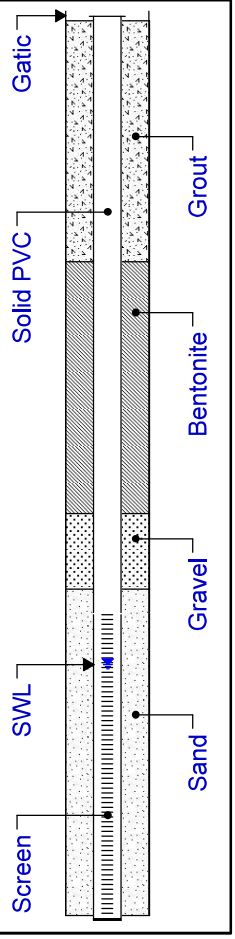
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.0			Concrete Pavers							
0.5			**FILL - SW** SAND: Paving							
1.0			**CH** CLAY							
1.5										
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										
6.0										
6.5				Dry	MHP	A	0			
7.0										
7.5										
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5										
13.0			**CL** Sandy CLAY							
13.5										
14.0				Wet	MP	A	0			
14.5										
15.0			**CH** CLAY							
15.5										
16.0										
16.5				Wet	HP	A	0			
17.0										
17.5										
18.0			~~End of Borehole~~							



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH103

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

Drill Method: Auger

Datum: See Figure

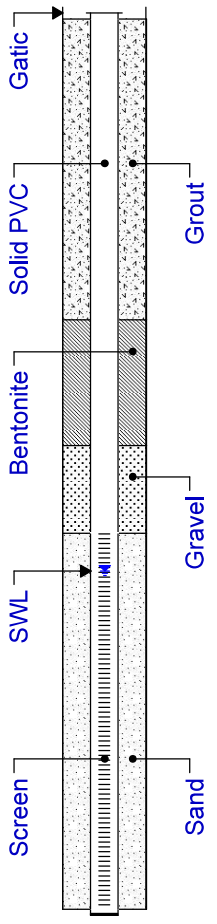
Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE

SAMPLE

Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)
0.0	Auger		~~Ground Surface~~						
0.0			Concrete Pavers						
0.5			**FILL - SW** SAND: Paving	Moist	MP	A	0		
1.0			**FILL - CL** Sandy CLAY						
1.5			**CH** CLAY: brown						
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									
5.5				Dry	MHP	A	0		
6.0									
6.5									
7.0									
7.5									
8.0									
8.5									
9.0			**CL** Sandy CLAY: white						
9.5									
10.0				Wet	MP	A	0		
10.5									
11.0			**CH** CLAY: brown						
11.5									
12.0									
12.5				Wet	VHP	A	0		
13.0									
13.5									
14.0									
14.5			~~End of Borehole~~						



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH104

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

Drill Method: Auger

Datum: See Figure

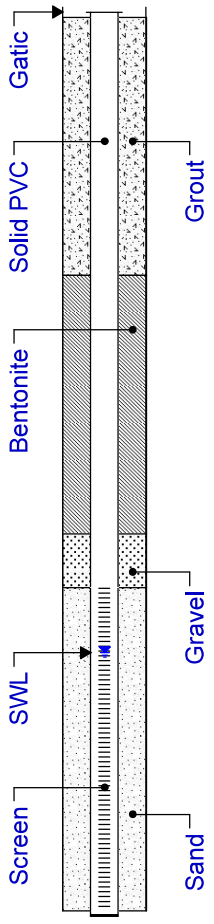
Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE

SAMPLE

Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)
0.0			~~Ground Surface~~						
0.0–0.5	Auger		Bitumen						
0.5–1.0			Road base: GRAVEL: grey	Dry	NP	A	1		
1.0–2.5			**FILL - SW** SAND: red						
2.5–11.5			**CL** Sandy CLAY	Dry	MP	A	0		
11.5–13.5			**CL** Sandy CLAY: red	Wet	LP	A	0		
13.5–14.5			**CH** CLAY: brown	Wet	MHP	A	0		
14.5–16.5			**CH** CLAY: brown	Wet	MHP	A	0		
16.5			~~End of Borehole~~						



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Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH105

