SA Country Fire Service

Brukunga State Training Centre
Detailed Site Investigation

March 2021

Executive summary

The South Australian Country Fire Service (CFS) engaged GHD Pty Ltd (GHD) to undertake an on-site and off-site environmental investigation in the vicinity of the CFS State Training Centre located at Pyrites Road, Brukunga (the site). The investigation assessed the nature and extent of per- and poly-fluoroakyl substances (PFAS); on-site in soil, concrete and groundwater; and off-site in groundwater, sludge stockpiles within the former Brukunga Mine and in the surface water and sediment of the adjacent Dawesley Creek.

This report documents the scope of work, methodology and findings of the additional on-site and off-site environmental investigations carried out by GHD between May and December 2020. The works were undertaken in accordance with the Sampling and Analysis Quality Plan (SAQP) prepared by GHD for the Brukunga CFS State Training Centre and surrounding area, dated 24 April 2020. The site location and site layout are illustrated in Figure 1 and Figure 2 at the end of this report, respectively.

Previous investigations reported PFAS concentrations in Dawesley Creek that were considered to potentially threaten groundwater and the South Australian Environment Protection Authority (SA EPA) was notified in 2019. The CFS commissioned Dr Ruth Keogh, an SA EPA accredited auditor of Fyfe Pty Ltd, on 3 December 2019 as the site contamination auditor. A voluntary site contamination assessment proposal (VSCAP) was prepared by GHD for the CFS Brukunga State Training Centre, pursuant to Section 103I of the Environment Protection Act, 1993 (SA) (EP Act). The SA EPA approved the VSCAP and provided a VSCAP acceptance letter on 21 January 2020.

The objectives of this investigation were to:

- Assess the nature and extent of PFAS impacts associated with historical site activities; on-site in groundwater, surface water, soil and on-site infrastructure (e.g. concrete slabs) as well as off-site in groundwater, surface water, sediment and sludge stockpiles.
- Identify and assess any potential risks to human health and the environment from PFAS site contamination arising from historical site activities, in the context of continued industrial use of the site and for relevant land uses for any affected off-site properties.
- Provide appropriate information to revise the conceptual site model (CSM) and to prepare a Remediation Options Assessment and Site Remediation Plans, to enable a site contamination auditor to prepare a site contamination audit report as part of the EPA accepted VSCAP..

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

Flux tests, soil and concrete

- The results of concrete, soil, flux and concrete core leachability testing confirmed that Hotpad B and to a lesser extent Hotpad A as well as the concrete walls of on-site water storage tanks, especially Tank 1 and Tank 4, continue to represent an ongoing source of PFAS to the environment. PFAS concentrations in leachates from 16 out of 21 samples concrete core samples were above the adopted assessment criteria for freshwater, with 13 samples (HPA1, HPB1-PPB5, all Tank 1 and all Tank 4 samples) exceeding the criteria for drinking water and four samples exceeding the criteria for recreational water (HPB1-HPB4). During a simulated rainfall event, PFAS concentrations up to two orders of magnitude above the adopted catchment specific WQG for freshwater were reported for surface run-off from Hotpad B. These high concentrations reflected high PFAS concentrations in concrete core samples, leachates and to a lesser extent in soil samples from Hotpad B.

- Soil samples taken to the west of Hotpad A and B, between the CFS site and Dawesley Creek, reported elevated PFAS concentrations exceeding either the ecological direct and/or indirect exposure criteria for PFOS. These impacts have not been vertically or laterally delineated towards Dawesley Creek.
- All on-site soil sampling locations reported elevated PFAS concentrations. All locations reported PFOS above the adopted interim criteria for ecological indirect exposure, except for SB02 in the main store building.

Storage tank water

- PFAS concentrations in all seven water storage tanks at the south-western corner of the CFS STC site exceeded the adopted catchment specific WQG for PFOS and PFHxS in freshwater as well as the health screening level for drinking water. The water in the storage tanks is considered a potential PFAS source as it could infiltrate the subsurface or run off into the surface water of Dawesley Creek during high rainfall events where excess water is discharged from the tanks. There is also the potential for the PFAS to be absorbed by the tank wall as shown by the concrete leaching test results for Tank 4.

Sludge, seepage water and leachability test

- PFAS were detected in 51 out of 61 sludge samples that were analysed and five of these samples exceeded the adopted PFOS interim criterion for ecological indirect exposure. Low level PFAS concentrations below the assessment criteria were reported for all sludge stockpile and disposal areas. Leach testing of sludge indicates that this material is acting as a source of PFAS to surface water and groundwater above the catchment specific WQG for PFOS and PFHxS.
- PFAS concentrations in five seepage water samples collected from the Brukunga mine waste rock dump to the west of Dawesley Creek exceeded the adopted catchment specific WQG, with two of these samples also exceeding the adopted health screening level for drinking water. The source of PFAS in the seepage water is likely from the sludge waste stockpiles. PFAS contaminated seepage water is potentially impacting Dawesley Creek surface water and groundwater.
- PFAS were found to readily leach from sludge and concrete cores samples with PFAS concentrations in the leachates being proportional to the PFAS concentrations in the solid sample.

Diversion drain

- PFAS concentrations in the diversion drain were below the LOR. As surface water samples collected above the inlet to the diversion drain reported PFOS and PFHxS concentrations below the catchment specific WQG, it is considered unlikely that PFAS concentrations in water within the diversion drain exceed these criteria.

Groundwater

- Groundwater flow in February and June 2020 was inferred to flow from higher elevated areas to the east and west of the CFS STC site towards Dawesley Creek, and in a generally southerly direction from the CFS STC site. Dawesley Creek generally flows towards the south and discharges into Mt Barker Creek located over 10 km south of the CFS STC site.

- An assessment of groundwater salinity indicated fresh to hyper-saline groundwater in the vicinity of the CFS STC site, the fresher of which may be suitable for potable use, irrigation, recreation and aesthetics, primary industries, livestock drinking water and aquaculture purposes (Gov SA 2019a).
- Groundwater PFHxS and PFOS concentrations exceeded the drinking water screening criterion in 7 out of a total of 26 tested groundwater monitoring wells in the vicinity of Brukunga Mine and in two out of five residential bores. The highest PFAS concentrations were reported in February 2020 for well H02, located adjacent the southern (down hydraulic gradient) boundary of the CFS STC site.
- Based on the February 2020 and June 2020 groundwater monitoring rounds results, PFAS in groundwater has been delineated in all directions against the drinking water screening criteria. However, based on surface water results it is considered likely that PFAS impacts in groundwater, associated with surface water bodies, are localised to impacted creek alignments.
- A Section 83A notification was submitted for the residential property on 296 Pyrites Road, Brukunga, SA (CT6053/276) in accordance with the Environmental Protection Act 1993 to the South Australian Protection Authority via email on 14 September 2020.

Surface water

- Background PFOS concentrations reported for Nairne Creek and upstream reaches of Mt Barker Creek and Bremer River, which were not impacted by Dawesley Creek, exceeded the PFAS NEMP fresh water 99% species protection level, indicating widespread PFAS impacts independent of the CFS STC site. Background concentrations in individual samples collected from upstream locations in Bremer River exceeded the PFAS NEMP drinking water guideline level.
- Catchment specific WQG for PFOS and PFHxS were derived in accordance with ANZG (2018) using data from Mt Barker Creek as reference sites. The catchment specific WQG for slightly to moderately and highly disturbed systems were calculated using the 80th and 90th percentile of the PFOS and PFHxS concentrations in Mt Barker Creek, respectively, and were adopted in lieu of the PFAS NEMP fresh water 99% species protection level for PFOS.
- PFAS impacts associated with the CFS STC site, above the catchment specific WQG, were observed to extend beyond the South Eastern Freeway and beyond Jaensch Road in Hartley SA 5255 (between Callington Road and North Bremer Road), approximately 37.4 km, downstream from the CFS STC site to the south and have not yet been delineated. It is noted that Nairne Creek, Bremer River and Mt Barker Creek are also contributing to PFAS in surface waters.
- The available flow data indicates that Dawesley Creek typically only contributes ≤ 20% to the flow in the downstream sections of Bremer River. However, the substantially higher PFOS and PFHxS concentrations measured in Dawesley Creek, relative to the upstream reaches of Mt Barker Creek, suggest that the majority of PFOS and PFHxS found downstream of the confluence of Mt Barker Creek and Bremer River is likely to be related to the CFS STC site.

Sediment

- Sediment within Dawesley Creek downstream of the CFS STC site exceeded the adopted assessment criteria for interim ecological indirect exposure and the health screening level for residential land use with access to soil.

- Impacts of PFAS concentrations in sediment have been delineated upstream of the CFS STC site at sampling location DC-UP01 and downstream of the CFS STC site at sampling location DC17A in Mt Barker Creek. The sediment impacts were confined to Dawesley Creek between the CFS STC site and the confluence of Dawesley Creek with Mt Barker Creek.

Risk assessment

- Incidental ingestion of sediment within Dawesley Creek by land owners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS STC site was the only identified potential SPR linkage where human receptors are exposed to PFAS concentrations above the adopted human health criteria. However, it is considered unlikely that human receptors will come into contact with PFAS quantities detrimental to their health. As a precaution, potential human receptors should be advised to avoid contact with identified PFAS sources.
- The risk to human receptors from consumption of fruit, vegetables and meat from livestock grown in the vicinity of Dawesley Creek downstream of the CFS STC site using contaminated surface water or groundwater could not be conclusively assessed due to lack of data.
- The risk to human receptors from consumption of fish and yabbies caught in PFAS-impacted surface water could not be assessed due to lack of data.
- For ecological receptors, four potentially complete SPR linkages where ecosystems are exposed to PFAS concentrations above the adopted criteria have been identified. These include (1) ecosystems at the CFS STC site and the area between Dawesley Creek and the CFS STC site with access to / in contact with contaminated soil, (2) ecosystems within Dawesley Creek and the downstream reaches of Mt Barker Creek and Bremer River exposed to contaminated surface water and sediment (Dawesley Creek only), (3) ecosystems at locations where contaminated sludge originating from the water treatment plant has been or is being placed and (4) ecosystems at locations exposed to seepage water impacted with PFAS.

Recommendations

Based on the results of the PFAS investigations completed to date, the following recommendations were provided:

- Undertake community information sessions on the results of PFAS investigations in the Brukunga area in accordance with the VSCAP milestone; advise stakeholders (landowners / occupants of properties located in the vicinity of Dawesley Creek downstream of the CFS STC) of PFAS impact in surface water and sediment in Dawesley Creek.
- Conduct an Environmental Risk Assessment (ERA) to assess the potential risks to the environment that may be associated with the presence of PFAS in soil, sediment, biota, surface water, concrete, sludge and groundwater, both on-site and off-site within the wider Investigation Area. If data collected as part of the ERA indicates PFAS has bioaccumulated in biota that is being caught and/or consumed by the public such as fish, yabbies, eggs, meat, poultry etc; a Human Health Risk Assessment (HHRA) may also be warranted depending on the concentrations detected. The results of the ERA (and HHRA if required) will inform the development of Remediation Options Assessments (ROA) and Site Remediation Plans (SRP).
- Prepare a remediation options assessment (ROA) to address mass flux from PFAS impacted infrastructure, soils and sludge.

- Prepare a SRP to execute the selected remedial technologies to address PFAS mass flux from the site causing environmental harm and harm to human health (if warranted).
- Undertake on-going monitoring of the CFS STC PFAS water filtration system in accordance with the developed SRP.
- Further sampling of surface water and sediment downstream of the CFS State Training Centre site in Dawesley Creek, Mt Barker Creek and Bremer River to delineate PFAS impacts; as well as upstream reference locations to develop a temporal robust data set, to determine seasonal trends and to derive reliable catchment specific assessment criteria. Further sampling will be undertaken in accordance with the SAQP to be reviewed and endorsed by the CFS and the auditor.
- Undertake “fingerprint” analysis of future surface water samples for the full “long” PFAS analytical suite to distinguish between different PFAS sources and to identify the relative contribution of the various PFAS sources to the PFAS load in Bremer River down gradient of its confluence with Mt Barker Creek.
- Undertake on-going monitoring of the CFS STC PFAS water filtration system in accordance with the SRP.
- Develop and instigate of a Construction Environment Management Plan (CEMP) if any intrusive works proposed in areas of the site where PFAS-impacted soils have been identified.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 12 and the assumptions and qualifications contained throughout the Report.

Table of Abbreviations

Abbreviation	Full form
AHD	Australian Height Datum
AMD	Acid mine drainage
ARD	Acid rock drainage
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999
ASLP	Australian Standard Leaching Procedure as per Australian Standard AS 4439.3-1997
ASP	Acid seepage pond
ATP	AMD treatment plant
CFS	South Australian Country Fire Service
COC	Chain of custody
CSM	Conceptual site model
DEM	Department of Energy and Mining
DEW	Department for Environment and Water
DQOs	Data quality objectives
DSI	Detailed Site Investigation
GAR	South Australian Guidelines for the Assessment and Remediation of Site Contamination 2019
GHD	GHD Pty Ltd
GME	Groundwater monitoring event
HDPE	High-Density Polyethylene
HEPA	Heads of Environment Protection Authorities Australia
JSEA	Job safety and environment analysis
LDPE	Low-Density Polyethylene
LOR	Limit of reporting
m bgl	Metres below ground level
mg/L	milligrams / Litre
NATA	National Association of Testing Authorities
NEMP	PFAS National Environmental Management Plan 2020
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
PFAS	Per- and poly-fluoroalkyl substances
PFHxS	Perfluorohexane sulfonate

Abbreviation	Full form
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PVC	Polyvinyl chloride
QA/QC	Quality assurance and quality control
SA EPA	South Australian Environment Protection Authority
SAQP	Sampling and analysis quality plan
SPR	Source-pathway-receptor
STC	State Training Centre
SWL	Standing water level
TDS	Total dissolved solids
TOC	Top of casing
TOPA	Total oxidisable precursor assay
TSF	Tailings storage facility
VSCAP	Voluntary site contamination assessment proposal
WRD	Waste rock dump
µg/L	micrograms / Litre

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Appendices

1. Introduction

The South Australian Country Fire Service (CFS) engaged GHD Pty Ltd (GHD) to undertake a detailed site investigation (DSI) in the vicinity of the CFS State Training Centre (STC) located at Pyrites Road, Brukunga (the site). The investigation assessed the nature and extent of per- and poly-fluoroakyl substances (PFAS); on-site in soil, concrete, stored tank water and groundwater; and off-site in groundwater, sludge stockpiles within the former Brukunga Mine and in the surface water and sediment of the adjacent Dawesley Creek. This report is subject to, and must be read in conjunction with, the limitations set out in Section 12 and the assumptions and qualifications contained throughout the Report.

This report documents the scope of work, methodology and findings of the additional on-site and off-site environmental investigations carried out by GHD between May and October 2020. The works were undertaken in accordance with the Sampling and Analysis Quality Plan (SAQP) prepared by GHD for the Brukunga CFS STC and surrounding area, dated 24 April 2020.
The site location and site layout are illustrated in Figure 1 and Figure 2 at the end of this report, respectively.

1.1 Background

Historically, the CFS used firefighting foam containing PFAS at the site during testing of delivery systems on firefighting appliances. PFAS foam has not been used at the site since 2001.

In addition to on-site PFAS use, it is understood that:

- Water within Dawesley Creek has been impacted by acid mine drainage (AMD) from the adjacent Brukunga Mine.
- Downstream of the CFS STC the Department of Energy and Mining (DEM) diverts water from Dawesley Creek through an acid treatment plant to raise the pH of the water prior to discharging back into Dawesley Creek.
- The South Australian Environment Protection Authority (SA EPA) identified elevated levels of PFAS within Dawesley Creek.

Following the SA EPA's findings, GHD was commissioned by the CFS to conduct an environmental assessment of the site to determine the source/s of PFAS contamination within Dawesley Creek.

The GHD investigation presented in our report dated 7 November 2019, identified PFAS on-site in soil, concrete and a water storage tank; and off-site in surface water of Dawesley Creek, the acid seepage pond (ASP), the acid treatment plant discharge channel (ATP), Pond 4 near where treated water is discharged into the underground diversion drain and sludge from the treatment plant (Figure 3). The concentrations of PFAS in the creek were considered to potentially threaten groundwater and the SA EPA was notified through a Section 83A Notification of site contamination of tank stored water dated 21 October 2019.

Based on the information provided, the SA EPA deemed the site a Level 1 regulatory priority in accordance with SA EPA (2017) Site Contamination Regulatory and Orphan Site Management Framework, and stated a voluntary site contamination assessment proposal (VSCAP) is necessary for effective regulation of the site. The SA EPA additionally requested a site contamination auditor is engaged to prepare a site contamination audit report as part of the VSCAP. The CFS commissioned Dr Ruth Keogh, an SA EPA accredited auditor of Fyfe Pty Ltd, on 3 December 2019 as the site contamination auditor.

The VSCAP was prepared by GHD for the CFS Brukunga State Training Centre, pursuant to Section 103I of the Environment Protection Act, 1993 (SA) (EP Act) and submitted to the SA EPA on 7 January 2020, following review and endorsement by the auditor. The SA EPA approved the VSCAP and provided a VSCAP acceptance letter on 21 January 2020.

GHD undertook an off-site investigation of groundwater, surface water and sediment in February 2020, where elevated levels of PFAS were found in groundwater across the former Brukunga Mine, the tailings storage facility and the southernmost extent of Dawesley Creek within the Brukunga Mine. PFAS concentrations exceeding adopted screening criteria were also found in a private residential bore, approximately 1.7 km south of the site. The findings of this investigation are summarised in Figure 3.

1.2 Objectives

The objectives of this DSI were to:

- Assess the nature and extent of PFAS impacts associated with historical site activities; on-site in groundwater, surface water, soil and on-site infrastructure (e.g. concrete slabs) as well as off-site in groundwater, surface water, sediment and sludge stockpiles.
- Identify and assess any potential risks to human health and the environment from PFAS site contamination arising from historical site activities, in the context of continued industrial use of the site and for relevant land uses for any affected off-site properties.
- Provide appropriate information to revise the conceptual site model (CSM) and to prepare a Remediation Options Assessment and Site Remediation Plans, to enable a site contamination auditor to prepare a site contamination audit report as part of the EPA accepted VSCAP.

2. Site Information

2.1 Site Identification

Site identification information for the CFS STC is summarised in Table 2-1.

Table 2-1 Summary of site identification information

Item	Description
Site Address	28 Pyrites Road, Brukunga, SA 5252
Certificate of Title	CT 5825/147
Legal Description	Allotment 6 in Filed Plan 102110 in the Area named Brukunga, Hundred of Kanmantoo
Local Government Authority	Mt Barker District Council
Current Zoning	Brukunga Mine
Property Owner	South Australian Country Fire Service
Land Use	Continuing use as CFS training centre
Area	4.25 ha
Site Elevation	Approximately 345 m AHD to 355 m AHD (Australian Height Datum)

The Site Location Plan for the CFS Brukunga Training Centre is shown on Figure 1. The site is located adjacent the former Brukunga Pyrite Mine in the township of Brukunga. The nearest surface water receptor is Dawesley Creek, which is located immediately to the west of the CFS STC site, flows north to south and forms a subcatchment of the Bremer River (Figure 4).

Relevant on-site features are shown in Figure 2. Historically, PFAS containing AFFF was used during firefighting training until 2001, especially on Hotpad A (refer to Section 2.3 Historical Site Use). Runoff from rainfall events and training activities off both hotpads is collected in a central gutter, which delivers all water via a gross pollutant trap (GPT) and a 300 mm gravity-fed stormwater pipe into a series of seven concrete water storage tanks in the south-western corner of the CFS STC site. Excess water flows from Tank 7 via an overflow pipe into the underground diversion drain, which was commissioned in June 2003 (Figure 5).

2.2 Off-site investigation area

The off-site investigation area included the former Brukunga Pyrite Mine, groundwater beneath private land to the west and to the south of the Brukunga Mine and surface water / sediment in Dawesley Creek, Nairne Creek, Mt Barker Creek and Bremer River to the south and south-east of the CFS STC site. Relevant features of the Brukunga Mine for this investigation (as shown in Figure 5 and EES (2019) Figure 3 attached at the end of the report) included:

- The north waste rock dump (WRD) to the north-west of the CFS STC site
- The northern, central and southern highwall – sheer cliff faces marking the western boundary of the Mine
- The northern, central and southern bench at the foot of the highwall to the west of Dawesley Creek and the CFS STC site
- Sludge and biosolids stockpiles used for revegetation trials at the southern bench
- The central works area adjacent to and to the west of Dawesley Creek and the CFS STC site
- The north cut located between the northern and the central bench
- The south cut located between the central and the southern bench

- The south WRD and the south extension WRD to the south-west of the CFS STC site and west of Dawesley Creek
- The east WRD east of Dawesley Creek and to the south of the CFS STC site
- The north and south collection pond for acid rock drainage (ARD), referred to as acid seepage ponds, to the south-east of the CFS STC site
- The former tailings storage facility (TSF) to the east of the CFS STC site
- A water treatment plant for the neutralisation of AMD off Watts Road to the east of the CFS STC site, referred to as (acid) treatment plant
- Six sludge ponds near the eastern boundary of the Mine used for drying the sludge generated by the acid treatment plant
- An emergency sludge overflow pond located to the south-east of the water treatment plant and to the north of the sludge drying ponds
- An underground diversion drain and open diversion channels diverting Dawesley Creek past the majority of the Mine
- Sections of the old creek alignment labelled as Pond 0, Pond 2, Pond 3 and Pond 4, which are used for AMD collection. The former Pond 1 is now defunct.

The Brukunga Mine is impacted by AMD. The DEM has implemented measures to reduce off-site impacts in Dawesley Creek. At a weir just north of Peggy Buxton Road, Dawesley Creek is diverted into an underground diversion drain, which passes underneath the CFS STC site before it discharges into an open diversion channel, approximately 40 m west of Pond 4 (Figure 5). The open diversion channel flows north to south and returns the water to the natural Dawesley Creek bed approximately 15 m east of Pond 2.

AMD generated within the mine is intercepted via constructed open channels and pipes and held in several collection ponds located in the former creek alignment (Pond 2, Pond 3 and Pond 4). The AMD is then pumped into the northern acid seepage pond (ASP) located at the foot of the tailings dam, east of Pyrites Road, and from there to the acid treatment plant (ATP) off Watts Road (Figure 5).

In the treatment plant, the AMD is chemically neutralised by mixing with a locally available waste lime slurry (calcium hydroxide) as the neutralising agent. The lime slurry, a by-product of the manufacture of acetylene, is delivered by truck to and stored in the lime delivery and storage area, approximately 20 m to the west of the ATP (Figure 5). The complex mixing of the neutralising agent and the acid water occurs in three successive tanks. The mixed liquor and a flocculent are then pumped to a sludge thickening tank, where the waste sludge settles to the bottom leaving the clean water to decant off the top of the tank into an open channel (sampling location ATP_1 in 2019). The treated water flows via the open channel into the clarifying pond, approximately 75 m south-west of the ATP, where it undergoes a final clarification step. After approximately 24 hours detention in the clarifying pond the treated water is pumped to and discharged into the underground diversion drain near Pond 4 (Figure 5).

The average pH value of the AMD treated at the plant is 2.5 and the pH value of the water returned to the underground diversion drain is 8.5 (alkaline). During the treatment process the pH value of water is raised to approximately 9.5, to enable the precipitation of Manganese. Other metals that are removed from the raw water, mainly as hydroxides, include iron, aluminium, zinc, nickel, cobalt, copper and cadmium. In 1998, the capacity of the AMD treatment plant was increased from 20 to 30 kilolitres per hour. The annual volume of acid water treated varies, reaching up to 150 megalitres.

The waste sludge is collected from the bottom of the thickening tank and pumped to the six sludge drying ponds or the emergency sludge overflow pond south-east of the ATP. Twice a year, the clarifying pond is drained, and the accumulated sludge is removed and transported by truck to the sludge drying ponds or the emergency sludge overflow pond. The dried sludge is transported from the drying ponds to the sludge waste pile areas at the foot of the highwall in the western part of the Brukunga Mine (Figure 5).

Under normal operating conditions of the AMD treatment system, the AMD impacted water in the old Dawesley Creek alignment between Peggy Buxton Road and Pond 2 is mostly stagnant. During strong rainfall events that exceed the capacity of the storage Ponds 2, 3 and 4, however, water may flow from Pond 2 via an overflow into Dawesley Creek, immediately downstream of the southern end of the open diversion channel.

Before the commissioning of the underground diversion drain in June 2003, runoff from the CFS STC hotpads containing PFAS and / or the tank overflow would have flown into Dawesley Creek and on into Pond 4, where PFAS was detected (GHD 2019a). The PFAS containing acidic creek water was pumped from Pond 4 into the ASP north and from the ASP to the acid treatment plant. While the ATP neutralises the AMD, it is not designed to remove PFAS. Some PFAS remained in the treated water and some PFAS was contained in the sludge waste generated at the ATP (GHD 2019a).The PFAS in the treated water reached Dawesley Creek via the open diversion channel. The PFAS in the sludge is likely to have leached from the sludge waste piles into the AMD collection system. As such PFAS has been cycling form the ATP via the sludge, the AMD collection system and back to the ATP.