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

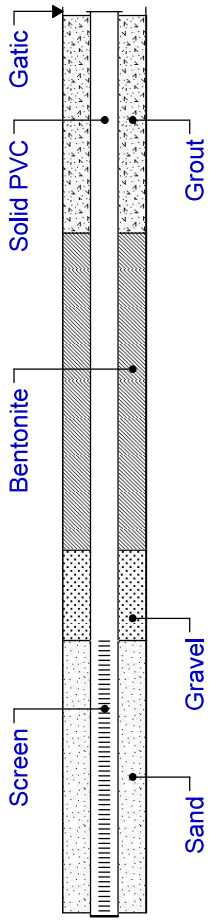
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers	Dry	MP	A	1			
1.0			SAND: paving sand							
1.5			**FILL -CL** CLAY: brown							
2.0										
2.5										
3.0			**CL** Sandy CLAY							
3.5										
4.0										
4.5										
5.0										
5.5										
6.0										
6.5										
7.0										
7.5				Dry	MP	A	0			
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5										
13.0										
13.5										
14.0			**CH** CLAY: brown							
14.5										
15.0										
15.5										
16.0										
16.5										
17.0				Dry	VHP	A	0			
17.5										
18.0										
18.5										
19.0										
19.5										
20.0			~~End of Borehole~~							



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

Job No: 1703073

Borehole Number: BH106

Project: Adelaide MFS Monitoring Wells

Client: SAFECOM

Drill Date: 5/07/2021

Site Location: 99 Wakefield Street, Adelaide 5000

Driller: Beyond Drilling

Engineer: RCA

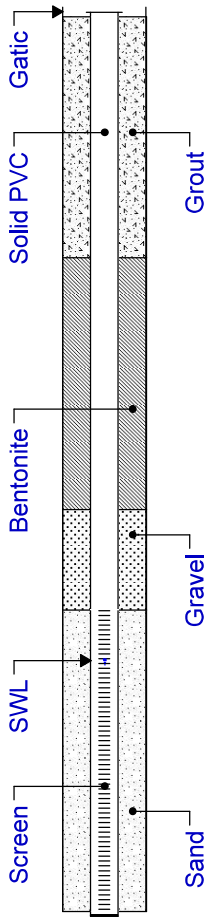
Drill Method: Auger

Datum: See Figure

Sheet: 1 of 1

TMK Consulting Engineers
100 Pirie Street
ADELAIDE SA 5000

SUBSURFACE PROFILE								SAMPLE		
Depth (m)	Method	Symbol	Description	Moisture	Plasticity	Odour	Visual	Sample ID	PID (ppm)	
0.0	Auger		~~Ground Surface~~							
0.5			Concrete Pavers							
1.0			SAND: paving sand							
1.5			**CH** CLAY: brown							
2.0										
2.5										
3.0										
3.5										
4.0										
4.5										
5.0										
5.5										
6.0				Dry	MHP	A	1			
6.5										
7.0										
7.5										
8.0										
8.5										
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0										
12.5			**CL** Sandy CLAY: red	Dry Wet	MP	A	0			
13.0										
13.5										
14.0			**CH** CLAY: brown							
14.5										
15.0										
15.5										
16.0				Wet	VHP	A	0			
16.5										
17.0										
17.5										
18.0			~~End of Borehole~~							



This report has been prepared for environmental purposes only. Not to be used for engineering purposes.

Odour : A = None, B = Low - Medium, C = Medium - High Visual : 1 = Fill, 0 = Natural

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

001

Client: MFS		Job No: 33/9080	
Job Name:		Date: 20-07-2021	
GHD Representative:	Vera Biermann	Arrival Time: 8.35	Departure Time: 12.00
Weather Conditions:	(Please circle) Fine (Overcast) (Light Rain) Heavy Rain Other_____		
Works Being Undertaken:	GME		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
Pantju Nam GHD			
Kelly Nam GHD			

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

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
GW103		Location GW103 was partially covered by a shipping container but still accessible for gauging & sampling
GW102 & GW104		accessible externally the other four wells are inside the MFS yard and require access / visitor cards

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:

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: 3319080	**Date:** 20, 07, 21
Job No.:	**Time:**
Location: Adelaide Station	**Sampler:** VB

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW101	–	12.529	–	
GW102	–	11.528	–	
GW103	–	12.097	–	well cap damaged
GW104	–	13.168	–	
GW105	–	12.120	–	
GW106	–	12.508	–	

Hydrasleeve Sampling Record

Project number:	3219080	Sampler initials	
Client:	MFS	PM initials	
Site location:	Adelaide Station		