2.3 Historical Site Use

The CFS State Training Centre at Brukunga begun operations in 1989 and has been developed into a training facility where specialised fire training courses are held for CFS volunteers and to provide for the growing demands of industry and commerce in fire safety training. The training centre has accommodation facilities, classrooms, Hotpad A (concrete slab) and Hotpad B (concrete pavers) where practical firefighting training, road crash rescue and HAZMAT training is conducted. Based on CFS anecdotal information the use of Hotpad A commenced in 1993 prior to the construction of Hotpad B in 2002. Reportedly Hotpad A has been used more often than Hotpad B.

In January 2018, South Australia was the first state to ban the use of fluorinated firefighting foams, with the amendment of the Environment Protection (Water Quality) Policy 2015 (Gov SA 2015) under the Environment Protection Act 1993, with full legislative requirements coming into effect on 30 January 2020 after a two-year transition period. The CFS did not use fluorinated firefighting foams during the transition period.

Historically, most of the water used during fire-fighting training activities and rainwater have been collected as surface runoff from the hotpads and transferred into a series of seven concrete water storage tanks for re-use in training activities. However, some of the water may also have infiltrated the soil beneath and surrounding the hotpads.

Deep Exploration Technologies Cooperative Research Centre (DET CRC) operated a Drilling Research and Training Facility at the disused Brukunga Mine (neighbouring the CFS training centre) from October 2011 – October 2017. At times it utilised some facilities at the CFS Training Centre such as accommodation and classrooms. They provided real world environment opportunities for field testing of new drilling and logging technologies and vocational education and training for the drilling industry.

The Brukunga Drilling Research and Training Facility was packed down by October 2017 in anticipation of the closure of Deep Exploration Technologies CRC due to the end of Government funding in 2018.

2.4 Surrounding Land Uses

Current surrounding land uses bordering the CFS STC site are summarised in Table 2-2 below:

Table 2-2 Summary of surrounding land uses and zoning

Orientation	Description of Surrounding Land Use	Zoning (Municipal council)
East and north east	Brukunga town centre, residential properties, vacant / grazing land beyond	Residential and Primary Production
North west, west and south west	Dawesley Creek, former Brukunga Mine, vacant / grazing land beyond	Brukunga Mine and Primary Production
South, south-east and east	Pyrites Road, vacant land, a tailings facility including dam and acid treatment plant, vacant / grazing land beyond	Brukunga Mine and Primary Production

Land use along Dawesley Creek was summarised in the Rural Solutions (2009) Rural Lands Investigations Report – Land Use and Economics, District Council of Mt Barker report as constituting grazing on modified pastures (96%), mining (2%) and residential (2%).The creek and river system of the surrounding area is described in Section 4.4.

2.5 Previous investigations

The following environmental investigations have been reviewed for this investigation:

- DEM 2014, PIRSA Mining Operations Unit, Summary of Brukunga Groundwater Results (Excel spreadsheet file), Department of Energy and Mining, South Australia, 2014
- EES (2019), Site Contamination Audit Report (Restricted Scope): Brukunga Mine Site, Environmental Earth Sciences, October 2019.
- GHD (2019a) CFS Brukanga State Training Centre Environmental Investigation, Report for SA Country Fire Service, November 2019
- GHD (2020a) CFS Brukunga State Training Centre Preliminary Site Investigation, Report for SA Country Fire Service, 27 March 2020
- GHD (2020b) CFS Brukunga State Training Centre Off-site Groundwater Investigation, Report for SA Country Fire Service, 23 April 2020

The EES (2019) Audit Report was based on the following previous investigations reports:

- GHD (2010) Post Remediation Solute Transport Modelling, Report for Brukunga Mine Remediation
- ERM (2012), Hydrogeology summary – Brukunga: TAG, Final. Report to DMITRE, November 2012
- URS (2013), Brukunga Phase 2 contaminated land investigation. Prepared for DMITRE, February 2013
- O'Kane Consultants Pty Ltd (2013), Brukunga pre-mine water quality determination, Prepared for DMITRE, March 2013
- SKM (2013) Brukunga Mine Remediation Program BR01-05. Technical Note 2C: Catchment Hydrological Modelling

- SKM (2013) Brukunga Mine Remediation Program BR01-06. Technical Note 2E: Embankment Design
- TAG (2015) Detailed design of the days Creek domain- Stage 1 of the progressive remediation of the Brukunga Mine Site. Prepared for DSD November 2015. Updated February 2018 (V08)
- URS (2015) Preliminary Remediation Action Plan, Former Brukunga Mine Site, Prepared for Department of State Development, 4 May 2015
- Jacobs (2015a) Brukunga Mine Remediation BR01-06 – Days Creek Domain. Detailed Design, Draft Construction Management Plan, 22 June 2015
- Jacobs (2015b) Brukunga Mine Remediation BR01-06 – Days Creek Domain. Detailed Design Development Report, 22 June 2015
- Golder Associates (2016), Three dimensional regional groundwater flow modelling – Brukunga Mine Remediation Program. Report to DSD, February 2016.

2.6 Summary of previous works

2.6.1 DEM (2014) PIRSA Mining Operations Unit

Information obtained from the DEM, PIRSA Mining Operations Unit (2014) Summary of Brukunga Groundwater Results (Excel spreadsheet file) indicated that in August 2014 groundwater samples obtained from four wells BH33, BH34, H02 and BH19 were analysed for PFAS compounds.

The reported PFAS results were below the limit of reporting (LOR), except for elevated perfluorooctanoic acid (PFOA) concentrations identified in two groundwater monitoring wells located to the west of the CFS STC site

- BH33 (0.07 µg/L) located to the south-west of the CFS STC site; and
- BH34 (0.03 µg/L) located to the west of the CFS STC site.

These wells were originally installed with temporary polyvinyl chloride (PVC) casing, according to SKM borelogs presented in the Golder (2016) report, and their current status is unknown.

2.6.2 EES (2019) Site Contamination Audit Report for former Brukunga Pyrite Mine

In 2013, the Department of Primary Industries and Resources South Australia (now Department of Energy and Mining) commissioned the accredited Site Contamination Auditor Mr. Philip Mulvey to provide a site contamination audit report and statement for the Brukunga Pyrite Mine, which was issued in October 2019. The CFS STC site was outside of the audit site boundary. The audit objective was to determine the nature and extent of any site contamination remaining on or below the Mine and to determine the suitability of proposed mine remediation.

The scope of Environmental Earth Sciences (2019) audit report included:

- Review of historic information pertaining to the whole Brukunga mine with regard to the EPA SA Audit Guidance issued in support of the Environment Protection Act 1993. The intention of this was to give an opinion on the suitability of the proposed remedial options for the Mine.
- Audit the investigations pertaining to the Brukunga mine that relate to the issues under guidance and regulations to the Act (except for surface water discharge).

- Provide an opinion on what further delineation of extent and restoration of acid generation and its causes was necessary.

The findings included:

- Based on the review of available reports and auditor observations the main contamination issue related to discharge of acid mine drainage (AMD) to nearby watercourses, resulting from remnant pyritic materials from historic mining operations being exposed to moisture and oxygen.
- Pyrite and pyrrhotite bands occur naturally in the area, such that remedial strategies must be based on the determination of an appropriate value for reduced acid generation based on pre-mining levels.
- General site contamination from industrial processes of refuelling and storage of fuels, oils and lubricants was present.

The auditor conditions to protect human and environmental receptors were as follows:

- Access by the general public to the Brukunga Mine were to be restricted until remedial works were completed and it was demonstrated that the site was suitable.
- Water treatment to neutralise acidification to remain in place until it was demonstrated that flows meet adopted water quality criteria.
- The capacity for water treatment to neutralise acidification to remain in place until water quality criteria were met for a period of ten years or after the passing of two stream flow rain events following one twelve months drought, post remediation.
- In-stream water level and water quality monitoring, with telemetry to remain in place, with capacity to notify water users in the surrounding area of flow events with unsuitable water quality.
- Community consultation, information and feedback to be established.

The auditor recommendations were as follows:

- Auditor verification or equivalent expert review of compliance with the pre-remediation conditions to be conducted prior to commencement of remediation works.
- Audit or expert review to be undertaken on completion of the monitoring period post remediation that evaluates design components improvements for Dawesley Creek and Taylors Creek domains.
- Outcomes of Days Creek remediation was to be reviewed and incorporated into the design specifications for remediation plans for the Dawesley Creek and Taylors Creek domains.
- A suitable expert team and project management process was to be developed to ensure implementation of the Auditor conditions.

Other relevant information

- The main aquifer was described as a fractured-rock type that was considered to be relatively low yielding; and minor aquifers were found to occur as perched or shallow groundwater table systems in the unconsolidated Quaternary alluvium. These fill some parts of the drainage lines of the Brukunga Mine such as Dawesley Creek.
- The SKM 2009 report provided a summary of information on wells utilised for groundwater monitoring purposes at Brukunga. A total of 46 boreholes were recorded, of which only 29 were reported to be intact/ operational. Of these, there only appeared to be reliable information (i.e. knowledge of the screened interval and screened unit) available for 15 boreholes.

- Sludge generated by the water treatment plant was initially to be stored in stockpiles on the southern mine bench area. In the long term, this material was to be encapsulated within a cell in the wider Brukunga mine area.

2.6.3 GHD (2019a) Environmental Investigation

GHD completed an Environmental Investigation on the CFS Brukunga State Training Centre between October and November 2019.

The scope of works completed by GHD included the following:

- Collection of three soil samples: one adjacent to the hotpads, one opposite the multi storey building in the central portion of the site and one opposite the Workshop in the north-west portion of the site.
- Collection of two composite concrete samples from two locations from Hotpad A and Hotpad B hardstand areas located in the so part of the site and used for firefighting training purposes.
- Collection of one water sample from on-site water storage tank 2.
- Collection of water samples from water in Acid Seepage Pond (ASP) (pre-treatment) and Acid Treatment Pond (ATP) (post treatment) to determine any effect on PFAS levels from acid treatment.
- Collection of seven water samples from along Dawesley Creek and associated settling ponds. Samples were collected upstream, adjacent to and down hydraulic gradient of the site.
- Collection of one sample from sludge waste located further to the south-west of the site.

Based on the findings of the environmental investigation, the following conclusions were made:

- PFAS concentrations were detected in concrete dust, pavers and soil surrounding the site as well as water held within a storage tank on-site and the adjacent Dawesley Creek. The distribution of PFAS on and adjacent to the site with consideration to the historical use of PFAS containing firefighting foam suggested the CFS training site was a source of PFAS to the environment.
- The distribution of PFAS within Dawesley Creek indicated that no upstream offsite source of PFAS was contributing to PFAS within the creek and the highest concentrations detected within the creek were detected adjacent to the southern corner of the site.
- PFAS was detected in water in ASP and ATP above the recreational criterion for the sum of perfluorohexane sulfonate (PFHxS) and perfluorooctane sulfonate (PFOS). A reduction in PFAS concentrations was observed post treatment, however this reduction did not alter the potential risk profile to sensitive receptors.
- PFAS was also detected downstream of the site, where water was reintroduced into Dawesley Creek post treatment. The concentration of PFAS detected at Pond 4 was higher than those detected in the ASP. This suggests PFAS concentrations within the creek system were likely to fluctuate with flow regimes.
- The reported concentrations of PFAS in Dawesley Creek were considered to threaten groundwater and 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 21 October 2019.

- Elevated concentrations of PFAS were detected in the concrete storage tanks used to hold fire training water resulting from PFAS entering the tank during fire training activities, as well as during wet weather events and leaching of PFAS from concrete surfaces.

2.6.4 GHD (2020a) Preliminary Site Investigation

GHD conducted a Preliminary Site Investigation (PSI) for the CFS Brukunga STC that included the following:

- Desktop review of available historic and current site information (e.g. previous reports, aerial photographs, title deeds, geological maps, data bases and registers);
- A site inspection checking for signs of contamination and confirming features documented in the desktop review; interviews with relevant people with knowledge of the site;
- Preparation of a preliminary conceptual site model and discussion of identified activities with potential for PFAS containing firefighting foam use.

The PSI identified two potentially contaminating activities associated with PFAS that have impacted soil and surface water on and adjacent to the site as well as potentially impacting groundwater in the area. The historical activities included:

- Historical use of PFAS containing firefighting foam at the CFS STC
- Treatment and disposal of acidic and metalliferous drainage and sulfidic waste associated with the Brukunga Pyrite Mine.

The preliminary CSM indicated that incidental consumption and direct contact with surface water and groundwater used for irrigation and recreational purposes such as filling of swimming pools are potentially complete exposure pathways, as well as consumption of fruit and vegetables irrigated with PFAS contaminated groundwater by surrounding residents.

GHD concluded that PFAS contamination on-site and off-site exists that may potentially pose a risk to human health or the environment. GHD recommended further investigations to assess the extent of PFAS in groundwater and to identify and assess any potential risks to human health and the environment from PFAS site contamination in the context of relevant land uses for any affected off-site properties.

2.6.5 GHD (2020b) Off-site Groundwater Investigation

GHD completed an Environmental Investigation on the CFS Brukunga STC in February 2020. The groundwater and surface water results of this investigation are shown in Figure 3).

The scope of works completed by GHD included the following:

- Locating, gauging and sampling of 17 monitoring wells using no flow techniques.
- Locating and sampling of surface water and sediment in Dawesley Creek.
- Sampling of produce (fruit, vegetables and meat) grown on- and off-site
- Laboratory analysis of 17 groundwater, two surface water, two sediment, one swimming pool and nine produce samples for PFAS and total dissolved solids (TDS, groundwater samples only).

Based on the findings of the investigation, the following conclusions were made:

- Reported PFOS concentrations exceeded the adopted freshwater screening criterion in all 15 tested groundwater monitoring wells within the Brukunga Mine and in one residential bore located 1.7 km south of the CFS STC site.

- The sum of PFHxS and PFOS concentrations in groundwater exceeded the drinking water screening criterion at ten locations, with the highest concentrations being reported for well H02, located directly south of the CFS STC site.
- The nature and off-site extent of PFAS impact in groundwater beneath the Brukunga Mine was practically delineated to the north and north-west and partially to the east, west and south. No delineation was found for surface water in Dawesley Creek.
- There was no clear delineation of PFAS associated with historical activities at the CFS STC site in groundwater down hydraulic gradient of the CFS STC site within the investigation area.
- PFAS impact in groundwater was found to extend at least 1.7 km down hydraulic gradient (south) of the CFS STC site, where PFAS concentrations exceeded the drinking water criterion in a private residential bore (well 6627-8333). However, PFAS concentrations in a private residential bore (6627-7520) located approximately 2.2 km down hydraulic gradient of the CFS STC site were below the limit of reporting.
- Stockpiles of sludge, generated by the AMD treatment plant, located along the central and southern bench at the foot of the highwall on the western side of the Mine had elevated PFAS concentrations and may be a secondary source of PFAS to groundwater up and across hydraulic gradient of the CFS STC site.
- PFAS concentrations in two Dawesley Creek water samples collected about 1.2 km and 1.25 km south of the CFS STC site on either side of the southern boundary of the Brukunga Mine exceeded the ecological (PFOS) and drinking water (sum of PFHxS and PFOS) screening criteria but were below the recreational criteria. It is considered likely that PFAS concentrations above the screening criteria extend further downstream of the Brukunga Mine in the surface water of Dawesley Creek.
- The sediment sample collected in Dawesley Creek within the southern boundary of the Brukunga Mine did not exceed the adopted screening criteria for commercial / industrial land use. However, the sum of PFHxS and PFOS concentrations in a sediment sample collected about 50 m south of the Brukunga Mine exceeded the screening criteria for residential land use with garden / soil access, which may be appropriate for the private land south of the Mine. It appears likely that PFAS impacts above the screening criteria may extend further down hydraulic gradient of the investigation area in the sediment of Dawesley Creek.
- PFAS concentrations in a private swimming pool, which is filled using groundwater from bore 6627-8333 downstream of the CFS STC site, exceeded the PFOS freshwater screening criterion but were below the recreational water screening criteria. The risk to human health from the recreational use of the swimming pool was considered to be negligible.
- PFAS were not identified in an apple grown at the CFS STC or off-site in biota (fruit, vegetables and meat from a locally grown lamb) sampled at two private properties downstream of the CFS STC site. Biota produced on-site and off-site down hydraulic gradient are not considered to represent a complete pathway between the impacted surface water or groundwater and human receptors.
- The reported PFAS results for water samples before and after the total oxidisable precursor assay (TOPA) indicate the absence of oxidisable or bio-transformable precursors. Thus, PFAS in the water samples appear to be stable.
- A Section 83A notification was submitted for the CFS Training Centre (28 Pyrites Road, Brukunga, SA, CT5825/147) and for the residential property on 260 Pyrites Road,

Brukunga, SA (CT5557/777) in accordance with the Environmental Protection Act 1993 to the South Australian Protection Authority via email on 26 February 2020.

To further develop the conceptual site model and determine the extent of PFAS contamination, the following was recommended:

- Soil sampling on the CFS STC site to assess the nature and extent of PFAS within the historical use and storage areas.
- Flux testing on concrete at each hotpad on the CFS STC site to assess PFAS leaching from the concrete structures.
- Additional groundwater monitoring wells to be installed across the investigation area to delineate the lateral extent of PFAS in groundwater.
- Sampling of the Dawesley Creek diversion south of the CFS STC site.
- Sampling of groundwater monitoring wells down hydraulic gradient of the investigation area.
- Further sampling of surface water in Dawesley Creek down hydraulic gradient to the south of the site.
- Sampling of private groundwater wells and fruit and vegetables at residents’ request, subject to the resident’s informed consent and endorsement by the CFS and the auditor.

3. Scope of Work

3.1 Investigation Rationale

To further develop the conceptual site model and determine the extent of PFAS contamination, GHD conducted further investigations in accordance with the SAQP (GHD 2020c) including:

- Flux testing on concrete at each hotpad on the CFS STC site to determine the contaminant mass flux from the concrete structures on the CFS STC site during a simulated 5 mm rainfall event.
- Soil sampling on the CFS STC site to assess the nature and extent of PFAS within the historical use and storage areas.
- Concrete dust sampling in one building where PFAS containing substances were historically stored and that had not been sampled previously.
- Installation and sampling of additional groundwater monitoring wells to delineate the lateral extent of PFAS in groundwater.
- Sampling of the Dawesley Creek diversion drain in the middle and south of the CFS STC site.
- Further sampling of surface water and sediment in Dawesley Creek, both adjacent to the CFS STC site and down hydraulic gradient to the south of the Brukunga Mine to determine; if exposure pathways are complete; to delineate the lateral extent of PFAS; and to assess temporal changes in PFAS between wetter and drier periods.
- Sampling of major water courses upstream of the impacted Dawesley Creek to establish the regional background of PFAS.
- Further sampling of sludge waste stockpiles along the bench at the foot of the highwall on the western side of the Mine and adjacent to the sludge drying ponds and the emergency sludge overflow pond on the eastern side of the mine to determine the nature and extent of PFAS contamination in this material.

The sampling locations are illustrated in Figure 6a to Figure 10 and the rationale for the selection of each sampling location is provided in Table 3-1 to Table 3-7.

3.1.1 Concrete Dust

The rationale for the concrete dust sampling locations (Figure 6a) is summarised in Table 3-1.

Table 3-1 Concrete dust sampling rationale

Sample ID	Location	Rationale
SB02_Concrete	Inside ‘main store’ building	Determine if concrete on site has PFAS impacts and is a PFAS source.

Note:
* Sampling location CD01 in SAQP renamed SB02_Concrete as the concrete sample was taken at location of soil bore SB02.

3.1.2 Flux Testing

The rationale for the flux testing locations is summarised in Table 3-2. Rainfall simulation areas for flux sampling at Hotpads A and B are shown in Figure 6a.

Table 3-2 Flux testing rationale

Sample ID	Location	Rationale
Samples FX01 - FX07 were collected at 10 minutes intervals over 70 minutes and tested for PFAS	Hotpad_A [1] - concrete slab in the southern part of the site	Determine the PFAS mass flux from the concrete structure via surface run-off during a simulated 5 mm rainfall event.
Samples FX08 – FX13 were collected at approx. 10 minutes intervals; Samples FX08 & FX13 were tested for PFAS)	Hotpad_B [2] - area to the north of Hotpad A covered by concrete pavers	Determine the PFAS mass flux from the paved area via surface run-off during a simulated 5 mm rainfall event.

Note:

[1] Sampling location FX02 in the SAQP was renamed Hotpad A in this investigation.

[2] Sampling location FX01 in the SAQP was renamed Hotpad B in this investigation.

3.1.3 Soil Sampling

The rationale for the soil sampling locations (shown in Figure 6a) is summarised in Table 3-3.

Table 3-3 Soil sampling rationale

Sample ID	Location	Rationale
On-site		
SB02	Inside ‘main store’ building	Determine the vertical extent of PFAS contamination in the soil profile underlying the concrete where PFAS containing foam was historically stored.
SB03	Between the office building and Hotpad B, approximately 30 m to the west of the multistorey building.	Determine the vertical extent of PFAS contamination in the soil profile where PFAS containing foam was historically used.
SB05	Hotpad B	Determine the vertical extent of PFAS contamination in the soil profile underlying the concrete where PFAS containing foam was historically used.
SB06	Hotpad A	
Off-site		
SB01	Between western CFS STC site boundary and Dawesley Creek.	Determine if water runoff from the CFS STC site has impacted the soil. Determine the vertical extent of PFAS contamination in the soil profile. Determine if the exposure pathway from the CFS STC site via the soil to Dawesley Creek is complete.
SB04	Between western CFS STC site boundary and Dawesley Creek, approximately 90 m south of SB01.	
SB07	Between western CFS STC site boundary and Dawesley Creek, approximately 75 m south of SB04.	

3.1.4 Sludge waste pile sampling

The rationale for the sludge waste pile sampling locations (Figure 7) is summarised in Table 3-4.

Table 3-4 Sludge waste pile sampling rationale

ID	Location	Rationale
SW01	Northern boundary of the sludge waste stockpile on the southern bench of the Brukunga Mine, south-west of the CFS STC site.	Assess the nature and extent of PFAS in sludge stockpiles located across the Brukunga mine”
SW02	Sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south of SW01.	
SW03	Sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south of SW02.	
SW04	Eastern boundary of the sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south-east of SW03.	
SW05	Sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south of SW03.	
SW06	Sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south of SW05.	
SW07	Eastern boundary of the sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south-east of SW06.	
SW08	Southern boundary of the sludge waste stockpile on the southern bench of the Brukunga Mine, about 50 m south of SW07.	
SW09	Southern boundary of the sludge waste stockpile on the southern bench of the Brukunga Mine.	
SW10 –SW15	Stockpile of loose sludge material (8 m long x 8 m wide x 4 m high) next to the emergency sludge overflow pond to the east of the CFS STC site.	Assess the nature and extent of PFAS contamination in the vicinity of the emergency sludge overflow pond.
SW16 – SW20*	Sludge waste stockpiles located in the vicinity of the six sludge drying ponds to the east of the CFS STC site.	Assess the nature and extent of PFAS in sludge stockpiles located across the Brukunga mine”

Note:
* Sample name varies from SAQP (see section 3.2).

3.1.5 Brukunga Mine Diversion Drain

The rationale for the Brukunga mine diversion drain surface water sampling locations (Figure 6a) is summarised in Table 3-5.

Table 3-5 Brukunga mine diversion drain surface water sampling rationale

ID	Location	Rationale
DIV01	Diversion drain passing underneath the CFS STC site; access via grate	Determine if the diversion drain is a preferential pathway for PFAS.

3.1.6 Groundwater Investigation

The rationale for the groundwater well installation and sampling locations (Figure 8) is summarised in Table 3-6.

Table 3-6 Groundwater Investigation rationale

ID	Location	Rationale
Onsite Wells		
GW01	Northern CFS STC site boundary.	To delineate the PFAS extent in groundwater to the north. To determine if there are off-site PFAS sources up hydraulic gradient of the CFS STC site.
Offsite Wells		
GW02	To the east of the CFS STC site, on the Watts Road verge at the northern boundary of the Mine near the water treatment plant.	To delineate the PFAS extent in groundwater to the north of the tailings storage facility and the acid treatment plant.
GW03	To the east of the CFS STC site, near the eastern boundary of the Mine.	To delineate the PFAS extent in groundwater to the east of the tailings storage facility.
GW04	To the east of the CFS STC site, to the south of the tailings area used to dry sludge generated by the water treatment plant, at the southern boundary of the Mine.	To delineate the off-site PFAS extent in groundwater to the south of the tailings storage facility.
GW05	289 Pyrites Road, Brukunga, on the road verge; to the south of the CFS STC site and the Mine.	To delineate the off-site PFAS extent in groundwater to the south (down hydraulic gradient) and to the east of Dawesley Creek.
GW06	Lot 294 Pyrites Road, Brukunga, on the road reserve south of the property near the boundary with 113 and 93 McIntyre Road, Brukunga; to the south of the CFS STC site and the Brukunga Mine.	To delineate the off-site PFAS extent in groundwater to the south (down hydraulic gradient) and to the east of Dawesley Creek.
GW07	260 Pyrites Road, Brukunga, near the south-western property boundary on the road verge; to the south of the CFS STC site and the Brukunga Mine.	To delineate the off-site PFAS extent in groundwater to the south (down hydraulic gradient) and to the west of Dawesley Creek.
H15	Lot 54 Pyrites Road, Brukunga, existing well on private land targeting deeper groundwater south of the tailings storage facility; to the south-east of the CFS STC site.	To delineate the off-site PFAS extent in groundwater to the south-east of the CFS STC site.
KAN23	Lot 100 Peggy Buxton Road, Brukunga, existing well on private land; to the west of the CFS STC site and the Mine.	To delineate the off-site PFAS extent in groundwater to the west of the CFS STC site and the Mine.
KAN26	203 Peggy Buxton Road, Brukunga, existing well on private land; to the west of the CFS STC site and the Mine.	To delineate the off-site PFAS extent in groundwater to the west of the CFS STC site and the Mine.