Well ID	GW102	Depth to Groundwater (mBTOC)	11.528
Date	20-07-21	Depth to top of sampler (mBTOC)	≈15m
QC sample	FS03 FD03	Well depth (mBTOC)	18.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
9.35	6.74	20.8	12139	220.4	3.12

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no odour colour: pale brown High turbidity, no sheen

Well ID	GW103	Depth to Groundwater (mBTOC)	12.097
Date	20-7-21	Depth to top of sampler (mBTOC)	≈12.50
QC sample		Well depth (mBTOC)	14.11

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.20	6.75	20.6	13697	267.7	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no sheen. pale yellow low turbidity no odour well cap damaged

Well ID	GW106	Depth to Groundwater (mBTOC)	12.508
Date	20-7-21	Depth to top of sampler (mBTOC)	~~17.970~~ ≈15m
QC sample		Well depth (mBTOC)	17.97

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10.51	6.65	20.7	11425	270.2	2.81

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	medium-high turbidity, no sheen, pale brown

Hydrasleeve Sampling Record

Project number:	3219080	**Sampler initials**	VB
Client:	MFS	**PM initials**	DV
Site location:	Adelaide Station		

Well ID	GW 105	**Depth to Groundwater (mBTOC)**	12.120
Date	20 - 07 . 21	**Depth to top of sampler (mBTOC)**	≈ 14.00
QC sample		**Well depth (mBTOC)**	16.39

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
10:00	6.75	19.6	9982	240.2	2.62

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	no ~~odour~~ odour no sheen. clear low turbity

Well ID	GW101	**Depth to Groundwater (mBTOC)**	12.529
Date	20.07.21	**Depth to top of sampler (mBTOC)**	≈ 13.5
QC sample		**Well depth (mBTOC)**	14,9

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.15	7.01	21.0	~~670~~ 9645	271.5	2.9

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	. high turbidity . no sheen. . pale brown . no odour.

Well ID	GW104	**Depth to Groundwater (mBTOC)**	13.168
Date	20-07-21	**Depth to top of sampler (mBTOC)**	
QC sample	RB03 off IP ; FB03	**Well depth (mBTOC)**	16.60

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
11.36	~~20~~. 6.57	20.5	11480	281.4	~~2.47~~ 2.42

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☒	pale brown no sheen high turbidity no odour FB03 collected at end of sampling

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 274494

Client Details

Client	GHD Pty Ltd
Attention	Dilara Valiff
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**3319080**
Number of Samples	9 Water
Date samples received	21/07/2021
Date completed instructions received	21/07/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	28/07/2021
Date of Issue	26/07/2021

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Josh Williams, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Waters Short						
Our Reference		274494-1	274494-2	274494-3	274494-4	274494-5
Your Reference	UNITS	GW101	GW102	GW103	GW104	GW105
Date Sampled		20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Date analysed	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	26	<0.01	11	0.04	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	27	0.01	16	0.099	0.02
Perfluorooctanoic acid PFOA	µg/L	1.9	<0.01	0.87	<0.01	<0.01
6:2 FTS	µg/L	1.2	<0.01	1.5	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	96	94	98	97	100
Surrogate $^{13}C_2$ *PFOA*	%	94	93	94	94	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	95	96	96	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	80	102	79	99	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	101	95	104	99
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	72	88	77	93	86
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	91	100	93	108	98
Total Positive PFHxS & PFOS	µg/L	53	0.01	27	0.14	0.02
Total Positive PFOA & PFOS	µg/L	29	0.01	17	0.1	0.02
Total Positive PFAS	µg/L	56	0.01	29	0.14	0.02

PFAS in Waters Short					
Our Reference		274494-6	274494-7	274494-8	274494-9
Your Reference	UNITS	GW106	FD03	RB03	FB03
Date Sampled		20/07/2021	20/07/2021	20/07/2021	20/07/2021
Type of sample		Water	Water	Water	Water
Date prepared	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Date analysed	-	21/07/2021	21/07/2021	21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.02	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.11	0.02	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	96	98	95	98
Surrogate $^{13}C_2$ *PFOA*	%	95	94	97	95
Extracted ISTD $^{18}O_2$ *PFHxS*	%	92	93	98	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	97	98	101	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	100	107	105
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	85	89	144	140
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	105	108	147	145
Total Positive PFHxS & PFOS	µg/L	0.13	0.02	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	0.11	0.02	<0.01	<0.01
Total Positive PFAS	µg/L	0.13	0.02	<0.01	<0.01