Where groundwater investigations were undertaken on private land, informed consent was obtained prior to undertaking groundwater investigations.

3.1.7 Surface Water and Sediment

The rationale for the surface water and sediment sampling locations (Figures 6a and 9a) is summarised in Table 3-7.

Table 3-7 Surface water and sediment sampling rationale

Sample ID	Location	Sample type	Rationale
CREEK_4	Dawesley Creek. Adjacent to western CFS STC site boundary, downstream from SB01 and GHD (2019) sampling location Creek 1.	Surface water and sediment	Determine if the exposure pathway from the CFS STC site via surface runoff or the soil to Dawesley Creek is complete and assess temporal changes in PFAS between wetter and drier periods.
CREEK_5	Dawesley Creek. Adjacent to western CFS STC site boundary, downstream from SB04 and GHD (2019) sampling location Creek 2.	Surface water and sediment	
CREEK_6	Dawesley Creek. Adjacent to western CFS STC site boundary, downstream from SB07 and upstream GHD (2019) sampling location Creek 3.	Surface water and sediment	
DC02	Dawesley Creek at the Pyrites Road Bridge, approx. 960 m downstream from GHD (2019) sampling location DC01.	Surface water and sediment	Delineate the downstream PFAS extent in surface water and sediment off-site.
DC03	Dawesley Creek at an unnamed road, near PFAS-impacted private bore 6627-8333 (Figure 3), approximately 540 m downstream from DC02.	Surface water and sediment	
DC04	Dawesley Creek at an unnamed road, near private bore 6627-7520 (Figure 3), approximately 330 m downstream from DC03.	Surface water and sediment	
DC05	Dawesley Creek at McIntyre Road, approx. 1.4 km downstream from DC04.	Surface water and sediment	
DC06	Dawesley Creek at Hawthorn Street, approx. 480 m downstream from DC05.	Surface water and sediment	
DC07	Dawesley Creek at Old Princess Highway, approx. 480 m downstream from DC06.	Surface water and sediment	
DC08	Dawesley Creek at Pastoral Road, approx. 2.7 km downstream from DC07.	Surface water and sediment	

3.2 Variations to SAQP

In variation to the SAQP, the position of soil sampling locations SB03 and SB06 were changed as shown in Figure 6a:

- SB03 was moved approximately 30 m to the west of the multistorey building. Due to space restrictions it was not possible to drill this soil bore inside the multistorey building.
- SB06 was moved approximately 20 m to the western side of Hotpad A to capture PFAS impact in the area closer to Dawesley Creek.

The sludge waste sampling locations were adjusted based on site conditions to target the observed sludge stockpiles. The actual sludge sampling locations are shown in Figure 7.

3.2.1 Inclusions to SAQP

During the investigation additional samples were collected and analysed, in variation to the SAQP. The additional samples, their locations and the justification for their inclusion in this investigation are listed in Table 3-8. The additional sampling locations are included in Figure 6a,

Figure 6b, Figure 6c, Figure 7, Figure 8, Figure 9a to 9d and Figure 10, as indicated in Table 3-8.

In September 2020, two additional monitoring rounds were conducted to collect additional background samples at the reference sites included in Table 3-8.

Table 3-8 Additional Sample Locations

Sample type	ID	Location	Justification	Figure Reference
Soil	SB08	Eastern side of Hotpad A	Determine the vertical extent of PFAS contamination in the soil profile underlying the concrete at the western (relocated SB06) and at the eastern (SB08) side of Hotpad A.	Figure 6a
Soil	Garden1 – Garden4	Disused vegetable garden located on 296 Pyrites Road, Brukunga	At request of landowners following approval by CFS and the auditor.	Figure 6b
Concrete core	SB05_Concrete, HPB1 – HPB5	Hotpad B	Collect a comprehensive data set (concrete, soil and flux tests) for PFAS at both hotpads.	Figure 6c
Concrete core	SB06_Concrete SB08_Concrete HPA1 – HPA5	Hotpad A		Figure 6c
Concrete core	Tank1/01b – Tank1/03b	Water storage tank 1	Determine if PFAS from contaminated water contained within the tank has adsorbed to the concrete matrix.	Figure 6c
Concrete core	Tank4_concrete Tank4/01b – Tank4/03b	Water storage tank 4		Figure 6c
Concrete core	Tank5_concrete	Water storage tank 5		Figure 6c
Concrete core	Tank7/01b – Tank7/03b	Water storage tank 7		Figure 6c
Surface water and sediment	DC02A	Dawesley Creek at 296 Pyrites Road, Brukunga, approx. 90 m downstream of DC02	Sampled at request of the landowners and to inform the PFAS extent in surface water and sediment.	Figure 9a
Surface water and sediment	DC06a, DC06b	Dawesley Creek at 16 Hawthorn St, Dawesley, between Hawthorn St and Old Princess Hwy, approx. 90 m and 340 m downstream of DC06		Figure 9a
Surface water and sediment	DC09	Dawesley Creek south of Kanmantoo Bluestone Quarry, approx. 6.6 km downstream of DC08	Delineate the downstream PFAS extent in surface water and sediment off-site.	Figure 9b

Sample type	ID	Location	Justification	Figure Reference
Surface water and sediment	DC10	Dawesley Creek, approx. 500 m downstream of DC09		Figure 9b
Surface water and sediment	DC11	Dawesley Creek, approx. 1.5 km downstream of DC10		Figure 9b
Surface water and sediment	DC13	Dawesley Creek at Balyarta Train Station, approx. 3.2 km downstream of DC11		Figure 9b
Surface water and sediment	DC14	Dawesley Creek, at Back Callington Road, approx. 850 m downstream of DC13		Figure 9b
Surface water and sediment	DC15	Dawesley Creek, at Éclair Mine Road and directly north of South Eastern Freeway, approx. 2.9 km downstream of DC14		Figure 9b
Surface water and sediment	DC16	Dawesley Creek, at Éclair Mine Road and south of the South Eastern Freeway, approx. 1.1 km downstream of DC15		Figure 9c
Surface water and sediment	DC17	Dawesley Creek, approx. 800 m downstream of DC16 and approx. 800 m upstream of confluence with Mt Barker Creek		Figure 9c
Surface water and sediment	DC17A	Mt Barker Creek, at 430D Callington Road, Salem, location of gauging station A4260679, approx. 5.2 km downstream of confluence with Dawesley Creek and 470 m upstream of confluence with Bremer River	Sampled to delineate the downstream PFAS extent in surface water and sediment off-site.	Figure 9c
Surface water and sediment	DC18	Bremer River, at Callington Road, approx. 120 m downstream of confluence with Mt Barker Creek	Delineate the downstream PFAS extent in surface water and sediment off-site.	Figure 9c
Surface water and sediment	DC19	Bremer River, at Jaensch Road, approximately 5.2 km downstream of DC18		Figure 9c

Sample type	ID	Location	Justification	Figure Reference
Groundwater	C04A	Location of groundwater well C04 on private land at Lot 54 Pyrites Rd, Brukunga, adjacent the southern boundary of the eastern portion of the Brukunga Mine.	Replace lost well C04, formerly located on the same property, and delineate PFAS impacts to the south of the eastern part of the Mine.	Figure 8
Groundwater	6627-5944	Private groundwater bore at 296 Pyrites Road, Brukunga	Sampled twice at request of landowner	Figure 8
Groundwater	6627-7126 (Hawthorn1)	Private groundwater bore at 16 Hawthorn Street, Dawesley	Sampled at request of landowner	Figure 8
Groundwater	6627-11131	Private groundwater bore at 483 Ironstone Range Road, Petwood	Sampled at request of landowner	Figure 8
Sludge	SS01, SS02, SS08, SS09	Surface samples on northern bench	Assess presence of PFAS in sludge stockpiles within the former Brukunga Mine, which were observed to have similar colour and texture to sludge originating from the water treatment plant.	Figure 7
Sludge	SS03 – SS07 SS10 – SS17 SS21, SS22	Surface samples from stockpiles on northern bench		Figure 7
Sludge	SS18 – SS20	Material beneath black lining of waste rock piles in northern bench		Figure 7
Sludge	SS23 – SS30	Stockpiles in the southern extension WRD near the southern Mine boundary		Figure 7
Brukunga Mine Seepage Water sampling locations				
Seepage Water	WW01	Water collection point at the base of the tailings dam adjacent to the Acid Seepage Ponds	Determine if seepage water from the tailings dam is impacted with PFAS.	Figure 10
Seepage Water	WW02	Water collection point 'B notch' at the base of the tailings dam adjacent to the Acid Seepage ponds, north of WW01		Figure 10
Seepage Water	WW03	Southern base of the South WRD adjacent to South Hill Road	Determine if seepage water from the South WRD is impacted with PFAS.	Figure 10
Seepage Water	WW04	South-western base of the South WRD adjacent to South Hill Road		Figure 10
Seepage Water	WW05	Northern edge of North Cut pit, off West Hill Road	Determine if seepage water from the North Cut pit is impacted with PFAS.	Figure 10
Seepage Water	WW06	Western edge of North Cut pit, off West Hill Road		Figure 10

Sample type	ID	Location	Justification	Figure Reference
Seepage Water	WW07	South-western corner of South Cut pit, off West Hill Road.	Determine if seepage water from the South Cut pit is impacted with PFAS.	Figure 10
Upstream surface water and sediment sampling locations				
Surface water and sediment	DC-UP01	Dawesley Creek, at Military Road, approx. 2.1 km upstream of the CFS STC	Determine PFAS background levels.	Figure 9a
Surface water and sediment	DC-UP02	Dawesley Creek at Moore Road, approx. 690 m upstream of DC-UP01		Figure 9a
Reference site / background locations within Bremer River catchment				
Surface water and sediment	NC01	Nairne Creek at Ironstone Range Road, approx. 740 m upstream of confluence with Dawesley Creek (between DC11 and DC13)	Determine PFAS background levels.	Figure 9c
Surface water and sediment	NC02	Nairne Creek at Ironstone Range Road, Petwood, approx. 1.3 km upstream of NC01		Figure 9c
Surface water and sediment	MBC01	Mt Barker Creek approx. 100 m upstream of confluence with Dawesley Creek, access via easement located in Lot 70 Samuels Road, Callington	Determine PFAS background levels and derive catchment specific assessment criteria in lieu of the PFAS NEMP 2020 Freshwater 99% species protection guideline value for PFOS.	Figure 9c, Figure 9d
Surface water	MBC01_A, MBC01_B, MBC01_C			Figure 9d
Surface water and sediment	MBC02	Mt Barker Creek approx. 11.3 km upstream of MBC01, access via easement located adjacent 106 Blue Wren Lane, Wistow.		Figure 9c, Figure 9d
Surface water	MBC02_A, MBC02_B, MBC02_C			Figure 9d
Surface water and sediment	BR01	Bremer River at Samuels Road, approx. 830 m upstream of confluence with Mt Barker Creek		Figure 9c, Figure 9d
Surface water	BR02, BR02_A, BR02_B, BR02_C	Bremer River beneath South Eastern Freeway, approx. 1.1 km upstream of BR01		Figure 9d

Sample type	ID	Location	Justification	Figure Reference
Surface water	BR03_A, BR03_B, BR03_C	Bremer River at Bridge St, Callington, approx. 1.3 km upstream of BR02		Figure 9d
Water from storage tank	Tank1 to Tank7	Seven concrete water storage tanks at the south-western corner of the CFS STC site	Obtain updated data on PFAS concentrations in all storage tanks on-site.	Tanks shown in Figure 6a and Figure 6c

Where soil, groundwater and/or surface water investigations were undertaken on private land, informed consent forms (Appendix A) were obtained prior to undertaking these investigations.

A selected number of surface water samples from Dawesley Creek, Mt Barker Creek and Bremer River was analysed for the full “long” PFAS analytical suite to determine the “fingerprint” of different PFAS sources contributing the water quality in the downstream reaches of Bremer River.

3.2.2 Exclusions to SAQP

The following sampling locations listed in the SAQP (GHD 2020c) were excluded from the scope of this investigation. The reasons for excluding the locations are provided in Table 3-9.

Table 3-9 Exclusions from the SAQP

Sample Type	ID	Location	Justification
Sediment	DC02	Dawesley Creek at the Pyrites Road Bridge, south of the site.	Bridge too high to reach with extendable arm; no site access due to fences on neighbouring properties.
Sediment	DC06	Dawesley Creek at Hawthorn Street	Creek bed lined with concrete and no sediment at location.
Groundwater	H10	289 Pyrites Road, Brukunga, existing DEM well on private land	Access denied by landowner.
Groundwater	GW08	289 Pyrites Road, Brukunga, near the western property boundary, to the south and west of Dawesley Creek	Access denied by landowner.
Groundwater	KAN27	Lot 100 Peggy Buxton Road, Brukunga, existing well on private land, to the west of the CFS STC site and the Mine.	Could not locate
Groundwater	KAN28	Lot 100 Peggy Buxton Road, Brukunga, existing well on private land, to the west of the CFS STC site and the Mine.	Could not locate

PFAS laboratory analyses were undertaken as part of the 2020 scope of work for the following primary samples:

- 15 groundwater samples
- 58 surface water samples
- seven seepage water samples
- 23 soil samples
- 24 concrete core samples

- one concrete dust sample
- 29 sediment samples
- 61 sludge samples
- nine concrete flux samples
- seven water storage tank samples.

In addition, PFAS leachability testing was conducted on six sludge waste samples and 21 concrete core samples. Leach testing on sludge samples was completed using the toxicity characteristic leaching procedure (TCLP) at pH 4.9. Concrete core samples were leach tested using the Australian standard leaching procedure (ASLP as per AS 4439.3) with water at pH 7. For concrete core samples collected from the water storage tanks in in November 2020 the leaching environment assessment framework (LEAF) methods of leaching, in accordance with USEPA methods SW846 1313, 1314, 1315 or 1316, were used with water at pH 7.

4. Geology and Hydrogeology

4.1 Topography

The regional topography is presented in the South Australia 1:50,000 topographic series (map sheets Echunga 6627-1 and Onkaparinga 6628-2) (SA DEH 2001).

The topography of the CFS STC site and its immediate vicinity is dominated by low hills with undulating upper slopes, sometimes with relatively flat summit surfaces, moderately inclined hillslopes and some short steep slopes. The topography of the Brukunga Mine has been significantly altered by human interference, with large waste rock dumps and sheer cliff faces.

4.2 Geology

4.2.1 Regional Geology

The geological information is largely based on 1:50,000 scale geological mapping completed by the Geological Survey of South Australia in the late 1970s to mid-1980s over the Onkaparinga (SA DME 1979) and Echunga (SA DME 1985) map sheet areas.

The underlying stratigraphic unit identified by the Geological Map of the Adelaide Region (at the site is classified as the Tapanappa Formation, typically characterised by medium to dark grey, thick-bedded to laminated, generally fine- to coarse-grained metasandstone; outcrops of small-scale, lenticular conglomerate beds, frequently cross-bedded, are associated with coarser-grained sandstone near the top of formation.

4.2.2 Local Geology

Twelve DEM well logs (GHD 2020b) from 4 m to 14 m deep wells within the Brukunga Mine describe the local geology as generally consisting of grey coloured fine grained quartz mica schist overlain by silty sand to 1-4 metres below ground level (m bgl). While not specified as part of the Tapanappa Formation, schist is a component described in the Kanmantoo Group of which the Tapanappa Formation is part of.

Driller logs obtained from the Department for Environment and Water's (DEW) WaterConnect database (DEW 2020) for wells in the Brukunga mine's Tailings Storage Facility (TSF) show fill material down to depths between 17.2 and 32 m bgl, described as backfill tailings. Golder (2016) described the tailings materials as silts, clayey silt and silty sands.

Driller logs available from the DEW's WaterConnect database for bores within 2 km of the site also correlate with the expected local geology with rock, schist and quartzite being most of the lithology recorded.

During the installation of eight groundwater monitoring wells in the investigation area, which were between 8 m and 23 m deep, fill material mostly consisting of clayey sand with gravels or a mixture of sand, quartzite, silt stone and schist was encountered up to 2.7 m bgl. Underlying the fill, pale brown to pale grey weathered schist with silver mica was the predominant material. The bore logs for two wells, one located near the eastern boundary of the Brukunga Mine and one located on farm land south of the tailings dam, recorded up to 9.6 m thick layers of medium to dark grey quartzite over pale brown schist or pale brown sand and quartzite. At one location approximately 2 km south of the CFS STC site, pale to medium grey schist was overlain by pale brown sand to 1.9 m bgl and white to yellow sandstone to 5.5 m bgl.

The bore logs for monitoring wells installed during this investigation as well as all bore logs for previously installed wells in the investigation area that have been provided to GHD, irrespective of their current status or if they were sampled or not, are provided in Appendix B. Bore logs for wells KAN12, KAN23, KAN26, KAN41, KAN45 and KAN52 were not available.

Soils encountered on-site during soil sampling as part of this investigation consisted of sand, gravels and clays, which appeared to be natural materials used as fill material to level the site. Bores refused on rock, which appeared to follow the natural topography, with depths ranging from 0.5 m bgl to 3.8 m bgl.

Off-site soil bores adjacent to the eastern boundary of the CFS STC site all refused at shallow depths ranging between 0.3 m bgl and 1.1 m bgl on rock. Soils consisted of sandy clay, to sandy clay with some gravels.

4.3 Hydrogeology

4.3.1 Regional hydrogeology

Other than narrow, thin deposits of alluvium along major drainage lines, the main regional aquifer is within the fractured bedrock. Bore yields are generally low (SKM 2008) with a maximum air-lift yield of about 0.25 L/sec. Many monitoring boreholes drilled at the site had no measurable yield.

A search of the PIRSA Drill Hole Enquiry System (DES) data (GHD, 2008) showed there were 31 wells with yield data within a 3 km radius of the mine centre (Figure 4-1), with a median yield of 0.33 L/s. This yield may, however, be an over-estimate, as it only includes boreholes completed as wells, and excludes “dry” holes. Conversely, the data does include some monitoring wells installed at the mine. The highest-yielding well (private irrigation well 6628-21783 shown on Figure 3, 4.5 L/s) is within an area mapped (1:50,000) as a large breccia zone, which cuts east-west across the regional structure.

In areas not impacted by mining activities, recorded total dissolved solids (TDS) in groundwater samples range from 2,000 to 3,000 mg/L. This is consistent with an average for 31 wells (PIRSA DES data) within a 3 km radius of approximately 2,000 mg/L. The elevated salinities and low yields suggest relatively evapotranspiration relative to recharge, and low permeability, consistent with the geology and climate.

It is typical in this type of geological environment to have shallow perched aquifers in the soil and upper weathered bedrock, separated from a deeper aquifer in the upper 20-60 m of bedrock by residual clays accumulated at the base of weathering. The lack of weathering below about 1 m over most of the area, however, indicates the upper perched aquifer is thin and probably ephemeral in this area. The limited weathering is also consistent with very low permeability.

Local aquifers are formed by the large waste rock stockpiles and the tailings storage facility, which are the most concentrated source of acid and metal, salt load to the local system. The water quality within these areas, with elevated salinity, acidity and metals has been discussed in SKM (2008) and Tonkin (2009), and the hydraulic properties are discussed in Section 4.3.2.

GHD (2020b) conducted a search of registered wells within a 2.0 km radius of the CFS STC site using the DEW’s WaterConnect database (DEW 2020). Registered bore search results are presented in Appendix C.

A summary of the results indicated the following:

- There are 180 registered groundwater wells within a 2.0 km radius; three are registered as operational, seven as abandoned, four as backfilled and one as flowing. The status of the remaining 165 wells is recorded as unknown or not recorded.
- The operational wells are used for observation (1), domestic (1) and stock purposes (1).

- Other well purposes listed included investigation/observation (65), river (1), irrigation (3), soak (1) and dam (1).
- Recorded standing water levels (SWL) for the registered wells ranged from 0.0 m bgl to 31 m bgl.
- Salinity levels recorded ranged from 100 mg/L total dissolved solids (TDS) to 15,370 mg/L TDS.
- The groundwater wells in closest proximity to the site are monitoring wells associated with the Brukunga Mine, immediately adjacent the western side of the CFS Training Centre and the former mine tailings dam to the east.
- Of the registered wells that had an aquifer recorded, the majority were recorded as the Tapanappa Formation (Elt on the table in Appendix C) with other aquifers noted as Talisker Calc-siltstone (Esa), Backstairs Passage Formation (Eeb) and Kanmantoo Group (Ek).

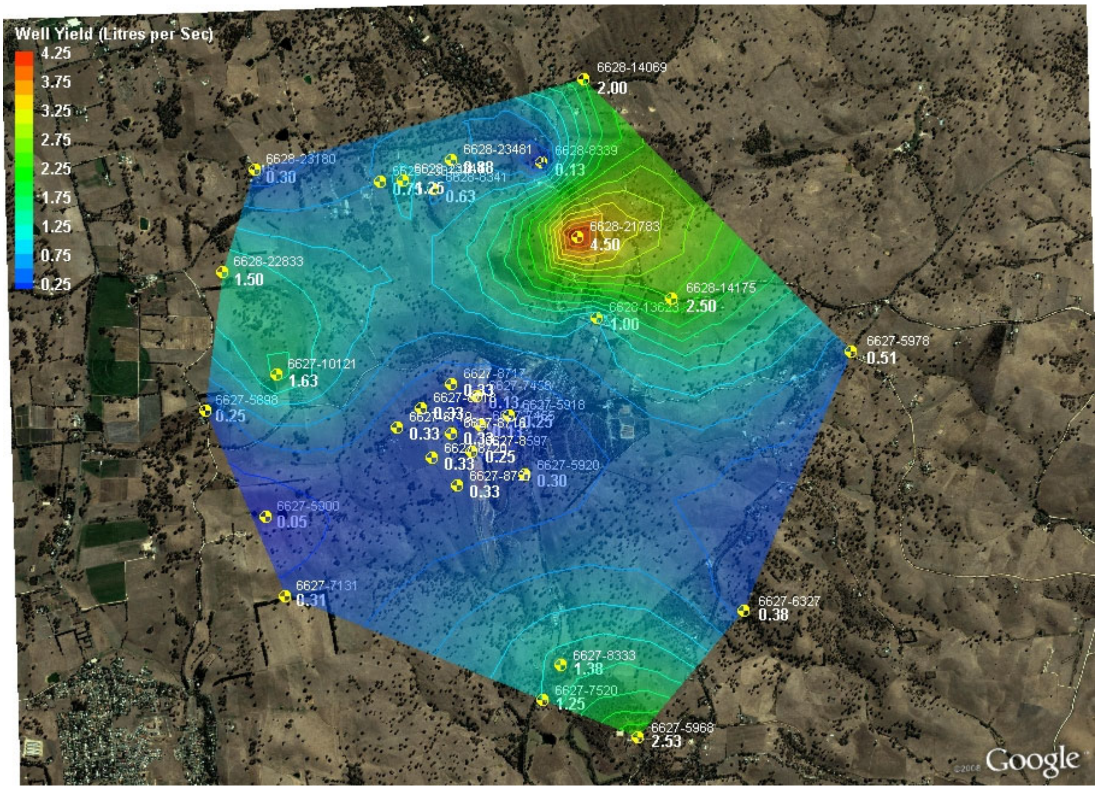


Figure 4-1 Well Yield Contours (L/s) (from GHD 2009)

4.3.2 Local Hydrogeology

The EES (2019) description of the hydrogeological conditions in the vicinity of the Brukunga Mine indicated a fractured rock groundwater system with low permeability. Groundwater at the site was considered to occur in multiple aquifers, summarised as follows:

- The main aquifer was described as a fractured-rock type that was considered to be relatively low-yielding, other than along fault zones.
- Minor aquifers were found to occur as perched or shallow groundwater systems in the unconsolidated Quaternary alluvium. These fill some parts of the drainage lines of the Brukunga Mine such as Dawesley Creek.
- Groundwater has also been recorded in fill deposits within the tailings storage facility and waste rock dumps.

Based on the current investigation and the GHD (2020b) off-site groundwater investigation, the specific hydrogeology of the investigation area is summarised in Table 4-1.