Method ID	Methodology Summary
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.3 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	274494-2
Date prepared	-			21/07/2021	1	21/07/2021	21/07/2021		21/07/2021	21/07/2021
Date analysed	-			21/07/2021	1	21/07/2021	21/07/2021		21/07/2021	21/07/2021
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	26	25	4	111	114
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	27	28	4	103	106
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	1.9	1.8	5	110	108
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	1.2	1.2	0	111	117
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	115	115
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	91	1	96	99	3	94	97
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	1	94	94	0	98	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	88	1	93	97	4	95	94
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	96	1	80	82	2	103	101
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	98	1	91	92	1	103	96
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	110	1	72	75	4	122	80
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	1	91	87	4	120	91

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	8	21/07/2021	21/07/2021		[NT]	[NT]
Date analysed	-			[NT]	8	21/07/2021	21/07/2021		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
6:2 FTS	µg/L	0.01	Org-029	[NT]	8	<0.01	<0.01	0	[NT]	[NT]
8:2 FTS	µg/L	0.02	Org-029	[NT]	8	<0.02	<0.02	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	8	95	94	1	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	8	97	94	3	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	8	98	92	6	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	8	101	103	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	8	107	109	2	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	8	144	138	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	8	147	137	7	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

CHAIN OF CUSTODY RECORD

GHD

GHD Adelaide
211 Victoria Square, Adelaide SA 5000
Telephone: 618 8111 6800 Facsimile: 618 8111 6899
Email: adlmail@ghd.com.au

GHD Mt Gambier
2A Helen St, Mt Gambier SA 5290
Telephone: 618 8721 0800 Facsimile: 618 8721 0899

GHD Roxby Downs
1/14 Tutop St, Roxby Downs SA
Telephone: 618 8671 4000 Facsimile: 618 8671 4099

Turnaround Requirement:
X STANDARD
☐ NON-STANDARD _____

Job Number	GHD Office	Relinquished By:	Received By:	Relinquished By:	Received By:
3319080	Adelaide	Vera Biermann	ELS Alex Stark		ELS
Project		Date/Time:	Date/Time:	Date/Time:	Date/Time:
3319080		20/07/21	20/7/21 @ 1pm		21-7-21 8:00

GHD Project Manager	GHD Contact
Dilara Valiff 0420959236	Vera Biermann 0435981783
Email Reports to: GHDLabReports@ghd.com; vera.biermann@ghd.com; dilara.valiff@ghd.com	Quote

SEND TO:

☐ **ALS Laboratories**
2-4 Westall Rd, SPRINGVALE, VIC 3171
Ph: 03 8549 9600
Contact:

☐ **MGT LabMark**
2-5 Kingston Town Close, OAKLEIGH VIC 3166
Ph: 03 9564 7055
Contact:

☐ **SGS**
16/33 Maddox St, ALEXANDRIA NSW 2015
Ph: 02 8594 0400
Contact:

☐ **BUREAU VERTIAS AMDEL**
2/35 Cormack Rd, WINGFIELD SA 5013
Ph: 08 8440 7100
Contact:

Sample I.D.		Date	Time	Sample Matrix S: Soil SL: Sludge W: Water A: Air	Container Type J: Jar; B: Bag; V: Vial; G: Glass bottle; P: Plastic bottle	Analyses Required: PFAS Short Screen (Std LOR)	Remarks
GW101	1	20 July 2021		W	P	X	
GW102	2	20 July 2021		W	P	X	
GW103	3	20 July 2021		W	P	X	
GW104	4	20 July 2021		W	P	X	
GW105	5	20 July 2021		W	P	X	
GW106	6	20 July 2021		W	P	X	
FD03	7	20 July 2021		W	P	X	
FS03	—	20 July 2021		W	P	X	Please forward to ALS.
RB03	8	20 July 2021		W	P	X	
FB03	9	20 July 2021		W	P	X	

ENVIROLAB
Environmental Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 274494

Date Received: 21-7-21
Time Received: 8:00
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks:

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2126808**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VERA BIERMANN	Contact	: Sarah Mathew
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 3319080	Date Samples Received	: 21-Jul-2021 14:50
Order number	: 3319080	Date Analysis Commenced	: 26-Jul-2021
C-O-C number	: ----	Issue Date	: 27-Jul-2021 13:23
Sampler	: ----		
Site	:		
Quote number	: EN/005		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- 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	FS03	----	----	----	----
			Sampling date / time	20-Jul-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2126808-001	--------	--------	--------	--------
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.03**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	**0.03**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	**0.03**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**109**	----	----	----	----
13C8-PFOA	----	0.02	%	**88.8**	----	----	----	----