Table 4-1 Summary of site specific hydrogeology

Feature	Details
Groundwater Occurrence and Depth to Groundwater	In February 2020, SWL across the investigation area ranged between 0.373 m bgl at well H04a and 17.066 m bgl at well GAMW-03. Groundwater elevations ranged from 329.920 m Australian Height Datum (AHD) at well H09 to 372.014 m AHD at well KAN45. In June 2020, SWL across the investigation area ranged between 1.141 m bgl at well GW01 and 19.734 m bgl at well KAN23. Groundwater elevations ranged from 290.807 m AHD at well GW06 to 421.737 m AHD at well KAN26.
Groundwater Flow Direction	Groundwater regional flow in 2020 was inferred to flow towards a north south aligned topographic trough represented by Dawesley Creek from regions of high topography to the east and west. The groundwater in the bottom of the trough generally flowed towards the south.
Groundwater Gradient	In June 2020, the groundwater gradient from well GW02 to GW01 along the eastern gradient was 0.038 m/m. In June 2020, the groundwater gradient from well GW05 to GW06 along the southern gradient was 0.015 m/m. In June 2020, the groundwater gradient from well KAN26 to KAN23 along the western gradient is 0.053 m/m.
Effective Porosity	The effective porosity, based on literature values [1], was estimated to be: East: 0.2 (tailings / silt) South: 0.26 (fractured rock / schist) West: 0.26 (fractured rock / schist)
Hydraulic Conductivity	The hydraulic conductivity, based on site data [2] (where appropriate) or literature values [3], ranged between: East: 5.0 x 10^{-2} m/day to 6.1 x 10^{-1} m/day [2] South: 8.6 x 10^{-3} m/day and 8.3 x 10^{-1} m/day [2] West: 1.7 x 10^{-6} m/day to 9.8 x 10^{-1} m/day [3]
Seepage Velocity	The seepage velocity of groundwater beneath the investigation area, based on the effective porosities and hydraulic conductivities listed above, was calculated to range between: East: 3.4 m/year to 42 m/year South: 0.18 m/year and 17 m/year West: 1.3 x 10^{-4} m/year and 72 m/year (for wells to the west of the Brukunga Mine on top of the highwall; for comparison, the seepage velocity for wells at the bottom of the highwall within the Brukunga Mine to the west of the CFS STC site in February 2020 was calculated to range between 8.2 x 10^{-3} m/year and 8.2 x 10^{2} m/year).

Feature	Details
Groundwater Salinity	TDS within groundwater beneath the investigation area, as an indicator of salinity, was determined by converting the June 2020 field measurements of Electrical Conductivity into TDS. In February 2020, the results ranged between 813 mg/L (well GAMW-03) and 22,100 mg/L (well H13), indicating fresh to hypersaline groundwater quality beneath the investigation area. In June 2020, TDS ranged from 484 mg/L (well GW05) to 5,802 mg/L (well GW01), indicating fresh to saline groundwater quality beneath the investigation area. Based on the lowest calculated TDS value of the groundwater beneath the investigation area, groundwater beneath the investigation area may be suitable for: • drinking water for human consumption (however may be aesthetically unacceptable (ADWG, 2011)) • irrigation, recreation and aesthetics, primary industries • livestock drinking water and aquaculture and human consumption of aquatic foods (SA EPA 2019a).

Notes:

[1] Modified from McWorter, D. and Sunada, D., Groundwater Hydrology and Hydraulics, Water Resources Publications, Colorado, USA, 1977, Table 2-2, Page 31.

[2] Modified from Golder 2016, Three dimensional regional groundwater flow modelling – Brukunga Mine Remediation Program. Report 127666011-R-005-RevA prepared for the Department of State Development, Golder Associates, 26 February 2016, Table 3.3 – Hydraulic conductivity data.

[3] Modified from McWorter, D. and Sunada, D., Groundwater Hydrology and Hydraulics, Water Resources Publications, Colorado, USA, 1977, Table 3-1, Page 82.

Groundwater contour maps showing the interpreted February 2020 and June 2020 groundwater contours and the inferred groundwater flow directions are presented in Figure 11a and Figure 11b at the end of this report.

4.4 Hydrology and Drainage

The nearest surface water receptor is the Dawesley Creek flowing north to south and located immediately west of the CFS STC site. Testing of surface water collected from Dawesley Creek has shown that this receptor has been impacted by surface water runoff associated with the CFS STC site area.

As discussed in the conceptual hydrogeological model (Appendix D) groundwater is likely to discharge to Dawesley Creek during periods of elevated groundwater levels, following heavy rain. However, much of the discharge is likely to be taken up as evapotranspiration by riparian vegetation in the alluvial sediments along the creek, with groundwater-fed base flow only occurring for short periods of time after heavy rainfall and discharge restricted to a few rock pools.

Following extended dry periods with standing groundwater levels lowered deep into the alluvium or into upper fractured bedrock Dawesley Creek is likely to be a losing stream. This is supported by flow data for Dawesley Creek and Mt Barker Creek available from the DEW's WaterConnect database (DEW 2020), which shows periods of no flow in both creeks over summer for most years, and by anecdotal evidence from residents, who describe both creeks as a series of disconnected stagnant pools in summer. Golder (2016, pp 12-13) also inferred that "the actual rate of groundwater discharge to surface water features is low. Elsewhere, groundwater discharge into local creeks from the deeper weathered and fractured rocks is considered to be at low to negligible rates, based (again) on the observation that groundwater levels are not higher than creek bed levels and flows in the creek are not perennial." It is also likely to be a losing stream where groundwater is extracted from the alluvial aquifer or near-creek fractured rock bores, such as AMD interception bores near the Mine or downstream private water supply bores.

Several smaller ephemeral drainage lines and watercourses including Days Creek, Jane Drain, North Creek, Taylors Creek flow into Dawesley Creek in the vicinity of the Brukunga Mine, while Dawesley Creek is being diverted around the majority of the Mine since 2003 (Section 2.2). Nairne Creek joins Dawesley Creek about 8 km south-south-east of the CFS STC site before Dawesley Creek flows into Mt Barker Creek a further 6 km south-east. Approximately 3.5 km east-south-east of the confluence with Dawesley Creek, Mt Barker Creek flows into Bremer River, which flows north to south, roughly parallel to Dawesley Creek about five to nine kilometres to east of Dawesley Creek (Figure 4). About 28 km south of the confluence with Mt Barker Creek the Bremer River empties into Lake Alexandrina, the artificially maintained lake at the mouth of the Murray River.

Drainage depressions are well defined throughout the region. Watercourses flow either southwards into the Dawesley Creek catchment, or eastward towards the Bremer River. The regional topography has been extensively modified by historic mining activities.

Creek Flow Data

Both historical and current flow data information for Dawesley Creek, Mt Barker Creek and Bremer River is publicly available online from the DEW WaterConnect data base (DEW 2020) and was accessed for the following five gauging stations (Figure 9c):

- Gauging station Dawesley Creek (A4260558) – located near Old Princess Hwy approximately 5.7 km downstream of the CFS STC site, 20.7 km upstream of the confluence with Mt Barker Creek and 240 m downstream of sampling location DC07
- Gauging station Mt Barker Creek (A4260557) – located off Smythe Road, approximately 18.9 km upstream of the confluence with Dawesley Creek, and approximately 7.6 km upstream of sampling location MBC02
- Gauging station Mt Barker Creek (A4260679) – located at sampling location DC17A at 430D Callington Road, Salem, approximately 5.2 km downstream of the confluence with Dawesley Creek and 470 m upstream of the confluence with Bremer River
- Gauging station Bremer River (A4260688) – located approximately 510 m upstream of the confluence with Mt Barker Creek and 170 m downstream of sampling location BR01
- Gauging station Bremer River (A4260533) – located near the north-eastern corner of 219 Hassam Road, Woodchester, approximately 13.6 km downstream of the confluence with Mt Barker Creek and 8.3 km downstream of sampling location DC19.

Please note that the distances given in the description of the gauging stations refer to stream lengths rather than geographical distances. A review of this dataset indicates the following:

- Flow in Dawesley Creek, Mt Barker Creek and Bremer River mainly occurs between May and November, with peak flow periods between July and September and the potential for summer storms to generate short but high flows in December to February.
- In the past 5 years, 2016 and 2017 had exceptionally high flows while 2018 to 2020 have been very dry.
- Throughout 2020, there has been very limited flow in Bremer River, upstream of the confluence with Mt Barker Creek. Since 2018 the flow in Bremer River has been much lower, relative to Mt Barker Creek and Dawesley Creek, than it was historically. The reason for this change in relative flow rate is not clear but it may be that there has been some surface water extraction from the upstream reaches of Bremer River.

- Throughout 2020, the flow in the upstream reaches of Mt Barker Creek has typically been more than five times higher than that in the upstream reaches of Dawesley Creek. The available data suggests that the upper reaches of Mt Barker Creek contribute, on average, more of the flow discharging into the Bremer River than the upper reaches of Dawesley Creek.

A summary of the DEW flow data at the five gauging stations is presented in Appendix E.

4.5 Conceptual Hydrogeological Model

A conceptual hydrogeological model for the CFS STC site and Brukunga Mine, provided in Appendix D, is taken largely from GHD’s 2009 study for the Brukunga Mine. Although the water level and climatic data are up to 2009, the concept remains valid.

5. Assessment Criteria

5.1 General

PFAS are the key contaminants of enquiry of this environmental investigation. As such, the assessment criteria adopted for this investigation were adopted form the following guidelines 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 substances (PFAS) in Recreational Water, National Health and Medical Research Council, Canberra, 2019
- NHMRC/NRMMC, 2011, Australian Drinking Water Guidelines 6, Version 3.5 updated August 2018, National Water Quality Management Strategy, National Health and Medical Research Council and Natural Resource Management Ministerial Council, Canberra, 2018, (ADWG)

The guideline values are shown in the results summary tables presented at the end of this report and application of these guidelines is summarised below.

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, 2018, (AWQG).
- Gov SA, 2015, Environment Protection (Water Quality) Policy (WQEPP) 2015, Version 30.1.2018, Government of South Australia, 2018
- NHMRC, 2008, Guidelines for Managing Risks in Recreational Water, National Health and Medical Research Council, Australian Government, Canberra, 2008
- SA EPA, 2019a, Guidelines for the assessment and remediation (GAR) of site contamination, Environment Protection Authority, South Australia, revised November 2019
- SA EPA, 2019b, Guidelines for regulatory monitoring and testing – Groundwater sampling Environment Protection Authority, South Australia, revised 2019

5.2 Soil, sediment, sludge and concrete

The adopted PFAS screening criteria for sediment, soil, sludge and concrete samples based on the PFAS NEMP 2020 are presented in Table 5-1 below. Samples collected from the CFS STC site and from within the boundary of the Brukunga Mine were compared to industrial/commercial criteria for human health. Samples taken from locations outside the Brukunga Mine were compared to human health screening criteria for residential land use with garden / access to soil. In addition, all samples were assessed against the interim soil criteria for ecological direct and indirect exposure.

Table 5-1 Adopted PFAS Interim Screening Criteria (sediment, soil, sludge and concrete)

Exposure Scenario	PFHxS [1]	PFOS [2]	PFOS/PFHxS[3]	PFOA [4]	Guideline
Soil – Human Health Screening Values Industrial/Commercial	20 mg/kg	20 mg/kg	20 mg/kg	50 mg/kg	PFAS NEMP
Soil – Human Health Screening Values Residential with garden / access to soil	0.01 mg/kg	0.01 mg/kg	0.01 mg/kg	0.1 mg/kg	PFAS NEMP
Soil – Interim Ecological Direct Exposure	-	1 mg/kg	-	10 mg/kg	PFAS NEMP
Soil – Interim Ecological Indirect Exposure	-	0.01 mg/kg	-	-	PFAS NEMP

Notes:

[1] PFHxS – perfluorohexane sulfonate

[2] PFOS – perfluorooctane sulfonate

[3] PFOS/PFHxS – Sum of PFOS and PFHxS; as per PFAS NEMP this guideline value includes PFOS only, PFHxS only and the sum of the two.

[4] PFOA – perfluorooctanoic acid.

5.3 Groundwater

To assess the contamination status of groundwater at a site, the GAR (SA EPA 2019a) provide 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 guidelines is described in Table 5-2.

Table 5-2 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 February 2020 ranged between 813 mg/L and 22,100 mg/L, indicating fresh to hyper-saline groundwater quality beneath the investigation area (GHD 2020b). The calculated TDS values ranged from 484 mg/L to 5,802 mg/L across all groundwater samples collected in June 2020, indicating fresh to saline water beneath the investigation area.
Step 2: Assess and identify surface water bodies within a 2 km buffer of the site	The nearest surface water receptor is Dawesley Creek, located directly west of the CFS STC site. Surface runoff from the site would flow into this water body. There is also potential groundwater discharge into Dawesley Creek (Appendix D).
Step 3: Review registered groundwater users in the Water Connect database	A review of the Water Connect database identified a total of 180 registered bores within a 2 km radius of the CFS STC site (GHD 2020b). The uses of the bores were listed as investigation (35), observation (31), irrigation (3), domestic bore 6627-8333 (1), dam (1), river (1), soak (1) and stock (1).

Process	Assessment
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 the potential use of groundwater for drinking water purposes and the freshwater ecosystems of Dawesley Creek and downstream creek systems.

Based on the assessment outlined in Table 5-2, the groundwater criteria were selected to protect the relevant environmental values identified for groundwater underlying the area of investigation. In the absence of PFAS assessment criteria for the environmental values of stock watering and irrigation in the PFAS NEMP 2020, the assessment criteria for drinking water were adopted for these environmental values.

The adopted groundwater screening / investigation levels, which are considered to protect potentially complete source receptor linkages, are summarised in Table 5-3.

Table 5-3 Adopted PFAS Interim Screening Criteria (Groundwater)

Exposure Scenario	PFHxS [1] (µg/L)	PFOS [2] (µg/L)	PFOS/PFHxS [3] (µg/L)	PFOA [4] (µg/L)	Guideline
Human health – drinking water	0.07	0.07	0.07	0.56	PFAS NEMP ADWG [5]
Human health – recreational water (domestic) [6]	0.7	0.7	0.7	5.6	NHMRC 2008 [6] ADWG [5]
Human health – recreational water (non-domestic) [7]	2	2	2	10	PFAS NEMP NHMRC 2019 [7]
Freshwater – 99% species protection [8]	-	0.00023	-	19	PFAS NEMP
Freshwater – highly disturbed systems [9]	0.0046	0.0066	-	-	Catchment specific WQG

Notes:

[1] PFHxS – perfluorohexane sulfonate

[2] PFOS – perfluorooctane sulfonate

[3] PFOS/PFHxS – Sum of PFOS and PFHxS; as per PFAS NEMP this guideline value includes PFOS only, PFHxS only and the sum of the two.

[4] PFOA – Perfluorooctanoic acid.

[5] The NHMRC/NRMMC 2011 Australian Drinking Water Guidelines 6, Version 3.5 updated August 2018, adopted the PFAS NEMP 2018 for drinking water, which were confirmed by the PFAS NEMP 2020.

[6] The NHMRC 2008 Guidelines for Managing Risks in Recreational Water recommend health guideline values for recreational water that correspond to 10 times the current drinking water guideline value. These guideline values apply in a domestic setting where groundwater is used for recreational purposes such as the filling of swimming pools.

[7] The PFAS NEMP 2020 adopted the NHMRC 2019 guidance for recreational water. These guideline values apply to creeks, rivers and lakes in non-domestic settings.

[8] The PFAS NEMP 2020 Freshwater 99% species protection level guideline value for PFOS of 0.00023 µg/L was replaced with catchment specific water quality guideline values (Section 5.5). However, the PFAS NEMP 2020 Freshwater 99% species protection level guideline value for PFOA of 19 µg/L was adopted for this investigation.

[9] Refer Section 5.5 for derivation of catchment specific water quality guideline values.

5.4 Flux Test

Water samples collected during flux testing were compared to the same criteria as surface water (Section 5.5), which generally match the criteria used in the initial environmental investigation by GHD in November 2019 (GHD 2019a) and the off-site investigation in February 2020 (GHD 2020b).

5.5 Surface water, seepage water and storage tank water

Water samples collected from Dawesely Creek, Nairne Creek, Mt Barker Creek, Bremer River, the diversion drain, from seepage water collection points and from the water storage tanks at the CFS STC site were compared to the same criteria as groundwater (Table 5-3),

Initial results showed that PFAS concentrations in surface water samples collected upstream of Dawesley Creek in Nairne Creek, Mt Barker Creek and Bremer River exceeded the PFAS NEMP 99% species protection water quality guidelines (WQG) for PFOS (0.00023 µg/L), indicating that other Bremer River subcatchments may be impacted by PFAS. In agreement with the SA EPA and the auditor, and in accordance with ANZG (2018), the catchment specific WQG for PFOS and PFHxS listed in Table 5-4 were derived for use in-lieu of the PFAS NEMP 99% species protection WQG for PFOS. The data used to calculate the catchment specific WQG are provided in Appendix F.

Table 5-4 Catchment specific water quality guideline values

Exposure Scenario	PFOS	PFHxS
Freshwater – highly disturbed system [1]	0.0066 µg/L	0.0046 µg/L
Freshwater – slightly to moderately disturbed systems [2]	0.0048 µg/L	0.0044 µg/L

Notes: [1] Based on 90th percentile of background concentrations in Mt Barker Creek – applies to Dawesley Creek (downstream of the CFS STC site).
[2] Based on 80th percentile of background concentrations in Mt Barker Creek – applies to Nairne Creek, Mt Barker Creek and Bremer River.

ANZG (2018) suggest that for moderately disturbed catchments, reference sites should be selected to represent water quality at the least disturbed sites within the moderately disturbed region, with the underlying aim being to bring all streams in the moderately disturbed region up to the quality of the less disturbed sites. To determine catchment specific WQG for PFOS in the Bremer River catchment, Mt Barker Creek and Bremer River were selected as reference sites and two additional rounds of surface water monitoring were conducted at several sampling locations for each reference site (refer to sections 3.2.1 and 7.10). Selected samples were analysed for the full “long” PFAS analytical suite to determine the “fingerprint” of different PFAS sources that may be contributing to the water quality in the downstream reaches of Bremer River. In addition, both historical and current flow data from the DEW WaterConnect data base was also reviewed (Appendix E).

The available dataset indicated that Bremer River was not a suitable reference site for use in deriving catchment specific WQG for PFOS as there has been very limited flow measured in Bremer River upstream of the confluence with Mt Barker Creek in 2020. In addition, the reported PFAS concentrations showed high variability between individual sampling locations and between sampling events (section 7.10.2). Elevated PFAS concentrations measured in individual samples collected in the township of Callington from the upstream reaches of the Bremer River indicated a moderate level of disturbance. In comparison, surface water discharges from Mt Barker Creek were found to dominate the flow observed in the downstream reaches of Bremer River and the PFAS concentrations measured in Mt Barker Creek samples were relatively consistent. These findings indicate that, in this dataset, the Mt Barker Creek samples generally represented the least disturbed of the range of collected samples and that Mt

Barker Creek was therefore the most suitable of the available reference locations to derive catchment specific WQG.

The available dataset for Mt Barker Creek was used to calculate catchment specific WQG for PFOS, for use in-lieu of the NEMP 99% species protection WQG for PFOS (0.00023 µg/L). ANZG (2018) suggest that for slightly to moderately disturbed ecosystems, test site medians should be compared with the 80th percentile of the reference site data and for highly disturbed ecosystems, the 90th percentile of the reference site data should be used. The 80th and 90th percentile PFOS and PFHxS reference concentrations were calculated using the dataset available for Mt Barker Creek upstream of the confluence with Dawesley Creek as shown in Table 5-4.

It is acknowledged that the data set does not meet the ANZG (2018) requirement of monthly sampling over two years for the derivation of catchment specific WQG values, as only a limited number of sampling events have been undertaken at the Mt Barker Creek reference locations over the 2020 winter and that the samples collected do not incorporate the drier low flow conditions in the Investigation Area waterways. Additional monitoring of PFAS concentrations both at reference locations and at locations downstream from the CFS STC during drier months would be required to understand the range of PFAS concentrations under different flow conditions. The derived catchment specific WQG for PFOS and PFHxS will be used until additional data become available and allow a revision of the WQG.

For the purpose of this assessment Nairne Creek, Mt Barker Creek and Bremer River were considered moderately disturbed ecosystems, while Dawesley Creek downstream of the CFS STC site was considered a highly disturbed ecosystem.

The classification of Dawesley Creek was made on the recommendation of the SA EPA, who stated via email (provided in Appendix F):

"The Dawesley Creek, assessed for many years as a result of the Brukunga Mine, continues to show evidence of adverse impacts from the mine based on the most recent 2015 assessment (https://www.energymining.sa.gov.au/minerals/mining/former_mines/brukunga_mine_site/water_quality_monitoring). Over 26 km of stream has been adversely affected by high levels of nutrients, metals and fine sediment deposition.

A 90% level of protection for the highly disturbed Dawesley Creek is considered to be appropriate based on its current and expected condition over at least the next few decades."

The corresponding catchment specific WQG for PFOS and PFHxS were applied to surface water in these subcatchments.

6. Methodology

6.1 General

Prior to any site works commencing, a job safety and environment analysis (JSEA) was prepared which considered the potential specific risks associated with the investigation methods and exposure to chemicals that were present at the site. All field staff were required to read, sign and conform to the site specific JSEA.

The following methodologies are in accordance with the following guidelines:

- National Environment Protection (Assessment of Site Contamination) Measure (1999) as amended 2013 (ASC NEPM).
- 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 Rivers and Streams. AS/NZS 5667.6:1998
- Australian/New Zealand Standard (1998) Water Quality – Sampling Guidance on Sampling of Groundwaters. AS/NZS 5667.11:1998.
- Australian/New Zealand Standard (1999) Water Quality – Sampling Guidance on Sampling of Bottom Sediments. AS/NZS 5667.12:1999.
- EPA Victoria (2000) Groundwater Sampling Guidelines.
- SA EPA (2019b) Guidelines for Regulatory Monitoring and Testing Groundwater Sampling.
- 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.

6.2 Concrete dust sampling

The concrete dust sampling methodology adopted during the sampling event is summarised in Table 6-1.

Table 6-1 Concrete dust sampling methodology

Activity	Details
Sampling	Concrete samples were collected using a hammer drill and a 10 mm Masonry Drill Bit and brush. The concrete dust generated by the drill was swept directly into laboratory supplied jars.
Sample preservation and transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment (drill bit and brush used to collect the samples) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.3 Concrete core sampling

The concrete core sampling methodology adopted during the sampling event is summarised in Table 6-2.

Table 6-2 Concrete core sampling methodology

Activity	Details
Sampling	Concrete core samples (from the hotpads and water storage tanks) were collected using a coring drill under the supervision of a GHD scientist/engineer. Lubrication and cooling of the drill was by mains water only. Each core was at least 150 mm in diameter and sawed in half lengthwise. One half of each tank core was vacuum-sealed in HDPE plastic and returned to Xypex for X55 treatment under COC documentation. The remaining tanks' half cores were cut in half lengthwise to obtain quarter cores and sufficient samples for QA/QC intra-laboratory duplicates. Following core drilling, the holes in the tanks and hotpads were reinstated by drilling contractor Symbiosis using Xypex Megamix II repair methodology.
Sample preservation and transport	Each cut core sample was vacuum-sealed and labelled with the project number and sample ID. The samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment (drill bit and brush used to collect the samples) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.4 Flux testing

The flux testing methodology adopted during the sampling event is summarised in Table 6-3.

The flux test for Hotpad A was conducted on 7 May 2020 with a maximum flow rate of 0.99 L/s. For the purposes of the flux test the entire area of Hotpad A of 832 m^2 was used to simulate a 5 mm rainfall event. The required time was 70 minutes.

The flux test for Hotpad B was conducted on 18 May 2020 using a longer hose with different fittings, which yielded a maximum flow rate of 0.29 L/s. Due to the large size of Hotpad B (1,858 m^2), the rainfall simulation area for flux sampling was limited to the area between the concrete bund in the centre of Hotpad B and the drain (214 m^2) to ensure that a 5 mm rainfall event could be simulated within a reasonable timeframe (60 minutes). The selection of the rainfall simulation area for Hotpad B was based on information provided by the CFS that this section of Hotpad B was used the most and potentially had the highest PFAS impact. The rainfall simulation areas for Hotpad A and Hotpad B are shown on Figure 6a.

During the flux tests it took 10 minutes and 30 minutes for the surface run-off to reach the collection point for flux test samples from Hotpad A and Hotpad B, respectively.

Table 6-3 Flux testing methodology

Activity	Details
Sampling	The area of the hotpad being tested was measured and multiplied by 5 mm in order to calculate the volume of water required to simulate a 5 mm rainfall event. The hose was run at maximum flow rate into a 20 L container. The time it took to fill the container was recorded, and the flow rate of the hose calculated from this. The total time that the hose needed to be run at maximum flow rate to simulate a 5 mm rainfall event was calculated based on these tests. Prior to running the flux test a blank sample was collected directly from the hose. The hose was then run at maximum flow rate over the hotpad to simulate the 5 mm rainfall event. Water samples were collected as the water ran off the hotpad into the drain as grab samples.
Sampling Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.5 Storage tank water sampling

The storage tank water sampling methodology adopted during the sampling event is summarised in Table 6-4.