Surrogate Control Limits

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

QUALITY CONTROL REPORT

Work Order	: **ES2126808**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VERA BIERMANN	Contact	: Sarah Mathew
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 3319080	Date Samples Received	: 21-Jul-2021
Order number	: 3319080	Date Analysis Commenced	: 26-Jul-2021
C-O-C number	: ----	Issue Date	: 27-Jul-2021
Sampler	: ----		
Site	:		
Quote number	: EN/005		
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*
Alex Rossi	Organic Chemist	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

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: 3810224)									
ES2127162-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.95	0.94	0.0	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.17	0.16	9.2	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.35	0.30	15.3	0% - 50%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3810224)									
ES2127162-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.04	0.03	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.09	0.08	20.5	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.27	0.22	23.3	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.21	0.18	16.4	0% - 50%
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3810224)									
ES2127162-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	0.54	0.48	11.0	0% - 50%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit

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: 3810224)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	116	72.0	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	118	68.0	131
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	113	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3810224)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	105	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	116	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	120	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	122	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	129	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3810224)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	119	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	122	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	113	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	105	71.4	144

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3810224)							
ES2127162-002	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	100	72.0	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	89.8	68.0	131
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	# Not Determined	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3810224)							
ES2127162-002	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	88.3	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	114	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	114	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	107	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	113	71.0	133

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3810224)							
ES2127162-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	93.2	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	106	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	119	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	74.2	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2126808**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VERA BIERMANN	Telephone	: +61-2-8784 8555
Project	: 3319080	Date Samples Received	: 21-Jul-2021
Site	:	Issue Date	: 27-Jul-2021
Sampler	: ----	No. of samples received	: 1
Order number	: 3319080	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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES2127162--002	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **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)							
FS03	**20-Jul-2021**	**26-Jul-2021**	16-Jan-2022	✓	**26-Jul-2021**	16-Jan-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
FS03	**20-Jul-2021**	**26-Jul-2021**	16-Jan-2022	✓	**26-Jul-2021**	16-Jan-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
FS03	**20-Jul-2021**	**26-Jul-2021**	16-Jan-2022	✓	**26-Jul-2021**	16-Jan-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
FS03	**20-Jul-2021**	**26-Jul-2021**	16-Jan-2022	✓	**26-Jul-2021**	16-Jan-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

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

Preparation Methods	Method	Matrix	Method Descriptions
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

GHD

GHD Adelaide
211 Victoria Square, Adelaide SA 5000
Telephone: 618 8111 8600 Facsimile: 618 8111 8699
Email: adimail@ghd.com.au

GHD Mt Gambier
2A Helen St, Mt Gambier SA 5290
Telephone: 618 8721 0800 Facsimile: 618 8721 0899

GHD Roxby Downs
1/14 Tulop St, Roxby Downs SA
Telephone: 618 8671 4000 Facsimile: 618 8671 4068

Turnaround Requirement:
X STANDARD
☐ NON-STANDARD

Job Number	GHD Office	Relinquished By:	Received By:	Relinquished By:	Received By:
3319080	Adelaide	Vera Biermann	ELS Alex Stark		SGS Yuyao
Project		Date/Time:	Date/Time:	Date/Time:	Date/Time:
3319080		20/07/21	20/7/21 @ 1pm		21/7/21 1520

GHD Project Manager	GHD Contact	Analyses Required
Dilara Valiff 0420959236	Vera Biermann 0435981783	
Email Reports to: GHDLabReports@ghd.com; vera.biermann@ghd.com; dilara.valiff@ghd.com	Quote	

Sample ID		Sample Date	Time	Sample Matrix (W = Water, S = Soil, A = Air)	Number of Containers	PFAS Short Screen (Std LOR)
GW101	1	20 July 2021		W	P	X
GW102	2	20 July 2021		W	P	X
GW103	3	20 July 2021		W	P	X
GW104	4	20 July 2021		W	P	X
GW105	5	20 July 2021		W	P	X
GW106	6	20 July 2021		W	P	X
FD03	7	20 July 2021		W	P	X
(1) FS03	—	20 July 2021		W	P	X
RB03	8	20 July 2021		W	P	X
FB03	9	20 July 2021		W	P	X