Table 6-4 Storage tank water sampling methodology

Activity	Details
Sampling	The manhole cover of each tank, located at the car park's ground level, was unlocked and opened. Each sample was taken as grab sample directly from the water tank using an extendable arm that was lowered through the manhole into the tank with the bottle opening pointing down to avoid collection of surface films. The bottles were appropriately labelled with a unique GHD job number, sample identification and sampling date. All samples were collected in laboratory supplied containers appropriate for PFAS analysis. Water quality parameters (pH, dissolved oxygen, electrical conductivity, reduction/oxidation (redox) potential and temperature) were measured using a multi parameter water meter and recorded using sampling record sheets. Depending on the water level in the tank, the water quality parameters were determined by placing the probe either directly into the tank or into a grab sample. The tank water was visually assessed for turbidity and any evidence of contamination.
Sampling Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.

Activity	Details
Decontamination	All non-disposable equipment (e.g. water quality meter) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.6 Soil sampling

The soil sampling methodology adopted during the sampling event is summarised in Table 6-5.

Table 6-5 Soil sampling methodology

Activity	Details
Borehole drilling	Soil bores were drilled using mechanical pushtube and hand auger (at locations with restricted access for the rig) techniques to maximum depths of 3.8 m (SB03) for pushtube and 1.1 m (SB01) for hand auger below the surface or the concrete slab. Soil bores drilled using pushtube technique were drilled by a licensed GHD approved driller. Soil bores drilled using hand auger technique were drilled by GHD personnel. Where a concrete surface was present, the concrete was cored using a hammer drill and a 120 mm masonry drill bit. Concrete coring was conducted by a licensed GHD concrete cutter.
Sampling	Where the soil was directly accessible, surface soil samples were taken from 0 – 0.1 m below surface using a shovel. Soil samples collected from the pushtube were collected at surface and 0.5 m intervals for the first 2 m bgl and 1 m intervals thereafter or where evidence of contamination or changes in lithology are observed. Soil samples collected from the hand auger were collected at surface and at 0.5 m intervals or where evidence of contamination or changes in lithology occured. Soil was reinstated following sampling. Soil samples were collected directly into PFAS suitable sample jars provided by the laboratory, using the jar to grab the sample directly from the soil, shovel, pushtube or hand auger.
Soil logging	Soils encountered at each sample location were described consistent with the AS 1726:2017 and recorded in PLog Data Collection Software on field tablets. Soil borehole logs are presented in Appendix B.
Sample preservation and transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment (shovel and hand auger) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.7 Sludge sampling

Sludge material originating from the acid water treatment plant covered the areas described as the sludge drying ponds, sludge emergency overflow pond and the sludge disposal area on the southern bench. DEM staff, who have been working on the Brukunga Mine for the past ten years, stated that during this time sludge had only been disposed in the sludge disposal area on the southern bench. However, material that looked similar to the sludge on the southern bench was observed on the northern bench in small stockpiles, one large stockpile along the foot of the highwall, and underneath the lining of the waste rock piles. These materials were also sampled and analysed. The sludge sampling methodology adopted during the sampling event is summarised in Table 6-6.

Table 6-6 Sludge sampling methodology

Activity	Details
Sampling	To collect sludge samples from the waste stockpile on the southern bench, a GHD approved driller was engaged to drill soil bores using pushtubes. The boreholes were extended up to 0.5 m into the natural ground up to a maximum depth of 5.7 m below the stockpile surface. Sludge samples were collected directly from the pushtube at surface and at 1 m intervals or where evidence of contamination or changes in composition were observed. In the vicinity of the emergency sludge overflow pond a further three soil bores (SW10, SW11 and SW15) were drilled to a maximum depth of 3.8 m below the stockpile surface. The boreholes were reinstated following sampling. Sludge samples from smaller stockpiles located near the sludge drying ponds and the emergency sludge overflow pond were taken as grab samples by digging up to 1 m deep into the stockpile using a shovel. Sludge samples were collected directly into laboratory supplied jars, suitable for PFAS analysis, using the jar to grab the sample directly from the sludge stockpile surface, the shovel or the pushtube.
Soil logging	Sludge encountered at each sample location was described consistent with the AS 1726:2017 and recorded in PLog Data Collection Software on field tablets.
Sample preservation and transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled prior to and during delivery to the laboratory. All samples will be transported to the laboratory by GHD Field Staff under Chain of Custody (COC) documentation.
Decontamination	All non-disposable equipment was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.8 Seepage water sampling

The seepage water sampling methodology is summarised in Table 6-7 below.

Table 6-7 Seepage water sampling methodology

Activity	Details
Sampling	Each sample was taken as grab samples directly from the seeping wall water collection point or run-off. The bottles were appropriately labelled with a unique GHD job number, sample identification and sampling date. All samples were collected in laboratory supplied containers appropriate for PFAS analysis.
Sample Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.

Activity	Details
Decontamination	No decontamination was required as no reusable equipment was utilised. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.9 Groundwater Well Installation and Sampling

The groundwater well installation methodology adopted during the site works is summarised in Table-6-8. DEW well permits are presented in Appendix G. Groundwater well construction details are presented in Appendix B.

Table-6-8 Groundwater Well Installation Methodology

Activity	Details
Underground service locating	All groundwater well locations were checked for the presence of buried services by a professional services locator before the commencement of the field investigations. In addition, underground service plans for the area were obtained prior to the commencement of the investigations and used to assist with locating underground services.
Well Installation	Groundwater monitoring wells were installed using DH400 Drilling Rig with air hammer to a maximum depth of 23 m bgl (well GW07). Clean augers were used to drill each well.
Well Construction	Groundwater monitoring wells were constructed with 50 mm diameter, Class 18, polyvinyl chloride (PVC). A 50 mm diameter, class 18 PVC end cap was threaded to the bottom of each well casing. Each monitoring well was installed generally with a 3.0 m screened section of class 18 PVC well casing, with the screen installed from the base of the well. Longer screens were used where wells were installed within fractured rock and fractures were low yielding, with minimal evidence of water strike. Graded and washed filter sand was placed around the well screen from the bottom of the borehole to approximately 0.5 m above the top of the well screen (1 m bgl). A bentonite seal was installed on top of the sand/gravel pack with the remaining annular space filled with a cement/bentonite grout from the top of the bentonite seal to ground surface. A locking expansion cap was installed in each groundwater monitoring well with all wells completed at the surface with a lockable stand piper monument.
Soil logging	Soils encountered at each well installation location were logged based on field interpretation, consistent with the AS 1726:2017 and recorded in PLog Data Collection Software on field tablets. Soil borehole logs are presented in Appendix B.
Well Development	Post installation the wells were developed using a dedicated disposable bailer for each well to remove fines from the borehole and promote the flow of groundwater from the surrounding formation into the well for subsequent sampling. Each well was considered to be suitably developed either when three well volumes has been removed, where recharge permitted, or until purge water ran clear or the well was purged dry.
Waste Disposal	Excess soil cuttings from well installation and groundwater from development and sampling activities were spread out near the well location.

Activity	Details
Well survey	The top of each well casing was surveyed to Australian Height Datum (AHD) and map grid Australia (MGA) zone 54 geocentric datum Australia (GDA 94). In the instance where the top of casing was not evenly cut, the highest point of the top of casing was surveyed. The survey results are presented in Appendix H.
Decontamination	All non-disposable equipment was washed with pH neutral phosphate and PFAS free detergent (Liquinox) and rinsed with clean water before and after use.

The groundwater sampling methodology adopted during the sampling event is summarised in Table 6-9.

Table 6-9 Groundwater sampling methodology

Activity	Details
Gauging	The monitoring wells' standing water levels (SWL) and bore depths were gauged in accordance with standard industry practice and the GHD documented standard field procedures. All wells were gauged with an oil / water interface probe prior to sampling. SWL and bore depths were recorded in the field using sampling record sheets. The SWL measurement were undertaken from the top of casing (TOC).
Sampling	Sampling was conducted using a no-purge method via high density polyethylene (HDPE) HydraSleeve™ samplers dedicated for each well in accordance with the Hydrasleeve (2019) Standard Operating Procedure (SOP). The sampler was slowly lowered into the screened section of the well to minimise disturbance. Once the HydraSleeve™ had reached the target depth it was slowly drawn up to open the valve and collect the sample. The sampler was removed within 1-5 minutes after deployment to allow for sample equilibration, raising it slowly to ensure the valve closed properly. All samples were obtained directly from the sampler sleeve into laboratory supplied containers with appropriate preservatives where required. Private residential bores with fixed pumps were sampled by running the pump. Once the water quality meter readings had stabilised as per GHD standard operating procedure samples were collected directly from the pump into laboratory supplied containers with appropriate preservatives, where required. All sampling containers were appropriately labelled with a unique GHD job number, sample identification and sampling date. All samples were collected in laboratory supplied containers appropriate for PFAS analysis. Water quality parameters (pH, dissolved oxygen, electrical conductivity, reduction/oxidation (redox) potential and temperature) were measured using a multi parameter water quality meter and recorded using sampling record sheets. The groundwater was visually assessed for turbidity and evidence of contamination.
Sample Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment (i.e. oil / water interface probe and water quality meter) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

Activity	Details
Well survey (if not available from DEM)	The top of each well casing was surveyed to Australian Height Datum (AHD) and map grid Australia (MGA) zone 54 geocentric datum Australia (GDA 94). In the instance where the top of casing was not evenly cut, the highest point of the top of casing was surveyed.

6.10 Surface water sampling

The surface water sampling methodology adopted during the sampling event is summarised in Table 6-10. Surface water samples were collected from the locations listed in Table 3-7 and Table 3-8.

Table 6-10 Surface water sampling methodology

Activity	Details
Sampling	Each sample was taken as grab sample directly from the water body using an extendable arm with the opening pointing down to avoid collection of surface films. The bottles were appropriately labelled with a unique GHD job number, sample identification and sampling date. All samples were collected in laboratory supplied containers appropriate for PFAS analysis. Water quality parameters (pH, dissolved oxygen, electrical conductivity, reduction/oxidation (redox) potential and temperature) were measured using a multi parameter water meter and recorded using sampling record sheets. The surface water was visually assessed for turbidity and any evidence of contamination.
Sample Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.
Decontamination	All non-disposable equipment (i.e. water quality meter) was washed with a PFAS-free and phosphate-free detergent and rinsed with clean water and additionally rinsed with demineralised water before and after each sample was collected. Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.11 Sediment sampling

The sediment sampling methodology adopted during the sampling event is summarised in Table 6-11. Sediment samples were collected from the locations listed in Table 3-7 and Table 3-8, provided it was safe to do so, and the creek bed contained sufficient sediment for sampling at the location.

Table 6-11 Sediment sampling methodology

Activity	Details
Sampling	Each sediment sample was taken as discrete grab sample from the edge of the creek / river by scooping the sediment directly into laboratory supplied containers appropriate for PFAS analysis . The sediment jars were appropriately labelled with a unique GHD job number, sample identification and sampling date.
Sample Preservation and Transport	Samples were stored on ice in an insulated cooler immediately after sampling and were kept chilled 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.

Activity	Details
Decontamination	Disposable nitrile gloves were worn during sampling and changed between samples to minimise the potential for cross-contamination. Further sample collection, handling and preservation details are summarised in Section 6.12.

6.12 Sample collection, handling and preservation

Due to the nature of PFAS, further care during sampling must be undertaken to minimise the potential for cross contamination during sample collection and transport. Table 6-12, adopted from WA DER 2017 and aligned with PFAS NEMP 2020, summarises the mitigation practice and alternative approach for each potential source of cross contamination during PFAS sampling.

Table 6-12 Summary of mitigation practices

Product	Mitigation practices	Alternative approach
Clothing and food		
New clothing	Prohibited for sampling personnel (1)	All field clothing was washed after purchase before using at the assessment area.
Clothing with stain-resistant, rain resistant, or waterproof coatings/ treated fabric (e.g. GORE-TEX®)		Sampling during rain was avoided if possible; polyethylene rain gear (e.g. disposable LDPE), vinyl, or polyvinyl chloride (PVC) clothing were acceptable.
Tyvek® clothing		None.
Fast food wrappers and containers		Rigid plastic containers or bags or stainless steel containers were used for all food brought to the assessment area.
Pre-wrapped foods and snacks (e.g. chocolate bars, energy bars, granola bars, potato chips etc.)		Food brought to the assessment area was contained in plastic (rigid containers or bags) or stainless steel containers.
Sampling equipment and containers		
Teflon®-containing or –coated field equipment (tubing, bailers, tape, plumbing paste, etc.)	Prohibited at site (2)	High-density polyethylene (HDPE) or silicone tubing, and HDPE or polypropylene field equipment recommended.
Teflon®-lined lids on containers (e.g. sample containers, rinsate water storage containers)	Prohibited at site (2)	Polypropylene lids (3) for sample containers and polypropylene or HDPE containers for rinsate.
Glass sample containers with lined lids	Contact with samples	Polypropylene or HDPE were used for sample containers (3) (PFAS adsorb strongly to glass).
Other products		
Aluminium foil	Prohibited at site (2)	Thin HDPE sheeting (commonly used as drop cloths for painting or home improvement) could be used.
Self-sticking notes and similar office products (e.g. 3M Post-it notes)	Prohibited at site (2)	Avoided the use of these products at the site.
Waterproof paper, notebooks, and labels	Prohibited at site (2)	Standard paper and paper labels.
Detergents and decontamination solutions (e.g. Decon 90® Decontamination Solution)	Prohibited for all equipment	Decontamination using Liquinox ® detergent (PFAS-free and phosphate-free) follow water-only decontamination approach.

Product	Mitigation practices	Alternative approach
Reusable chemical or gel ice packs (e.g. Blue Ice®)	Prohibited for sample storage and transport	Ice contained in plastic (polyethylene) bags (double bagged).

Notes

(1) Sampling personnel includes all personnel who:

- were directly involved in the collection, handling, and/or processing of samples prior to the samples leaving the assessment area; or
- handled any part of equipment that directly contacts surface water or aquatic sediment; or
- Were within 2–3 m of the sampling location during sampling.
- Personnel were not included as sampling personnel if they remain at least 2–3 m away from sample collection areas prior to and during sampling.

(2) Entire sample collection and processing area, including vehicles used by sampling personnel.

(3) USEPA and ASTM method for the analysis of PFAS in solid and liquids specify polypropylene or HDPE with polypropylene lids.

6.13 Laboratory analysis

Selected samples were submitted for laboratory analysis to a National Association of Testing Authorities (NATA) accredited laboratory under standard chain of custody procedures. The analysing laboratories are as follows:

- Primary Laboratory – Envirolab Group
- Secondary Laboratory – ALS
- All samples were tested for PFAS short analytical suite except selected surface water samples from Dawesley Creek, Mt Barker Creek and Bremer River analysed for the full “long” PFAS suite to determine the “fingerprint” of different PFAS sources.

6.14 Community engagement

GHD conducted the community engagement in accordance with the VSCAP (GHD 2019b) , the CFS Community Engagement Plan and EPA (2018) Site Contamination Guideline for communication and engagement. A comprehensive summary of the community engagement is provided in Appendix A.

1. Community engagement included posting and / or delivering letters to the landowners of private properties on which proposed groundwater and surface water sampling locations were located to obtain informed consent to conduct the monitoring program. The informed consent was obtained from the following private owners: Ray & Tania Jackson, Lot 294, 296 Pyrites Rd, Brukunga
2. Peter Buik, Peggy Buxton Road Pty Ltd, 203 Peggy Buxton Rd, Brukunga
3. Elizabeth Jean Shephard, Lot 54 Pyrites Rd, Brukunga
4. Milos J Castelli, 16 Hawthorn Street, Dawesley, "The Brae"
5. Brad McAvanney, 483 Ironstone Range Rd, Petwood
6. Paul Johnston, 430D Callington Road, Salem.

In addition, letters were posted and / or delivered to the landowners of private properties adjacent to proposed groundwater and surface water sampling locations located on road reserves (public land) that were not accessible by public roads to obtain permission to access the road reserve via their property. A door knock was conducted as part of this environmental investigation to distribute an information letter to properties adjacent to the new monitoring wells installed. Copies of the community engagement letters are provided in Appendix A.

GHD (2020d) undertook a door knock/water use survey regarding existing water use, groundwater bores and frequency/type of use, including preparation of communication collateral and Survey Monkey. The survey area was determined based on the results of the surface water samples collected from Dawesley Creek and is shown in Figure 12.

GHD will also be assisting the CFS with Community Information Sessions on the results of the survey and information regarding PFAS impacts in the Brukunga area as required. This Information Sessions will be undertaken in accordance with the VSCAP milestones.

7. Results

All field notes collected as a part of this investigation can be found in Appendix I. Calibration certificates for the interface probe and water quality meter can be found in Appendix J. Laboratory reports and chain of custody documentation can be found in Appendix K. Photographs taken during site investigations can be found in Appendix L. Results tables for field parameters and analytical data can be found at the end of this report.

7.1 Concrete

The analytical results for one concrete dust sample (SB02) and 24 concrete core samples (seven from Hotpad A, six from Hotpad B, three from Tank 1, four from Tank 4, one from Tank 5 and three from Tank 7) are presented in Table 1 at the end of this report. PFAS concentrations in concrete exceeding the adopted screening criteria are shown in Table 7-1 and illustrated in Figure 13 at the end of this report.

Table 7-1 Concrete analytical exceedances May and July 2020

No. of primary samples	Analyte	Value (µg/kg)	Samples exceeding criteria
PFAS NEMP 2020 Interim Ecological Direct Exposure (1,000 µg/kg PFOS)			
25	PFOS	1,200	SB05_Concrete (Hotpad B pavers)
PFAS NEMP 2020 Interim Ecological Indirect Exposure (10 µg/kg PFOS)			
25	PFOS	1,200	SB05_Concrete (Hotpad B pavers)
		140	HPB1 (Hotpad B pavers)
		190	HPB2 (Hotpad B pavers)
		150	HPB3 (Hotpad B pavers)
		65	HPB4 (Hotpad B pavers)
		18	Tank1/01b
		59	Tank4
		28	Tank4/01b
		38	Tank4/02b

7.2 Flux test results

7.2.1 Field observations

The flux tests were undertaken following a period of minimal rainfall with no rainfall recorded at the Bureau of Meteorology weather station at Nairne (Station number 023739, located approximately 5 km south-west of the site) in the three days period prior to the test (Table 7-2).

The weather during the flux test at Hotpad A on 7 May 2020 was overcast with showers. The weather station in Mt Barker (Station number 023733) recorded temperatures between 11.3°C and 15.4°C recorded for the day and the weather station in Nairne recorded 4.4 mm of rainfall.

The weather during the flux test at Hotpad B on 18 May 2020 was slightly overcast with temperatures between 8.9°C and 19.4°C and no rainfall.

Table 7-2 BOM rainfall observations at Nairne (weather station 023739)

Flux test	Date of Works	Rainfall observations prior to flux test (mm)			
		24 hours	72 hours	1 week	3 weeks
Hotpad A	7 May 2020	0	0	13.0	58.8
Hotpad B	18 May 2020	0	0	5.6	62.8

The climate observations for Brukunga are provided in Appendix M.

7.2.2 Analytical results

The analytical results of the flux tests are presented in Table 2 at the end of this report. The calculated PFAS mass flux off the hotpads during the flux tests is summarised in Table 7-3. For Hotpad A, the mass flux was calculated for each 10 minute interval of the simulated 5 mm rainfall event, yielding a total of 168 µg PFAS (sum of total) that were mobilised during the experiment. For Hotpad B, the PFAS mass flux was calculated for the first 30 min interval and the following 52 min interval, assuming constant PFAS concentrations in the runoff off the rainfall simulation area for each interval. Overall, a total of 1,069 µg PFAS (sum of total) were mobilised from the 214 m^2 rainfall simulation area at Hotpad B during the experiment. Assuming a constant PFAS mass flux per square metre for the whole area of Hotpad B, the total PFAS mass flux off the 1,858 m^2 Hotpad B during a 5 mm rainfall event was calculated to be 9,281 µg PFAS (sum of total).

Table 7-3 PFAS mass flux off hotpads in a simulated 5 mm rainfall event

ID	Interval (min)	Total PFAS (µg/L)	Flow rate (L/s)	Mass (µg)
Hotpad A (total area)				
FX01	10	0.04	0.99	24
FX02	20	0.05	0.99	30
FX03	30	0.07	0.99	42
FX04	40	0.01	0.99	6
FX05	50	0.08	0.99	48
FX06	60	0.02	0.99	12
FX07	70	0.01	0.99	6
			TOTAL	**168**
Hotpad B (mass flux test area; 11.5% of total hotpad area)				
FX08	30	1.2	0.29	626
FX13	82	0.49	0.29	443
			TOTAL	**1,069**

Based on the flux test results the annual PFAS mass flux off Hotpad A and Hotpad B was calculated using the long-term average annual rainfall of 675.3 mm recorded at the weather station in Nairne (Station ID 023739, BOM 2020), located 4.8 km to the south-west of Brukunga. With the conservative assumption of constant PFAS mass flux off the hotpads during any rainfall event, the flux test results were divided by five mm and multiplied with the average annual rainfall of 675.3 mm. In an average year, up to 23 mg and 1,253 mg could be mobilised via surface runoff off Hotpad A and Hotpad B per year.

The PFOS concentrations detected in the surface water runoff from Hotpad A and Hotpad B exceeded the catchment specific surface WQG for PFOS in all samples collected and analysed. The PFHxS concentrations detected in the surface water runoff were also above the catchment specific WQG for PFHxS in all samples collected and analysed from Hotpad B and in four samples from Hotpad A. The PFHxS concentrations in the remaining three samples from

Hotpad A were below the laboratory’s LOR of 0.01 µg/L and thus potentially above the WQG of 0.0046 µg/L. The change in total PFAS and PFOS concentrations in the surface runoff over time is shown in Figure 7-1.

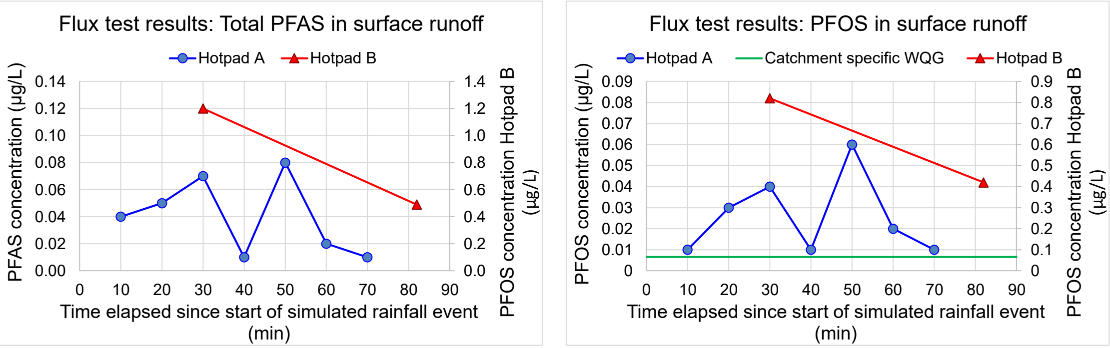


Figure 7-1 Sum of total PFAS and PFOS in runoff from hotpads over time (note the different scale for Hotpad A and Hotpad B)

7.3 Storage tank water

The analytical results for water samples collected on 28 October 2020 from the seven water storage tanks at the Brukunga Mine are provided in Table 3 at the end of this report. PFAS concentrations above the adopted assessment criteria are summarised in Table 7-4.

Table 7-4 Storage tank water analytical exceedances October 2020

No. of primary samples	Analyte	Value (µg/L)	Samples exceeding criteria
Catchment specific WQG for PFOS – highly disturbed ecosystems (0.0066 µg/L PFOS)			
7	PFOS	0.41	Tank1
		0.36	Tank2
		0.34	Tank3
		0.25	Tank4
		0.37	Tank5
		0.32	Tank6
		0.28	Tank7
Catchment specific WQG for PFHxS – highly disturbed ecosystems (0.0046 µg/L PFHxS)			
7	PFHxS	0.08	Tank1
		0.09	Tank2
		0.08	Tank3
		0.07	Tank4
		0.09	Tank5
		0.08	Tank6
		0.07	Tank7
PFAS NEMP 2020 Health Drinking Water (0.07 µg/L sum of PFOS and PFHxS)			
7	Sum of PFOS and PFHxS	0.49	Tank1
		0.46	Tank2
		0.42	Tank3
		0.32	Tank4
		0.45	Tank5
		0.41	Tank6
		0.36	Tank7

7.4 Soil

Soil samples were collected on-site from various locations (Figure 6a) and off-site from a disused vegetable garden located at 296 Pyrites Road, Brukunga (Figure 6b), at the request of the landowner.

Soil analytical results are presented in Table 4 at the end of this report. PFAS concentrations in exceedance of the adopted assessment criteria are summarised in Table 7-5 and shown in Figure 13 at the end of this report.