Relinquished by: V. VEGA
21/7/21 @ 1422

SEND TO:

☐ **ALS Laboratories**
2-4 Westall Rd, SPRINGVALE, VIC 3171
Ph: 03 8549 9600
Contact:

☐ **MGT LabMark**
2-5 Kingston Town Close, OAKLEIGH VIC 3166
Ph: 03 8564 7055
Contact:

☐ **SGS**
16/33 Maddox St, ALEXANDRIA NSW 2015
Ph: 02 8594 0400
Contact:

☐ **BUREAU VERITAS AMDEL**
2/35 Cormack Rd, WINGFIELD SA 5013
Ph: 08 8440 7100
Contact:

Remarks

Please forward to ALS.

Environmental Division
Sydney
Work Order Reference
ES2126808

Telephone : +61-2-8784 8555

Remarks:

ECO Environmental

Environmental monitoring
& sampling equipment
Rentals and sales.

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fax: +61 8 9328 2677
eco@ecoenvironmental.com.au
www.ecoenvironmental.com.au
214 Lord St Perth WA 6000

Equipment Information

Instrument: HIM1002A
Serial Number: SN#01-5377

Equipment Check

	Enclosed	Returned	Comment
Heron Interface Level Meter	☑	☐	
Heron Carry Bag	☑	☐	
Spare 9V. Battery	☑	☐	

Inspection Details

	Pass	Fail	Comment
De-con wash of tape (100m)	☑	☐	
De-con wash of reel	☑	☐	
Inspection for faults, corrosion, damage	☑	☐	
Meter in good working order, clean and ready for use	☑	☐	
Check that threaded nut on probe is tight	☑	☐	

This is to certify that where possible, this instrument has been cleaned in accordance with the manufacturer's general maintenance procedure as recommended in the instrument service manual.

ECO Standard Rental Terms & Conditions apply to all equipment calibrations.

Regards

Dave McGraw 15/7/21

Equipment Specialist
ECO Environmental

ECO Environmental

Environmental monitoring
& sampling equipment
Rentals and sales.

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214 Lord St Perth WA 6000

Equipment Information

Instrument: YSIPP3A
Serial Number: 10C101428 (Display)
20G100798 (Sonde)

Equipment Check

	Enclosed	Returned	Comment
YSI Pro Plus Display	☑	☐	
YSI Quatro Sonde	☑	☐	
- YSI 1001 pH Probe *(LN: 12F)*	☑	☐	
- YSI 1002 ORP Probe *(LN: 11G)*	☑	☐	
- YSI 5560 Cond/Temp Probe *(LN: 12J)*	☑	☐	
- YSI Polarographic DO Sensor *(LN: 13D)*	☑	☐	
Flow Cell & Attachments (x2)	☑	☐	
Probe Guard	☑	☐	
Rubber Storage/Calibration Sleeve	☑	☐	
Calibration Cup + Cap	☑	☐	
YSI Cable Management Kit	☑	☐	
YSI Pro Series ProComm II Kit	☑	☐	
User Manual + Flow Cell Manual + CD-Rom	☑	☐	
Spare Batteries (x 2) & Screwdriver	☑	☐	
Laminated Quick Start Guide	☐	☐	

Sensor Calibration Details

	Calibration Undertaken	Accuracy	Pass	Fail
Temperature	Factory Calibrated	±0.2°C	☑	☐
Dissolved Oxygen	☑ 100% Saturation	±2%	☑	☐
	Pressure Compensation	1014 hPa	☑	☐
Conductivity	☑ 12.88mS/cm	±0.5%	☑	☐
	☐ Check linearity at 1.413mS/cm	±0.5%	☐	☐
Salinity	Auto Calibrated	±1%	☐	☐
pH	☑ pH 7.00	± 0.2	☑	☐
	☑ pH 4.00	± 0.2	☑	☐
ORP	☑ 238 mV at 21 °C	±20mV	☑	☐

This is to certify that where possible, this instrument has been calibrated in accordance with the manufacturer's calibration procedure as recommended in the instrument service manual.

ECO Standard Rental Terms & Conditions apply to all equipment calibrations.

Regards

Dave McGraw 24/5/21
Checked DM
15/7/21

Equipment Specialist
ECO Environmental

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The Power of Commitment