Table 7-5 Soil analytical exceedances May / September 2020

No. of primary samples	Analyte	Value (µg/kg)	Samples exceeding criteria
PFAS NEMP 2020 Interim Ecological Direct Exposure (1,000 µg/kg PFOS)			
23	PFOS	1,400 1,300 2,100	SB01_0-0.2 SB01_0.2-0.4 SB01_0.9-1.1
PFAS NEMP 2020 Interim Ecological Indirect Exposure (10 µg/kg PFOS)			
23	PFOS	1,400 1,300 2,100 130 19 27 250 25 26 170 740 33	SB01_0-0.2 SB01_0.2-0.4 SB01_0.9-1.1 SB03_0-0.2 SB04_0-0.2 SB05_0.1-0.2 SB05_0.3-0.4 SB06_0.4-0.6 SB06_1.0-1.2 SB07_0-0.2 SB07_0.4-0.6 SB08_0.2-0.4

7.5 Sludge

7.5.1 Field observations

The sludge material consisted of pale orange gypsum with a sandy-silty texture that was very light in weight. Sludge material collected from the sludge waste stockpiles on the southern bench was classified as sandy silt. In contrast, the sludge material collected from the sludge waste stockpiles around the emergency sludge overflow pond included clayey sand, sand, sandy clay, and clay. This difference is due to operational procedures as sludge from the acid treatment plant is pumped directly into the sludge drying ponds and, once dry, transferred by truck to the sludge waste piles at the foot of the highwall on the western side of the mine, while the sludge in the area of the emergency sludge overflow pond is mixed with other fill material.

All sludge waste pile soil bores on the southern bench (SW01 to SW09) were advanced until refusal on hard rock material underlying the waste piles. At three of these locations (SW07 to SW09) a 10 cm thick wet sludge layer was observed between 2.0 m and 4.2 m below the surface of the sludge waste pile (Appendix B). This was most likely perched water due to differences in sludge consistency resulting in a more porous sludge layer overlying a less permeable sludge layer within the sludge waste pile.

Two sludge waste soil bores on the south-western side of the emergency sludge overflow pond (SW10 and SW11) were advanced until collapsing bore holes prevented further progress due to a wet layer of sandy clay fill material, which was encountered between 1.4 and 3.0 m bgl at SW10 and between 1.1 and 3.0 m bgl at SW11. This layer most likely consisted of perched water sitting on top of a less permeable layer of fill material onto which the emergency sludge overflow pond was built.

7.5.2 Analytical results

Sludge analytical results are presented in Table 5 at the end of this report. Exceedances of the adopted criteria are summarised in Table 7-6 and illustrated in Figure 14a to Figure 14d at the end of this report.

Table 7-6 Sludge analytical exceedances May 2020

No. of primary samples	Analyte	Value (µg/kg)	Samples exceeding criteria (Location)
PFAS NEMP 2020 Interim Ecological Indirect Exposure (10 µg/kg PFOS)			
61	PFOS	65 18 36 18 29	SS15 (Northern Bench) SS16 (Northern Bench) SS17 (Northern Bench) SS27 (Southern Extension WRD) SW15 (Emergency Sludge Overflow Pond)

7.6 Leachability tests

The leachability of PFAS compounds from selected sludge and concrete core samples was tested using a multiple extraction procedure, in accordance with the Australian Standard Leaching Procedure (ASLP, AS 4439.3-2019). The analytical results of the leachability tests for sludge and concrete core samples are provided in Table 6a and Table 6b at the end of this report and summarised in Table 7-7. The concrete core samples were collected from both hotpads and from on-site water storage tanks number one, four, five and seven, which have previously held PFAS containing water.

Table 7-7 Summary of leachate exceedances

No. of primary samples	Sludge / concrete exceedances		Leachate exceedances	
	Criterion	Sample (concentration)	Criterion	Sample (concentration)
Sludge surface samples				
3	Ecological Indirect Exposure *	SS15 (65 µg/kg) SS17 (36 µg/kg) SS27 (18 µg/kg)	Drinking water ^ and	SS15 (0.61 µg/L) SS17 (0.33 µg/L) SS27 (0.29 µg/L)
			Fresh water – PFOS #	SS15 (0.59 µg/L) SS17 (0.32 µg/L) SS27 (0.29 µg/L)
			Fresh water – PFHxS #	SS15 (0.03 µg/L) SS17 (0.01 µg/L)
Sludge waste stockpile samples				
3	Ecological Indirect Exposure *	-	Drinking water ^	SW13 (0.08 µg/L)
			Fresh water – PFOS #	SW04 (0.02 µg/L) SW09 (0.02 µg/L) SW13 (0.08 µg/L)

No. of primary samples	Sludge / concrete exceedances		Leachate exceedances	
	Criterion	Sample (concentration)	Criterion	Sample (concentration)
			Fresh water – PFHxS [#]	SW04 (0.01 µg/L) SW09 (0.02 µg/L) SW13 (0.05 µg/L)
Concrete core samples				
21	Ecological Indirect Exposure *	HPB1 (140 µg/kg) HPB2 (190 µg/kg) HPB3 (150 µg/kg) HPB4 (65 µg/kg) Tank1/01 (18 µg/kg) Tank4_Concrete (59 µg/kg) Tank4/01 (28 µg/kg) Tank4/02 (38 µg/kg)	Recreational water [§]	HPB1 (7.0 µg/L) HPB2 (7.5 µg/L) HPB3 (7.1 µg/L) HPB4 (2.5 µg/L)
			Drinking water ^	HPA1 (0.16 µg/L) HPB1 (7.0 µg/L) HPB2 (7.5 µg/L) HPB3 (7.1 µg/L) HPB4 (2.5 µg/L) HPB5 (0.075 µg/L) Tank1/01 (0.19 µg/L) Tank1/02 (0.093 µg/L) Tank1/03 (0.21 µg/L) Tank4_Concrete (0.81 µg/L) Tank4/01 (1.3 µg/L) Tank4/02 (0.72 µg/L) Tank4/03 (0.15 µg/L)
			Fresh water – PFOS [#]	HPA1 (0.071 µg/L) HPA3 (0.011 µg/L) HPB1 (5.0 µg/L) HPB2 (3.8 µg/L) HPB3 (4.5 µg/L) HPB4 (1.6 µg/L) HPB5 (0.064 µg/L) Tank1/01 (0.16 µg/L) Tank1/02 (0.069 µg/L) Tank1/03 (0.16 µg/L) Tank4_Concrete (0.61 µg/L) Tank4/01 (0.56 µg/L) Tank4/02 (0.66 µg/L) Tank4/03 (0.13 µg/L) Tank5_Concrete (0.01 µg/L)
			Fresh water – PFHxS [#]	HPA1 (0.087 µg/L) HPA5 (0.005 µg/L) HPB1 (2.1 µg/L) HPB2 (3.7 µg/L) HPB3 (2.6 µg/L) HPB4 (0.9 µg/L)

No. of primary samples	Sludge / concrete exceedances		Leachate exceedances	
	Criterion	Sample (concentration)	Criterion	Sample (concentration)
				HPB5 (0.011 µg/L) Tank1/01 (0.032 µg/L) Tank1/02 (0.024 µg/L) Tank1/03 (0.042 µg/L) Tank4_Concrete (0.20 µg/L) Tank4/01 (0.75 µg/L) Tank4/02 (0.064 µg/L) Tank4/03 (0.024 µg/L)

Notes:
* PFAS NEMP 2020 guideline for Interim Ecological Indirect Exposure (10 µg/kg PFOS)s
^ PFAS NEMP 2020 Health Drinking Water (0.07 µg/L sum of PFOS and PFHxS)
# Catchment specific WQG –highly disturbed ecosystems (0.0066 µg/L PFOS and 0.0046 µg/L PFHxS)
§ NHMRC 2019 Recreational Water PFAS Guidelines (2 µg/L sum of PFOS and PFHxS)

7.7 Seepage water

The analytical results for seepage water samples collected at the Brukunga Mine are provided in Table 7 at the end of this report. PFAS concentrations above the adopted assessment criteria are summarised in Table 7-8 and illustrated in Figure 15 at the end of this report.

Table 7-8 Seepage water analytical exceedances July 2020

No. of primary samples	Analyte	Value (µg/L)	Samples exceeding criteria
Catchment specific WQG for PFOS – highly disturbed ecosystems (0.0066 µg/L PFOS)			
7	PFOS	0.0071 0.12 0.035 0.023	WW03 WW04 WW06 WW07
Catchment specific WQG for PFHxS – highly disturbed ecosystems (0.0046 µg/L PFHxS)			
7	PFHxS	0.028 0.0049 0.0078 0.088	WW04 WW05 WW06 WW07
PFAS NEMP 2020 Health Drinking Water (0.07 µg/L sum of PFOS and PFHxS)			
7	Sum of PFOS and PFHxS	0.15 0.11	WW04 WW07

7.8 Brukunga Mine Diversion Drain

A grab sample was collected from the diversion drain at the CFS STC on 18 May 2020. The surface water quality parameters and the analytical results for this sample are presented in Table 8 and Table 9 at the end of this report. The water in the diversion drain was fresh with slightly alkaline pH, high oxygen content and oxidising redox potential. All reported PFAS concentrations were below the laboratory LOR. It is noted that the standard laboratory LOR was above the catchment specific WQG for PFOS and PFHxS.

7.9 Groundwater

7.9.1 Field observations and parameters

Groundwater gauging data collected during the February 2020 and June to September 2020 groundwater monitoring events is provided in Table 10 at the end of this report and summarised in Table 4-1. Fixed pumps installed on private residential bores (6627-5944, 6627-7126, 6627-7520, 6627-8333 and 6627-11131) could not be removed, hence the standing water levels could not be measured. The observed SWL in monitoring wells C04a, GW01, GW03, GW05 and GW07 were above the screened section of the wells. This was considered not relevant, however, as PFAS are not floating contaminants and none of the wells are in close proximity to small shallow PFAS sources, which might pass over the screen.

Groundwater parameters collected during 2020 are summarised in Table 7-9 and provided in Table 11 at the end of this report.

Table 7-9 Summary of groundwater parameters 2020

Parameter	Range	Comments
pH	Feb: 2.39 (BH19) – 6.39 (6627-7520) Jun: 6.43 (6627-5944) to 7.0 (KAN23) [1]	Acidic to slightly acidic Slightly acidic to alkaline
Electrical conductivity (µS/cm)	Feb: 1,250 (GAMW-03) – 34,000 (H13) Jun-Sep: 744 (GW05) to 20,641 (GW02)	Low to high Low to high
TDS [2] (mg/L)	Feb: 813 (GAMW-03) – 22,100 (H13) Jun-Sep: 484 (GW05) to 13,417 (GW02)	Fresh to saline Fresh to saline
Dissolved oxygen (mg/L)	Feb: 0.49 (KAN41) – 8.35 (H09) Jun-Sep: 1.42 (GW02) to 6.54 (KAN26)	Low to high Low to Moderate
Redox potential [3] (mV)	Feb: 218 (6627-8333) – 711 (H01) Jun-Sep: -17 (6627-7126) to 240 (GW03)	Oxidising conditions Reducing to oxidising
Temperature (ºC)	Feb: 15.3 (H12) – 21.9 (BH19) Jun-Sep: 14.4 (GW01) to 17.4 (6627-7126)	Normal range for summer Normal range for winter

Notes:

[1] The field pH values recorded in June 2020 indicated a faulty pH probe, were not representative of the site conditions and were replaced with lab values or excluded from this table.

[2] TDS values were calculated by multiplying the electrical conductivity values with a conversion factor of 0.65.

[3] Redox potential relative to the standard hydrogen electrode (SHE) was calculated by adding an off-set voltage of 199 mV to the field redox potential measurements made with an Ag/AgCl electrode saturated with KCl.

In June 2020, the groundwater was predominantly clear to pale brown with low to medium turbidity and no sheen. The sample from well KAN23 had a slight sulphur odour. During the sampling of private bore 6627-5944 strong / slight methane odour was observed upon starting the pump in August / September 2020, respectively. However, the odour dissipated after some time while the water quality parameters were stabilising prior to the sample being collected.

7.9.2 Analytical Results

The tabulated analytical results for this investigation and the February 2020 GME are presented in Table 12 at the end of this report, and laboratory reports are provided in Appendix K. Fourteen primary groundwater samples were submitted for laboratory analysis as part of this investigation. The reported February 2020 and June to September 2020 concentrations of all analytes were below the laboratory limit of reporting or below the adopted assessment criteria, except for those summarised in Table 7-10. The June 2020 and February / March 2020 groundwater exceedances for PFOS and the sum of PFOS and PFHxS are shown in Figure 16a. The extent of PFAS impacts in groundwater in the investigation area is illustrated with inferred sum of PFOS and PFHxS concentration contours in Figure 16b at the end of this report.

Table 7-10 Summary of groundwater analytical results 2020

No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
PFAS NEMP 2020 health screening level for drinking water (0.07 µg/L sum of PFHxS and PFOS)			
17 (Feb/Mar 2020)	Sum of PFHxS and PFOS	0.15 0.16 0.42 0.17 0.16 0.08 0.08 0.09	6627-8333 BH22 H02 H04a H06a H13 KAN12 KAN45
15 (Jun-Sep 2020)	Sum of PFHxS and PFOS	0.110 0.084	6627-5944 * 6627-5944_B *
Catchment specific WQG – highly disturbed ecosystem (0.0066 µg/L PFOS)			
17 (Feb/Mar 2020)	PFOS	0.08 0.02 0.09 0.03 0.02 0.04 0.02 0.02 0.03 0.02 0.03 0.08 0.03 0.02 0.02 0.02	6627-8333 BH19 BH22 GAMW-03 H01 H02 H04a H04b H06a H09 H12 H13 KAN12 KAN41 KAN45 KAN52
15 (Jun-Sep 2020)	PFOS	0.010 0.063 0.046	GW03 6627-5944 * 6627-5944_B *
Catchment specific WQG – highly disturbed ecosystem (0.0046 µg/L PFHxS)			

No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
17 (Feb/Mar 2020)	PFHxS	0.07	6627-8333
		0.07	BH22
		0.02	GAMW-03
		0.03	H01
		0.38	H02
		0.15	H04a
		0.04	H04b
		0.12	H06a
		0.05	KAN12
		0.06	KAN45
15 (Jun-Sep 2020)	PFHxS	0.047	6627-5944 *
		0.038	6627-5944_B *

Note:
* Higher value adopted from QA/QC analysis.

7.9.3 Section 83A notification

The reported concentrations of PFAS in a sampled groundwater monitoring bore were considered to constitute harm to groundwater and a Section 83A notification form was submitted in accordance with the South Australian Environment Protection Act 1993 (Gov SA 1993) to the SA Environment Protection Authority via email on 14 September 2020 as follows:

- Private bore 6627-5944.

A copy of the Section 83A notification form is provided in Appendix N.

7.10 Surface water

Surface water samples were collected from Dawesley Creek, both upstream and downstream of the CFS Brukunga STC, as well as from Mt Barker Creek (downstream of the confluence with Dawesley Creek) and from Bremer River (downstream of the confluence with Mt Barker Creek). In addition, surface water samples were collected from reference sites in Nairne Creek, Mt Barker Creek and Bremer River upstream of the confluence with Dawesley Creek / Mt Barker Creek to determine PFAS background concentrations used to derive catchment specific water quality guidelines for PFOS and PFHxS in the highly disturbed ecological system of Dawesley Creek and the slightly to moderately disturbed ecological systems of Nairne Creek, Mt Barker Creek and Bremer River.

7.10.1 Field observations and parameters

Reference sites

Nairne Creek, upstream of the confluence with Dawesley Creek, was observed to be shallow with clear water flowing slowly over a rocky creek bed. The water in Mt Barker Creek upstream of the confluence with Dawesley Creek had medium turbidity and was flowing freely over a rocky creek bed. The Bremer River upstream of the confluence with Mt Barker Creek was observed to be clear to pale yellow and stagnant to slow moving with reeds abundant at BR02 and algae present at BR01 and BR02.

The background surface water quality parameters collected from the reference sites are summarised in Table 7-11 and presented in Table 8 at the end of this report.

Table 7-11 Summary of background surface water quality parameters in July and September 2020

Parameter	Water course	Value	Comments
pH	Nairne Creek	8.03 to 8.45	Slightly alkaline
	Mt Barker Creek	7.64 to 8.80	Neutral to slightly alkaline
	Bremer River	7.47 to 9.2	Neutral to slightly alkaline
Electrical conductivity (µS/cm)	Nairne Creek	1,187 to 1,342	Moderate
	Mt Barker Creek	1,150 to 1,966	Moderate
	Bremer River	2,975 to 15,330	Moderate to high
Total dissolved solids[1] (mg/L)	Nairne Creek	772 to 872	Fresh
	Mt Barker Creek	748 to 1,278	Fresh to brackish
	Bremer River	1,934 to 9,965	Brackish to saline
Dissolved oxygen (mg/L)	Nairne Creek	10.36 to 10.55	High
	Mt Barker Creek	7.83 to 12.15	Moderate to High
	Bremer River	1.10 to 12.88	Low to high
Redox potential[2] (mV)	Nairne Creek	423 to 428	Oxidising conditions
	Mt Barker Creek	65 to 433	Oxidising conditions
	Bremer River	18 to 435	Oxidising conditions
Temperature (ºC)	Nairne Creek	11.1 to 12.4	Normal for winter
	Mt Barker Creek	9.2 to 16.8	Normal for winter
	Bremer River	11.5 to 19.0	Normal for winter

Notes:

[1] TDS values were calculated by multiplying the electrical conductivity values with a conversion factor of 0.65.

[2] Redox potential relative to the standard hydrogen electrode (SHE) was calculated by adding an off-set voltage of 199 mV to the field redox potential measurements made with an Ag/AgCl electrode saturated with KCl.

Dawesley Creek and downstream reaches of Mt Barker Creek and Bremer River

Dawesley Creek was observed to be flowing freely in a shallow, predominantly rocky creek bed that was approximately 1.5 m to 5 m wide. The wider sections of the creek (e.g. DC16 and DC17) often had abundant reeds along the banks and submerged water plants in the middle of the creek bed. The water was mostly clear with low to medium turbidity. The sampling locations located upstream of the CFS Brukunga STC (DC-UP01 and DC-UP02) were within the area that was burnt during the Cudlee Creek bushfires in December 2019. The water at the sampling locations adjacent the CFS STC site (Creek_4 to Creek_6) was stagnant during sampling in May 2020. The water in the diversion drain between the Media Training Building and Hotpad B was flowing freely in May 2020.

Mt Barker Creek downstream of the confluence with Dawesley Creek (DC17A) had clear to pale brown water with low to medium turbidity and was free flowing slowly in a wide (< 10 m) and deep channel. The Bremer River downstream of the confluence with Mt Barker Creek (DC18 and DC19) had water with medium turbidity flowing slowly in a wide (< 10 m) and deep channel.

The surface water quality parameters collected as a part of this investigation are summarised in Table 7-12 and presented in Table 8 at the end of this report.

Table 7-12 Summary of surface water quality parameters May to August 2020

Parameter	Value	Comments
pH	4.59 (Creek_5) to 9.47 (DC04)	Acidic to alkaline
Electrical conductivity (µS/cm)	1,170 (DC02) to 7,915 (Creek_6)	Moderate to high
Total dissolved solids [1] (mg/L)	761 (DC02) to 5,145 (Creek_6)	Fresh to saline
Dissolved oxygen (mg/L)	2.55 (Creek_6) to 17.95 (DC08)	Low to high
Redox potential [2] (mV)	39 (DC17A) to 593 (Creek_6)	Oxidising conditions
Temperature (ºC)	2.7 (DC08) to 15.4 (Creek_4)	Normal for winter

Notes:

[1] TDS values were calculated by multiplying the electrical conductivity values with a conversion factor of 0.65.

[2] Redox potential relative to the standard hydrogen electrode (SHE) was calculated by adding an off-set voltage of 199 mV to the field redox potential measurements made with an Ag/AgCl electrode saturated with KCl.

7.10.2 Analytical results

Reference sites

Background surface water PFAS analytical results of this investigation for the reference sites Nairne Creek, Mt Barker Creek and Bremer River are presented in Table 9 at the end of this report. The results were used to calculate catchment specific WQG for PFOS and PFHxS (section 5.5). PFAS concentrations above the adopted assessment criteria are summarised in Table 7-13.

Table 7-13 Summary of background surface water analytical exceedances July / September 2020

No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
PFAS NEMP 2020 Freshwater 99% protection level (0.00023 µg/L PFOS)			
32	PFOS	0.0006 to 0.0270	All except for BR02 (23/07/20)
Catchment specific WQG for PFOS – slightly to moderately disturbed systems (0.0048 µg/L PFOS)			
32	PFOS	0.0270 0.0072 0.0074 0.0108 0.0160 0.0160 0.0160 0.0070 0.0050 0.0071 0.0066 0.0054 0.0061	BR01 BR03_1A BR03_1B BR03_1C * BR03_2A * BR03_2B BR03_2C MBC01_2A * MBC02_1A * MBC02_2A MBC02_2B NC01 NC02
Catchment specific WQG for PFHxS – slightly to moderately disturbed systems (0.0044 µg/L PFHxS)			

No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
32	PFHxS	0.0440 0.0330 0.0310 0.0380 0.0730 0.0610 0.0600 0.0050 0.0046 0.0049 0.0047	BR01 BR03_1A BR03_1B BR03_1C * BR03_2A * BR03_2B BR03_2C MBC01_2A * MBC01_2B NC01 NC02
PFAS NEMP 2020 Health Drinking Water (0.07 µg/L sum of PFOS and PFHxS)			
32	Sum of PFOS and PFHxS	0.0710 0.0890 0.0770 0.0760	BR01 BR03_2A* BR03_2B BR03_2C

Note:
* Higher value adopted from QA/QC analysis

Dawesley Creek and downstream reaches of Mt Barker Creek and Bremer River

Surface water PFAS analytical results of this investigation and the February 2020 investigation are presented in Table 9 at the end of this report. These include samples from Dawesley Creek and from reaches of Mt Barker Creek and Bremer River downstream of the confluence with Dawesley Creek. The standard laboratory LOR for PFOS and PFHxS (0.01 µg/L) was higher than the catchment specific WQG for these analytes (0.0044 µg/L to 0.0066 µg/L). Ultra-trace PFAS analysis was undertaken for selected surface water samples to confirm if PFOS and PFHxS concentrations exceeded the catchment specific WQG.

Assessment criteria exceedances for the surface water samples collected in February 2020 and between May and August 2020 are summarised in Table 7-14 and shown in Figure 17 at the end of this report.

Table 7-14 Surface water analytical exceedances 2020

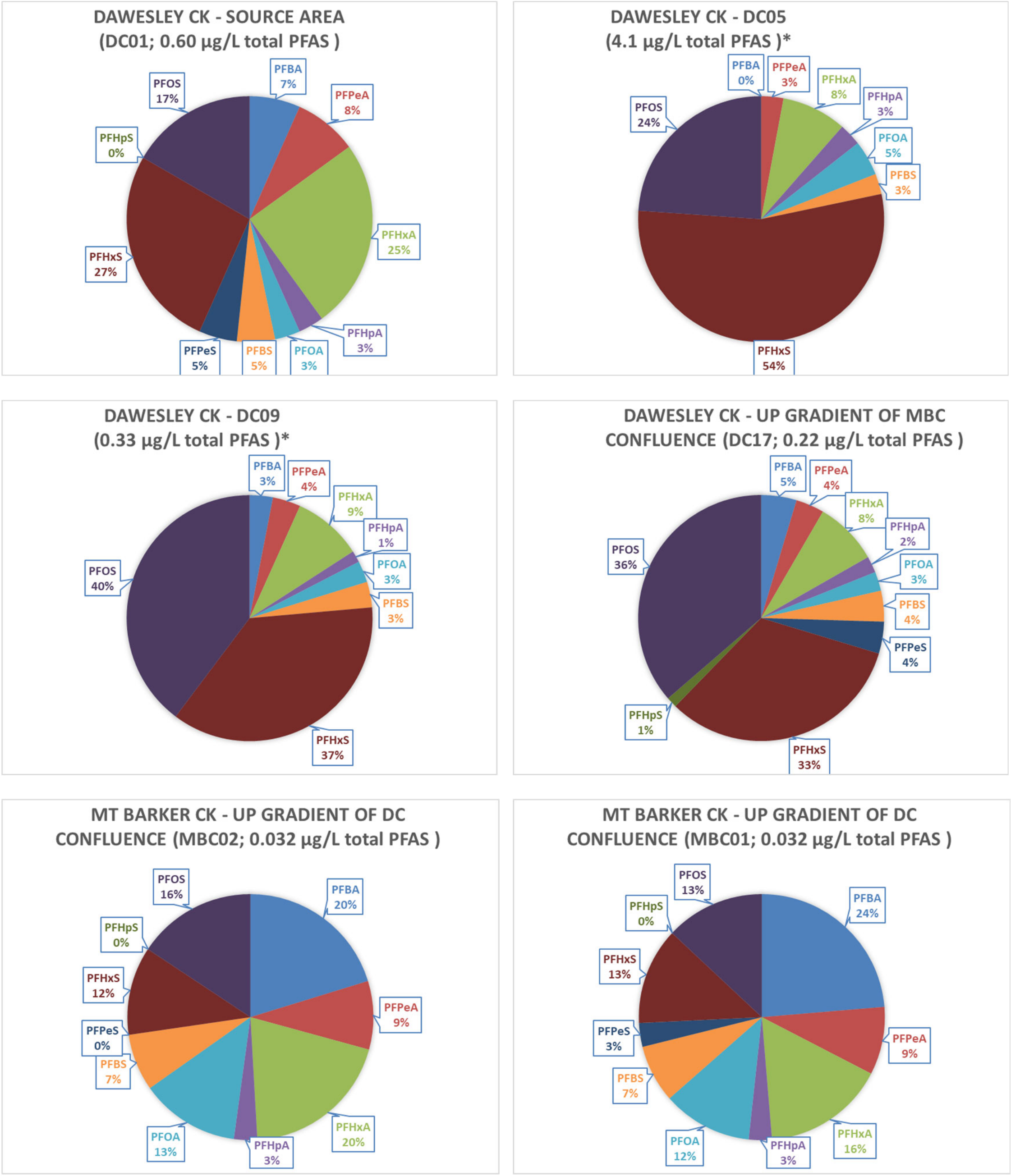
No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
Catchment specific WQG for PFOS – highly disturbed systems (0.0066 µg/L PFOS)			
2 (Feb 2020)	PFOS	0.099	DC01
		0.11	BV01
26 (May – Aug 2020)	PFOS	0.12	Creek_4
		0.94	Creek_5
		0.66	Creek_6
		0.03	DC02
		0.06	DC02A
		0.05	DC03
		0.06	DC04
		0.98	DC05 *
		0.17	DC06
		0.09	DC06A
		0.08	DC06B
		0.09	DC07
		0.08	DC08
		0.13	DC09
		0.11	DC10
		0.13	DC11
		0.097	DC13
		0.081	DC14
		0.080	DC15
		0.087	DC16
		0.078	DC17
Catchment specific WQG for PFOS – slightly to moderately disturbed systems (0.0048 µg/L PFOS)			
26 (May – August 2020)	PFOS	0.014	DC17A
		0.012	DC18
		0.020	DC19 *
Catchment specific WQG for PFHxS – highly disturbed systems (0.0046 µg/L PFHxS)			
2 (Feb 2020)	PFHxS	0.16	DC01
		0.22	BV01

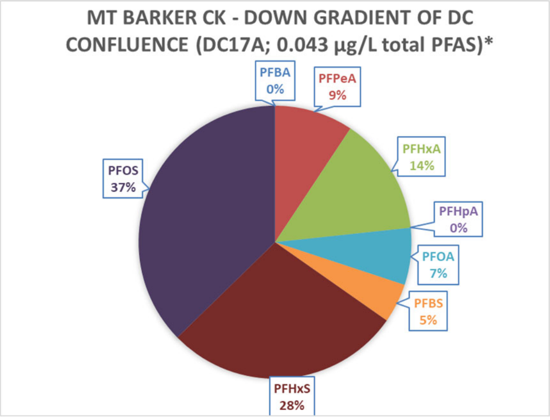
No. of primary samples	Analyte	Concentration (µg/L)	Samples exceeding criteria
26 (May – Aug 2020)	PFHxS	0.17	Creek_4
		2.2	Creek_5
		2.0	Creek_6
		0.01	DC02
		0.07	DC02A
		0.02	DC03
		0.02	DC04
		2.23	DC05 *
		0.08	DC06 *
		0.07	DC06A
		0.06	DC06B
		0.05	DC07
		0.06	DC08
		0.12	DC09 *
		0.11	DC10
		0.11	DC11
		0.088	DC13
		0.081	DC14
		0.066	DC15
		0.072	DC16
		0.070	DC17
Catchment specific WQG for PFHxS – slightly to moderately disturbed systems (0.0044 µg/L PFHxS)			
26 (May – August 2020)	PFHxS	0.0064	DC17A
		0.0140	DC18
		0.0150	DC19 *
PFAS NEMP 2020 Health Drinking Water (0.07 µg/L sum of PFOS and PFHxS)			
2 (Feb 2020)	Sum of PFOS and PFHxS	0.26	DC01
		0.33	BV01
26 (May – August 2020)	Sum of PFOS and PFHxS	0.29	Creek_4
		3.1	Creek_5
		2.6	Creek_6
		0.08	DC04
		3.21	DC05 *
		0.24	DC06
		0.16	DC06A
		0.14	DC06B
		0.14	DC07
		0.14	DC08
		0.25	DC09 *
		0.22	DC10
		0.24	DC11
		0.18	DC13
		0.16	DC14
		0.15	DC15
		0.16	DC16
		0.15	DC17
NHMRC 2019 Recreational Water (2 µg/L sum of PFOS and PFHxS)			
26	Sum of PFOS and PFHxS	3.1	Creek_5
		2.6	Creek_6
		3.21	DC05 *

Note:
* Higher value adopted from QA/QC analysis

PFAS fingerprint results

Results for the full “long” PFAS analytical suite for selected surface water samples from Dawesley Creek and from reference sites are presented in Table 9. The relative distribution of PFAS compounds at sampling locations in Dawesley Creek and Mt Barker Creek is illustrated in Figure 7-2 while Figure 7-3 shows the PFAS “fingerprint” for sampling locations in Bremer River.



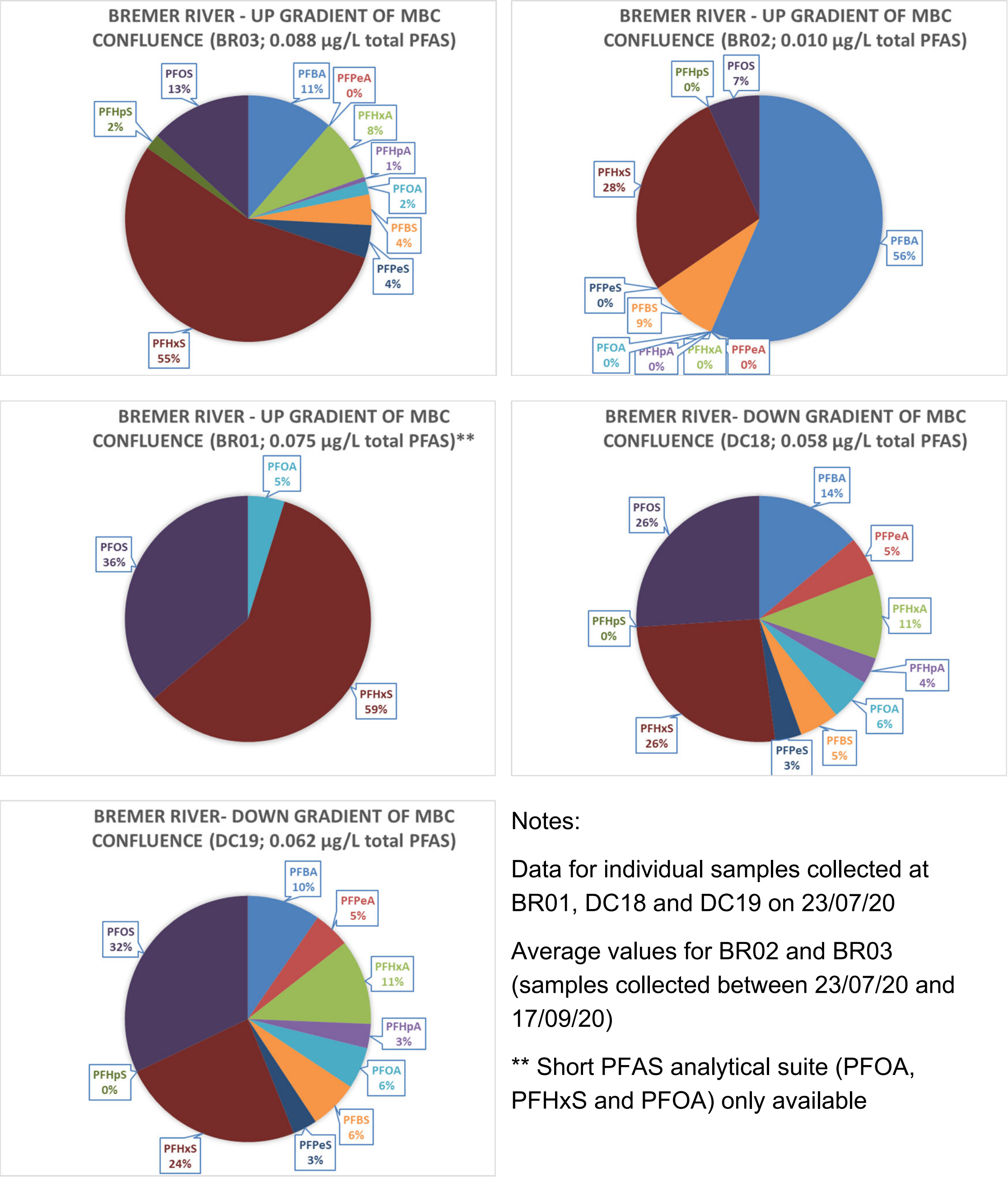


Notes:
Data for individual samples collected at DC01 to DC17A between 11/02/20 (DC01) and 17/08/20 (DC17A)

Average values for MBC01 and MBC02 (samples collected between 23/07/20 and 17/09/20)

* No PFPeS and PFHpS data available

Figure 7-2 PFAS “fingerprint” in Dawesley Creek and Mt Barker Creek



BREMER RIVER - UP GRADIENT OF MBC CONFLUENCE (BR03; 0.088 µg/L total PFAS)

BREMER RIVER - UP GRADIENT OF MBC CONFLUENCE (BR02; 0.010 µg/L total PFAS)

BREMER RIVER - UP GRADIENT OF MBC CONFLUENCE (BR01; 0.075 µg/L total PFAS)**

BREMER RIVER- DOWN GRADIENT OF MBC CONFLUENCE (DC18; 0.058 µg/L total PFAS)

BREMER RIVER- DOWN GRADIENT OF MBC CONFLUENCE (DC19; 0.062 µg/L total PFAS)

Notes:

Data for individual samples collected at BR01, DC18 and DC19 on 23/07/20

Average values for BR02 and BR03 (samples collected between 23/07/20 and 17/09/20)

** Short PFAS analytical suite (PFOA, PFHxS and PFOA) only available

Figure 7-3 PFAS "fingerprint" in Bremer River

7.11 Sediment

7.11.1 Field observations

The sediment samples taken from Dawesley Creek primarily consisted of dark grey/black fine to coarse grained sand with non-plastic fines and rich in organic material (loam).

Nairne Creek consisted of brown/pale brown fine to coarse grained sand with fine grained gravel upstream of the confluence with Dawesley Creek. Mt Barker Creek had a rocky creek bed with little to no accessible sediment at MBC02 and fine to coarse grained sand with non-plastic fines at MBC01.

The sediment in the Bremer River consisted of pale brown fine to coarse grained sand with fine to medium grained gravel upstream of confluence with Mt Barker Creek (BR01) and brown, fine to coarse grained sand with non-plastic fines downstream of the confluence.

7.11.2 Analytical results

Sediment PFAS analytical results of this investigation and the February 2020 investigation are presented in Table 13 at the end of this report. These include samples from Dawesley Creek, Nairne Creek, Mt Barker Creek and Bremer River. PFAS assessment criteria exceedances for sediment samples collected in Dawesley Creek in February 2020 and between May and August 2020 are summarised in Table 7-15 and illustrated in Figure 18 at the end of this report. PFAS concentrations in all sediment samples collected in Nairne Creek, Mt Barker Creek and Bremer River were below the adopted assessment criteria.

Table 7-15 Sediment analytical exceedances 2020

No. of primary samples	Analyte	Value (µg/kg)	Samples exceeding criteria
PFAS NEMP 2020 Interim Ecological Indirect Exposure (10 µg/kg PFOS)			
2 (Feb 2020)	PFOS	25	DC01
		62	BV01
29 (May – Aug)	PFOS	33	Creek_4
		810	Creek_5
		500	Creek_6 *
		40.3	DC02A *
		58	DC03
		44	DC04
		28	DC06A
		15	DC06B
		27	DC07
		65	DC08
		37	DC09 *
		59	DC10
		31	DC11
		27	DC15
		34	DC16
		48	DC17
PFAS NEMP 2020 Health Residential Accessible Soil (10 µg/kg Sum of PFOS and PFHxS)			
2 (Feb 2020)	Sum of PFOS and PFHxS	27	DC01
		70	BV01

No. of primary samples	Analyte	Value (µg/kg)	Samples exceeding criteria
29 (May – Aug)	Sum of PFOS and PFHxS	38	Creek_4
		970	Creek_5
		540	Creek_6
		42.1	DC02A
		61	DC03
		45	DC04
		29	DC06A
		15	DC06B
		28	DC07
		68	DC08
		38	DC09 *
		60	DC10
		33	DC11
		27	DC15
		35	DC16
		49	DC17

Note:
* Higher value adopted from QA/QC analysis

Previously reported analytical results for groundwater (before and after the total oxidisable precursor assay - TOPA) and biota samples (GHD 2020b) are provided in Table 14 and Table 15, respectively, at the end of this report.

8. Quality Assurance and Quality Control

The Data Quality Objectives (DQOs) for the investigation are detailed in the Sampling and Analysis Quality Plan (GHD 2020c) and based on guidance presented in:

- NEPC (1999) National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (ASC NEPM) No. 1 – Schedule B2, Guideline on Site Characterisation, National Environment Protection Council, 2013.

The 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.

Data Quality Indicators (DQIs), field (QA/QC) measures field quality assurance and quality control (QA/QC) measures and laboratory QA/QC measures are presented in Appendix O. DQIs including precision, accuracy (or bias), representativeness, completeness and comparability have been reviewed. Blank analytical results are presented in Table 16 at the end of this report. Water, sediment and soil RPD results are presented in Table 17, Table 18 and Table 19 respectively, at the end of this report.

In summary, the results of the QA/QC program indicated that there were no significant non-conformances, which could potentially compromise the data, and that the analytical data were of an acceptable quality for the purposes of this investigation.

9. Discussion

9.1 Distribution of PFAS

9.1.1 Concrete

Concrete core samples taken from concrete pavers at Hotpad B showed high PFAS concentrations. PFOS concentrations in five cores were above the PFAS NEPM interim ecological criterion for indirect exposure, with one sample exceeding the PFAS NEPM interim ecological criterion for direct exposure. This correlates with the flux test undertaken on Hotpad B (refer section 9.1.2) and soil sampling undertaken beneath Hotpad B (section 9.1.4).

Detectable concentrations of PFAS were identified in the concrete dust sample from inside the main store (SB02), which correlates with soil sampling undertaken beneath the main store. In contrast, PFAS compounds were not detected in core samples from the concrete slab at Hotpad A, although in 2019 PFAS had been detected in a concrete sample from the central portion of Hotpad A (CONCRETE_1). PFAS appear to be not evenly distributed within the concrete slab of Hotpad A. However, the flux test from Hotpad A reported that PFAS are mobilised from both hotpads via runoff during rainfall events.

PFAS concentrations were also detected in concrete cores taken from three water storage tanks at the CFS STC site (Tank 1, Tank 4 and Tank 5), while PFAS concentrations in concrete cores taken from Tank 7 were below the laboratory's LOR. One sample from Tank 1 and three samples from Tank 4 exceeded the PFAS NEPM interim ecological criterion for indirect exposure. The results are consistent with the sorption of PFAS concentrations present in the stored tank water (section 9.1.3) onto the concrete of the tank walls. The results of the concrete leaching test results (section 9.1.6) indicate that the concrete tank walls could potentially act as an ongoing source of PFAS to any clean water that may be stored in the tanks in the future.

9.1.2 Flux tests

The flux tests were conducted to determine the PFAS mass flux that is mobilised from the hotpads via surface runoff during rainfall events. PFAS concentrations in the runoff off Hotpad B were twice as high at the start of the simulated rainfall event than at the end. However, PFAS runoff concentrations off Hotpad B may have varied during the experiment, as was observed for PFAS runoff concentrations off Hotpad A, which showed no trend over time. Hotpad B contributed about 98% of the PFAS load during the flux tests compared to about 2% running off from Hotpad A.

The results showed that both hotpads together contribute up to 9.2 mg PFAS per 5 mm rainfall event and up to 1,244 mg PFAS annually to surface runoff that eventually drains into Dawesley Creek. This annual PFAS mass flux included 935 mg PFOS (75%). Based on these findings, the hotpads are acting as an ongoing source of PFAS to the environment during rainfall events and training exercises.

9.1.3 Storage tank water

The PFAS concentrations in all seven water storage tanks at the south-western corner of the CFS site exceeded the adopted catchment specific WQG for PFOS and PFHxS in freshwater as well as the health screening level for drinking water. The water in the storage tanks is considered a potential PFAS source as it could infiltrate the subsurface or reach Dawesley Creek via the open diversion channel when excess water is discharged from the tanks to the underground diversion drain during high rainfall events. There is also the potential for PFAS to be absorbed by the tank walls as shown by the concrete test results for Tank 4 and Tank 5 (Section 9.1.1).

9.1.4 Soil

Soil sampling across the CFS site identified elevated concentrations of PFAS at all locations. Generally, the distribution of PFAS in soil was observed to be variable both laterally and vertically, however the following observations were made:

- PFOS concentrations were elevated, above the nominated ecological assessment criteria, in soils beneath the hotpads and in open soil between the western site boundary and Dawesley Creek.
- The highest concentrations of PFAS in soil were detected in soil bores located between the western site boundary and Dawesley Creek. The elevated PFAS concentrations in soil in this portion of the investigation area are likely a result of PFAS mass fluxing out of hotpads A and B.
- The lateral and vertical extent of PFAS impacts in soil between the hotpads and the old Dawesley Creek alignment has not been delineated due to problematic site access and refusal during drilling. Based on the elevated PFAS concentrations in the old Dawesley Creek alignment, it is likely PFAS in soil extend laterally to Dawesley Creek. Further soil sampling to the west of SB01, SB04 and SB07 would be required to confirm this. Based on the vertical PFAS profile in bore holes SB01 and SB07 and expected groundwater levels around one metre bgl it is considered likely that the shallow soils also act as potential ongoing secondary sources for PFAS impacts in groundwater.
- PFAS was detected in soil beneath the main store building where PFAS foams were historically stored, indicating some leaks or spills had occurred in this area resulting in PFAS migrating through the concrete floor. The concentrations detected in soil beneath the main store did not exceed the nominated assessment criteria.

Soil sampling within the garden of the residential property located at 296 Pyrites Road identified detectable concentrations of PFAS in soil that were below the adopted HIL A assessment criteria for residential properties. The tenants of the property were not aware of bore water currently being used on the property. However, it is considered likely that the garden has historically been watered with bore water from the registered bore 6627-5944 on the property. The bore water was found to contain PFAS concentrations above the adopted assessment criteria for drinking water (see section 9.1.9) and is considered the likely source of PFAS in soil on this property.

9.1.5 Sludge

PFAS were detected in 51 out of 61 sludge samples that were analysed and five of these samples exceeded the adopted PFOS interim criterion for ecological indirect exposure. Low level PFAS concentrations below the assessment criteria were reported for all sludge stockpile and disposal areas. Despite these low concentrations the large amounts of sludge waste generated in the acid rock drainage treatment plant contain considerable amounts of PFAS. In combination with the leaching test results (section 9.1.6), these results indicate that the sludge represents a significant PFAS source as PFAS are likely to leach from the sludge with the potential to impact ecological receptors via groundwater, seepage water and surface water pathways.

9.1.6 PFAS leachability

PFAS compounds are highly water soluble and the ASLP results indicate that PFAS are leaching from the sludge and concrete under the simulated ASLP conditions. The PFAS concentrations in the leachates were proportional to the PFAS concentrations in the sludge or concrete, i.e. the higher the PFAS concentration was in the sludge or concrete, the higher the PFAS concentration was in the leachate. The leachability of PFAS from sludge indicated that PFAS contained in fresh sludge is likely to leach into the soil and groundwater. The leachability of PFAS from concrete cores indicated that residual PFAS impacts in the concrete of Hotpad B and to a lesser extent Hotpad A and in the soil underneath and adjacent to the CFS site are likely to act as a source for the continual migration of PFAS downward deeper into the soil profile and into the groundwater. The concrete walls of water storage tanks Tank 1, Tank 4 and Tank 5 are also likely to act as ongoing sources of PFAS that may leach into any clean water that may be stored within the tanks.

The highest PFAS leachate concentrations were reported for four Hotpad B concrete core samples that had the highest PFAS content (HPB1 to HPB4). The concentrations of the sum of PFHxS and PFOS in these four leachates were above the adopted NHMRC criteria for recreational water. The leachates of all analysed sludge samples and concrete core samples from Hotpad A, Tank 1, Tank 4 and Tank 5 exceeded the catchment specific WQG for PFOS and PFHxS in fresh water, even if the concentrations did not exceed the adopted assessment criteria for sludge or concrete. The leachate concentrations of the sum of PFHxS and PFOS in one sludge waste stockpile sample (SW13) and in 13 concrete core samples (HPA1, all Hotpad B samples, all Tank 1 and all Tank 4 samples) exceeded the PFAS NEMP guideline value for drinking water (0.07 µg/L) even though the PFAS concentrations in the sludge sample and in five concrete core samples were below the assessment criteria. This indicates that solids with acceptable PFAS levels may contribute to PFAS concentrations in surface water or groundwater that may pose health or ecological risks.

9.1.7 Seepage water

PFAS concentrations in five seepage water samples collected from the Brukunga Mine waste rock dump to the west of Dawesley Creek (WW03, WW04, WW05, WW06 and WW07) exceeded one or more of the adopted catchment specific WQG in freshwater. In addition, the PFAS concentrations collected at sampling locations WW04 and WW07 also exceeded the adopted health screening level for drinking water. These sampling locations are located to the south and north of the sludge waste piles between the Southern Highwall and the South WRD, respectively. The sludge waste piles in this area were found to contain low level PFAS concentrations and are considered to be the likely source of PFAS detected in the seepage water (Section 9.1.5). Due to their high solubility PFAS compounds may have leached quickly from freshly deposited sludge into the groundwater that is surfacing as seepage water at sampling locations WW04 and WW07.

Sampling locations WW03 and WW04 are located close enough to Dawesley Creek to potentially act as source for PFAS in surface water, while seepage water at the other locations is more likely to be a PFAS source for the underlying groundwater.

9.1.8 Brukunga Mine Diversion Drain

The water quality parameters of the underground diversion drain sample were similar to those observed in Dawesley Creek downstream of the CFS site except for the electrical conductivity, which was more than 38% lower than in any other surface water sample. The water in the diversion drain was fresh while the water in Dawesley Creek was fresh to saline. There were no detectable PFAS concentrations reported for the diversion drain at the CFS STC site. However, the standard LOR for this sample (0.01 µg/L) was above the adopted catchment specific WQG for PFOS (0.0066 µg/L) and PFHxS (0.0046 µg/L) in fresh water so that the PFAS concentrations may potentially have been above the catchment specific WQG.

Due to the concentrations of PFAS detected in surface water and groundwater adjacent and beneath the site, it is reasonable to expect that, if the diversion drain was impacted by on-site PFAS sources, the concentrations would be above the standard LOR. If PFAS are present in the diversion drain water below the standard LOR, but above the catchment specific WQG, it is likely reflecting regional background PFAS concentrations. Background concentrations in Dawesley Creek upstream of the CFS site were below the catchment specific WQG for PFOS and PFHxS (Section 9.1.10).

9.1.9 Groundwater

The reported PFAS concentrations in groundwater were below the limit of reporting (LOR) for all wells sampled in June 2020 expect for GW03, which showed PFOS results at the LOR (0.01 µg/L). Based on the results of the February 2020 GME and this investigation, PFAS impact is delineated in all directions around the CFS site except east of the acid rock drainage / water treatment plant towards GW03. East of the CFS site may be considered practically delineated based on the low concentration of PFAS reported in GW03 and the fact that GW03 is located 620 m up-gradient of the CFS site with a groundwater elevation over 30 m higher than the CFS site.

Groundwater sampled from two private wells in February at 260 Pyrites Road, Brukunga (6627-8333) and in August / September 2020 at 296 Pyrites Road, Brukunga (6627-5944), both downstream and down-gradient from the CFS STC site, exceeded the adopted health assessment criteria for drinking water. These two wells are located within 75 m of Dawesley Creek. It is likely that localised groundwater impacts will extend along the Dawesley Creek alignment down the hydraulic gradient, beyond the current investigation area. The impact is possibly a combination of contaminated groundwater moving down the valley through the alluvial and shallow fractured rock aquifer, as well as localised periodic inflow of contaminated surface water into the aquifer, when it is a losing stream after prolonged dry weather or due to localised extraction-induced drawdown of groundwater.

9.1.10 Surface water and sediment

Reference sites

- **Nairne Creek**: PFAS background concentrations in Nairne Creek were reported above the adopted catchment specific WQG for PFOS and PFHxS in slightly to moderately disturbed systems. However, the observed total PFAS concentrations in Nairne Creek were about half of those in Dawesley Creek upstream of the confluence of both creeks. Due to dilution with water from Nairne Creek total PFAS concentrations in Dawesley Creek downstream of the confluence decreased by almost 25%. PFAS fingerprint and flow information were not available for Nairne Creek. Under the present conditions in Dawesley Creek and Nairne Creek, Nairne Creek was not considered a significant source of PFAS. Should PFAS concentrations in Dawesley Creek between the CFS STC site and the confluence with Nairne Creek decrease significantly in the future, this assessment may need to be re-evaluated.
- **Mt Barker Creek**: The catchment specific WQG for slightly to moderately disturbed systems correspond to the 80th percentile of the reported PFOS and PFHxS concentrations in the upstream reaches of Mt Barker Creek (section 5.5). Therefore, 20% of the samples from Mt Barker Creek exceed, by definition, the WQG. Fingerprint analysis showed distinct differences between the relative distribution of PFAS compounds in Dawesley Creek, Mt Barker Creek and Bremer River. Mt Barker Creek had an average total PFAS concentration of 0.032 µg/L that was characterised by high concentrations of perfluorobutanoic acid (PFBA, 20%-24%), perfluorohexanoic acid (PFHxA, 16%-20%), PFOS (13-16%), PFOA

(12%-13%), PFHxS (12%-13%) and perfluoropentanoic acid (PFPeA, 9%). The DEW's flow monitoring data indicates that Mt Barker Creek typically contributes ≥ 80% to the flow in the downstream sections of Bremer River. Therefore, Mt Barker Creek should be considered as a potential source of PFBA, PFHxA, PFOA and PFPeA. However, the upper reaches of Mt Barker Creek were found to be the least PFAS impacted reference site tested in the investigation area, with total PFAS concentrations almost an order of magnitude lower than in Dawesley Creek and ≥ 25% lower downstream of the confluence with Dawesley Creek. It will be important to continue to monitor flow rates and PFAS concentrations in Mt Barker Creek especially should PFAS concentrations in Dawesley Creek decrease substantially in the future.

- **Bremer River**: PFAS background concentrations at two out of three sampling locations in Bremer River (BR01 and BR03) were reported above the adopted catchment specific WQG for slightly to moderately disturbed systems. Four samples from Bremer River, three of which were collected after a rainfall event from sampling location BR03 within the township of Callington, also exceeded the adopted PFAS NEMP drinking water criterion for the sum of PFHxS and PFOS. The results for Bremer River showed high variability between sampling locations and between sampling events. During this investigation, the upstream reaches of the Bremer River were found to be stagnant to slow moving, contributing only 0.2% of the total flow downstream of the confluence with Mt Barker Creek between May and October 2020 (Appendix E). Fingerprint analysis showed that the average total PFAS concentration in Bremer River ranged from 0.010 µg/L at sampling location BR02 to 0.085 µg/L at sampling location BR03, with PFHxS (28-59%), PFBA (11%-56%), PFOS (7%-36%) and PFBS (4%-9%) being the predominant PFAS compounds. Given the high PFAS concentrations measured in individual samples collected from the upstream reaches of the Bremer River, especially within the township of Callington (BR03), the Bremer River must be considered a potential additional PFAS source downstream. Therefore, it will be important to continue to monitor flow conditions in Bremer River and to incorporate upstream Bremer River sampling locations into future sampling events when there is more substantial flow.

Sediment samples collected from reference sites in Nairne Creek, Mt Barker Creek and Bremer River contained detectable PFAS concentrations below the adopted assessment criteria.

Dawesley Creek and downstream reaches of Mt Barker Creek and Bremer River

Between May and August 2020, PFAS were detected in all surface water samples collected from Dawesley Creek adjacent to and downstream of the CFS site, as well as from downstream reaches of Mt Barker Creek and Bremer River. In all samples, the reported PFAS concentrations exceeded the adopted catchment specific WQG for PFOS and PFHxS.

The highest PFAS concentrations in surface water, in excess of the adopted criteria for recreational water, were found in Dawesley Creek adjacent the CFS site (sampling locations Creek_5 and Creek_6) and approximately 4.4 km downstream of the CFS site (DC05). A total of 16 sampling locations within Dawesley Creek downstream of the CFS site had PFAS concentrations above the adopted drinking water criteria. There was no clear correlation between PFAS concentrations within Dawesley Creek and the distance from the CFS site downstream.

PFAS concentrations in the downstream reaches of Mt Barker Creek (DC17A) and Bremer River (DC18, DC19) downstream were lower than those in Dawesley Creek, but higher than the background concentrations in Mt Barker Creek upstream. The observed PFAS concentrations reflected the mixing of Dawesley Creek and Mt Barker Creek. Although the DEW's flow monitoring data indicates that Dawesley Creek typically only contributes ≤ 20% to the flow in the downstream sections of Bremer River, the substantially higher PFOS and PFHxS concentrations measured in Dawesley Creek, relative to the upstream reaches of Mt Barker Creek, mean that the majority of the PFOS and PFHxS found downstream of the confluence of Mt Barker Creek and Bremer River is likely to be related to the CFS site.

This interpretation is supported by the results of the PFAS fingerprint analysis. The lower reaches of Dawesley Creek (DC14 to DC17) had consistent total PFAS concentrations of 0.21 µg/L to 0.24 µg/L with a characteristic composition of PFOS (35%-39%), PFHxS (31%-35%), PFHxA (8%-9%), PFBA (4%-5%), and PFPeA, PFOA, PFBS and perfluoropentane sulfonic acid (PFPeS) (≤4% each).

Dawesley Creek background sampling locations DC-UP01 and DC-UP02 were located upstream of the CFS Brukunga STC in the area that was burnt by the Cudlee Creek bushfire in December 2019. A review of information provided by the CFS indicated that aerial fire suppressants and retardants used during the Cudlee Creek fire are unlikely to have contained any PFAS. This is supported by the fact that the detected background PFAS concentrations at these locations were below the adopted catchment specific WQG and lower than background concentrations reported for reference sites in Nairne Creek and Mt Barker Creek, which were not affected by the Cudlee Creek fire.

In the currently available dataset, PFAS impacts in surface water have been delineated with respect to the adopted assessment criteria for Health Drinking Water (PFAS NEMP 2020): upstream of the CFS site at sampling location Creek_1 in 2019 (GHD 2019) and at sampling location DC-UP01 in this investigation; and downstream of the CFS site at sampling location DC17A, located approximately 5.2 km downstream of the confluence of Dawesley Creek and Mt Barker Creek. PFAS impacts with respect to the adopted catchment specific WQG for PFOS and PFHxS in fresh water have been delineated upstream of the CFS site at sampling location DC-UP01 but not downstream of the CFS site. The impacts extent beyond Jaensch Road in Hartley (between Callington Road and North Bremer Road), approximately 37 km, downstream from the CFS.

The PFAS NEMP suggests that the PFOS concentrations observed downstream of sampling location DC06A are unlikely to represent a direct exposure risk to more than 95% of aquatic organisms or recreational users of the waterway. As the concentrations exceeded the catchment specific WQG however, the potential increase in the bioaccumulation of PFOS in aquatic organisms and the resulting risk to higher trophic level organisms associated with the reported PFOS concentrations should be considered in a human health and environmental risk assessment.

Sediment

PFAS concentrations in 13 out 16 sediment samples collected from Dawesley Creek downstream of the CFS site exceeded the adopted assessment criteria for interim ecological indirect exposure and the health screening level for residential land use with access to soil. PFAS concentrations found in sediment adjacent the CFS site (Creek_5 and Creek_6), were about an order of magnitude higher than those in all other samples. There was no clear trend in PFAS concentrations in the sediment of Dawesley Creek relative to the distance from the CFS site. Sediment samples collected from the lower reaches of Mt Barker Creek (DC17A) and Bremer River (DC18 and DC19) contained detectable PFAS concentrations below the adopted assessment criteria.

Background sediment samples collected from Dawesley Creek upstream of the CFS site contained no detectable PFAS (DC-UP02) or PFAS concentrations below the assessment criteria (DC-UP01).

Impacts of PFAS concentrations in sediment have been delineated upstream of the CFS site at sampling location DC-UP01 and downstream of the CFS site at sampling location DC17A in Mt

Barker Creek. The sediment impacts were confined to Dawesley Creek between the CFS site and the confluence of Dawesley Creek with Mt Barker Creek.

Given that only one surface water and sediment sample have been collected per sampling location to date, no conclusions can be drawn regarding seasonal trends, potential effects of flow rates and water levels on PFAS concentrations in surface water and sediment or potential interactions between PFAS in surface water and sediment.

9.2 Conceptual Site Model (CSM)

9.2.1 General

A conceptual site model (CSM) is an 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 (Sources)
- Presence of a receptor which may be harmed (Receptors)
- Existence of a means of exposing a receptor to the source (Pathways) and whether exposure pathways are complete or incomplete.

A site specific CSM, presented below, has been developed based on previous investigations and GHD’s 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 to human health and the environment that may be encountered.

9.2.2 Sources

Based on previous investigations, on-site sources of contamination include shallow soil contamination from movement and storage of firefighting trucks as well as soil and surface water contamination from PFAS use and storage, while off-site sources include activities associated with the Brukunga Pyrite Mine.

The following sources of PFAS were identified on the CFS STC site:

- Use of per- and polyfluoroalkyl substances (PFAS) on and adjacent to Hotpad A and Hotpad B and inside the main store.
- Water stored in seven concrete storage tanks with PFAS absorbed by the tank walls, as shown by the concrete leachate results.
- Ongoing leaching of PFAS from concrete structures associated with the fire training area.
- Ongoing leaching of PFAS from shallow soils underneath the hotpads and between the hotpads and the western site boundary.

The following sources of PFAS were identified on the Department of Mining and Energy’s properties and surrounding areas:

- Ongoing leaching of PFAS from shallow soils between the western CFS STC boundary and the old Dawesley Creek alignment both towards the old creek alignment and into the groundwater.
- Acid treatment plant discharge
- Acid seepage pond and associated sediment

- Sludge waste piles on Brukunga Mine
- Settling ponds and associated sediment.

9.2.3 Exposure pathways

For an exposure to occur, a complete pathway must exist between a source of contamination and a receptor. Where the exposure pathway is incomplete, there is no exposure, and hence no risk. The following exposure pathways may need to be considered:

- Incidental consumption of and dermal contact with contaminated surface water and sediment during recreational activities within Dawesley Creek, downstream of the Mine and CFS STC site
- Direct dermal contact or incidental ingestion of contaminated soil on the CFS site during maintenance activities
- Inhalation of contaminated soil or dust
- Consumption of fruit from trees grown on-site and off-site possibly intersecting contaminated groundwater or being irrigated by contaminated groundwater
- Livestock consuming contaminated surface water within Dawesley Creek
- Livestock consuming contaminated groundwater
- Consumption of contaminated livestock/eggs etc. fed on irrigated pasture and stock watering from contaminated sources
- Domestic recreational use of contaminated groundwater to fill swimming pools
- Aquatic and terrestrial fauna / flora ingesting or taking up contaminated surface water or sediment directly or via food web exposures.

9.2.4 Receptors

The potential receptors relevant to site activities are:

- Firefighters and other professionals undertaking training courses on-site
- Workers and visitors to the CFS site and surrounding properties
- Subsurface construction/maintenance workers on the CFS site
- Ecosystems of Dawesley Creek and possibly Mt Barker Creek and Bremer River further south of CFS site
- Users of surface water of Dawesley Creek and possibly of Mt Barker Creek and Bremer River downstream of Dawesley Creek
- Users of bore water in the vicinity of the CFS site and in the vicinity of Dawesley Creek downstream or downgradient of the CFS site
- Livestock consuming PFAS-impacted water including
  - groundwater from bores in the vicinity of the CFS site
  - groundwater in the vicinity of Dawesley Creek downstream of the CFS site or
  - surface water from Dawesley Creek and possibly from Mt Barker Creek and Bremer River downstream of Dawesley Creek
- Consumers of produce where PFAS-impacted water has been used for irrigation/livestock watering or where livestock had access to PFAS-impacted surface water
- Consumers of aquatic biota (e.g. fish and yabbies) caught in PFAS-impacted surface water.

9.2.5 Potentially complete exposure pathways

Potential SPR linkages based on the CSM are presented in Table 9-1 and in Figure 19 at the end of this report.

Whilst potentially complete SPR linkages have been identified for on-site firefighters, workers or visitors as well as land owners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS site, incidental ingestion of sediment within Dawesley Creek was the only SPR linkage where human receptors are exposed to PFAS concentrations above the adopted human health criteria. Due to difficult access to and small quantities of sediment in Dawesley Creek, it is considered unlikely that human receptors will come into contact with PFAS concentrations detrimental to their health. This also applies to other identified potential human SPR linkages. Therefore, the risk to human receptors posed by PFAS contamination identified in this investigation is deemed acceptable. As a precaution, potential human receptors should be advised to avoid contact with identified PFAS sources such as soil and concrete at the CFS site and between the CFS site and Dawesley Creek, sludge originating from the water treatment plant, as well as water and especially sediment within Dawesley Creek.

The risk to human receptors from consumption of fruit, vegetables and meat from livestock grown in the vicinity of Dawesley Creek downstream of the CFS site using contaminated surface water or groundwater could not be conclusively assessed due to lack of data.

The risk to human receptors from consumption of fish and yabbies caught in PFAS-impacted surface water was not assessed as part of the DSI.

With respect to ecological receptors, the following complete SPR linkages requiring action have been identified:

- Ecosystems at the CFS site and the area between Dawesley Creek and the CFS site with access to / in contact with contaminated soil with PFAS concentrations above interim ecological criteria for indirect / direct exposure.
- Ecosystems within Dawesley Creek, Mt Barker Creek and Bremer River exposed to PFAS concentrations in surface water and sediment (Dawesley Creek only) above ecological criteria along a length of approximately 37 km, downstream from the CFS site to Jaensch Road, Hartley (between Callington Road and North Bremer Road).
- Ecosystems at locations where sludge originating from the water treatment plant has been or is being placed, especially where PFAS concentrations in the sludge exceed the adopted ecological criteria.

9.2.6 CSM Data Gaps

Most of the CSM data gaps identified during the February 2020 off-site investigation (GHD 2020) have been addressed in this investigation and the CSM has been updated accordingly. However, the following data gaps remain or have been identified during this investigation:

- The vertical and lateral extent of PFAS contamination in soil immediately west of the CFS site boundary. Limited soil sampling beneath Hotpad A and Hotpad B indicates that the soil is impacted beneath this infrastructure. Based on the use of PFAS associated with this infrastructure, the PFAS detected in concrete/pavers of these structures and the flux test results, it is assumed that soils underlying this infrastructure are impacted with PFAS.
- Soil underlying PFAS-impacted sludge has not been assessed.
- The downstream extent of PFAS in the surface water and sediments requires delineation.

- It has not been assessed whether livestock, such as chicken, sheep, cattle, alpacas and horses that are consuming PFAS-impacted groundwater or surface water (from Dawesley Creek or Mt Barker Creek), and produce gained from these livestock, such as eggs, meat and milk, are bio-accumulating PFAS.
- Ecological impacts within the creek system have not been assessed.
- It has not been confirmed whether aquatic biota in PFAS-impacted surface water are bio-accumulating PFAS.

Table 9-1 Conceptual Site Model

Potential source	Receptor	Pathway	Pathway present?
PFAS contaminated concrete and soil on-site	Firefighters, workers and visitors to the CFS site exposed to contaminated soil, concrete or dust	Inhalation of contaminated soil or dust Direct dermal contact with contaminated concrete or soil Incidental ingestion of contaminated soil	No PFAS concentrations detected in concrete and soil on-site to date were below the adopted Tier 1 human health assessment criteria.
	Firefighters, workers and visitors to the CFS site and adjacent properties exposed to rainwater runoff from hotpads	Direct dermal contact with contaminated rainwater runoff from hotpads Incidental ingestion of contaminated rainwater runoff from hotpads	Unlikely Flux testing identified elevated PFAS concentrations exceeding human health criteria for drinking water in surface runoff from both hotpads. PFAS concentrations, however, did not exceed recreational criteria. Whilst it is possible that on-site firefighters, workers or visitors could incidentally ingest contaminated surface runoff from the hotpads, it is unlikely that they will ingest quantities detrimental to their health.
	Ecosystem at the CFS site	Direct contact with contaminated soil Ingestion of contaminated soil Bioaccumulation through indirect contact	Possible PFAS concentrations detected in soil exceeded the adopted Tier 1 interim ecological criteria for indirect exposure.
	Ecosystem of Dawesley Creek downstream of the CFS site	Rainwater event runoff from hotpads to discharge to waterbodies / freshwater environments	Possible Surface water sampling in Dawesley Creek has identified PFAS concentrations exceeding Tier 1 ecological risk criteria and catchment specific WQG.
	Groundwater beneath the site	Migration through porous media and discharge to water bodies / freshwater environments	Possible While water used during training activities and rainfall is collected as surface runoff and transferred into the storage tanks; some water may also infiltrate the ground and leach PFAS from the soil into the groundwater.
PFAS-impacted soil, sludge and sediment off-site	Workers and visitors to the area to the west between Dawesley Creek and the	Inhalation of contaminated soil or dust Direct dermal contact with contaminated soil	No PFAS concentrations detected in soil in this area to date were below the adopted Tier 1 human health assessment criteria.

Potential source	Receptor	Pathway	Pathway present?
	CFS site exposed to contaminated soil or dust.	Incidental ingestion of contaminated soil	
	Ecosystems in the area to the west between Dawesley Creek and the CFS site	Direct contact with contaminated soil Ingestion of contaminated soil Bioaccumulation through indirect contact	Possible PFAS concentrations detected in soil in this area exceeded the adopted Tier 1 interim ecological criteria for direct and indirect exposure.
	Workers at and visitors to locations where sludge has been or is being placed or handled	Inhalation of contaminated (dried) sludge or dust	No PFAS concentrations detected in sludge to date were below the adopted Tier 1 human health assessment criteria.
		Direct dermal contact with contaminated sludge	
		Incidental ingestion of contaminated sludge	
	Ecosystems at locations where sludge has been or is being placed	Direct contact with contaminated sludge Ingestion of contaminated sludge Bioaccumulation through indirect contact	Possible PFAS concentrations detected in sludge exceeded the Tier 1 adopted interim ecological criteria for indirect exposure.
	Landowners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS site exposed to contaminated sediment from Dawesley Creek	Direct dermal contact with contaminated sediment within Dawesley Creek	Unlikely PFAS concentrations detected in Dawesley Creek sediment exceeded the adopted Tier 1 human health criteria for residential land use with accessible soil. GHD (2020d) identified two properties where the landowners, occupants or visitors use Dawesley Creek for purposes that may involve contact with sediment (swimming and/or fishing/yabbying). However, sediment was either difficult to access or present only in small quantities at most sampling locations. Exposure to PFAS via the dermal route to an extent that may be detrimental to health is considered unlikely.

Potential source	Receptor	Pathway	Pathway present?
		Incidental ingestion of contaminated sediment from Dawesley Creek	Unlikely PFAS concentrations detected to date in Dawesley Creek sediment exceeded the adopted human health criteria for residential land use with accessible soil. Whilst it is possible that landowners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS site could incidentally ingest contaminated sediment from within Dawesley Creek, it is unlikely that they will ingest quantities detrimental to their health. At most sampling sites, sediment was either difficult to access or present only in small quantities.
	Ecosystems exposed to contaminated sediment from Dawesley Creek downstream of the CFS site	Direct contact with contaminated sludge Ingestion of contaminated sludge Bioaccumulation through indirect contact	Possible PFAS concentrations detected within the sediment within Dawesley Creek downstream of the CFS site exceeded the adopted Tier 1 interim ecological assessment criteria for indirect exposure.
	Groundwater	Migration through porous media and discharge to water bodies / freshwater environments	Possible Infiltrating rainfall may leach PFAS from impacted soil into the groundwater.
PFAS-impacted surface water and seepage water (associated with rainwater event runoff from hotpads, leaching of PFAS from contaminated sludge or sediment into surface water and PFAS-impacted	Firefighters, workers and visitors to the CFS site	Direct dermal contact with contaminated surface water	Unlikely PFAS were not detected within the diversion drain. The drain is covered and not easily accessible. PFAS concentrations detected in surface runoff from both hotpads exceeded the adopted Tier 1 human health criteria for drinking water but were below the criteria for recreational water. Whilst it is possible that workers or visitors could incidentally ingest contaminated surface water, it is unlikely that they will ingest quantities detrimental to their health.
		Incidental ingestion of contaminated surface water	
	Recreational users of Dawesley Creek, Mt Barker Creek and Bremer River downstream of the CFS site (i.e. landowners and occupants of and visitors to properties located in the vicinity of these waterways)	Direct dermal contact with contaminated surface water	Unlikely PFAS concentrations detected to date within surface water downstream of the CFS site did not exceed the adopted Tier 1 assessment criteria for recreational water, except for one sampling location on the Brukunga Mine that is impacted by acid mine drainage and not accessible to the public – i.e. unlikely to be used for recreational purposes.
		Incidental ingestion of contaminated surface water	

Potential source	Receptor	Pathway	Pathway present?
groundwater surfacing where mining activity has altered the topography)	Landowners and occupants of and visitors to properties located in the vicinity of Dawesley Creek, Mt Barker Creek and Bremer River, downstream of the CFS site, where plants / livestock for human consumption are watered with or have access to contaminated surface water	Consumption of meat or produce originating from livestock watered with or with access to contaminated surface water	Possible GHD (2020d) identified that livestock on three properties downstream of the CFS site consume water from Dawesley Creek with PFAS concentrations above the Tier 1 drinking water criterion for the sum of PFOS and PFHxS. Livestock on three properties consume water from Mt Barker Creek, which exceeds the adopted catchment specific Tier 1 ecological WQG. Meat or produce originating from livestock watered with or with access to contaminated surface water have not yet been tested.
		Consumption of fruit and vegetables irrigated with contaminated surface water	Unlikely GHD (2020d) identified that surface water from Mt Barker Creek with PFAS concentrations above the adopted catchment specific Tier 1 ecological WQG is used to water fruit and vegetables on two properties. However, a single round of produce testing of fruit and vegetables, which had been irrigated with PFAS contaminated (bore-) water, reported PFAS concentrations below the LOR (GHD 2020b).
	Landowners and occupants of and visitors to properties located in the vicinity of Dawesley Creek, Mt Barker Creek and Bremer River, downstream of the CFS site, who go fishing / yabbying in these creeks	Consumption of aquatic biota (e.g. fish and yabbies) caught in PFAS-impacted surface water.	Possible GHD (2020d) identified six properties where landowners, occupants or visitors go fishing or yabbying in Dawesley Creek or Mt Barker Creek. It has not been confirmed whether caught specimens are consumed. Aquatic biota caught in these PFAS-impacted creeks has not yet been tested.
	Ecosystems of Dawesley Creek, Mt Barker Creek and Bremer River downstream of the CFS site	Direct contact with contaminated surface water Ingestion of contaminated surface water Bioaccumulation through indirect contact	Possible Surface water sampling in Dawesley Creek, Mt Barker Creek and Bremer River has identified PFAS concentrations exceeding the adopted Tier 1 ecological risk criteria and catchment specific WQG. The downstream extent of PFAS impacts in Bremer River has not been delineated.

Potential source	Receptor	Pathway	Pathway present?
	Pets / livestock drinking and plants being watered with contaminated surface water from Dawesley Creek, Mt Barker Creek and Bremer River downstream of the CFS site	Direct contact with contaminated surface water Ingestion of contaminated surface water Bioaccumulation through indirect contact	Possible The water use survey (GHD 2020d) confirmed that pets / livestock consume water from Dawesley Creek or Mt Barker Creek with PFAS concentrations above the adopted Tier 1 drinking water criteria or the catchment specific Tier 1 ecological WQG. Fruit and vegetables on two properties are irrigated with water from Mt Barker Creek.
	Workers at and visitors to locations where seepage water surfaces on the ground	Direct dermal contact with contaminated seepage water	Unlikely PFAS concentrations detected in seepage water to date exceeded the adopted human health assessment criteria for drinking water in two samples but were below the recreational criteria. NHMRC (2019) Guidance on PFAS in Recreational Water considers exposure to PFAS via dermal and inhalation routes as negligible.
		Incidental ingestion of contaminated seepage water	Unlikely PFAS concentrations detected in seepage water to date exceeded the adopted human health assessment criteria for drinking water in two samples but were below the recreational criteria. Whilst it is possible that workers or visitors to locations where seepage water occurs could incidentally ingest contaminated seepage water, it is unlikely that they will ingest quantities detrimental to their health.
	Ecosystems exposed to PFAS-impacted seepage water downstream of locations where seepage water occurs	Direct contact with contaminated seepage water Ingestion of contaminated seepage water Bioaccumulation through indirect contact	Possible PFAS concentrations detected in seepage water exceeded the adopted Tier 1 ecological risk criteria and catchment specific WQG.

Potential source	Receptor	Pathway	Pathway present?
PFAS-impacted groundwater	People using groundwater for domestic and drinking purposes	Consumption of contaminated groundwater	Unlikely Some TDS values in groundwater beneath the assessment area were below 1,200 mg/L, indicating that groundwater may be suitable for potable use (NHMRC/NRMMC, 2011 updated 2018). GHD identified one property (296 Pyrites Road, Brukunga) with a registered groundwater bore (well 6627-5944) within the plume extent that is plumbed directly to the house. While bore water may have historically been used for domestic purposes, including drinking water, it is unlikely that this continues today as the TDS values of the bore water in Aug/Sep 2020 exceeded 2,300 mg/L and rainwater is available as alternate water source for domestic purposes. GHD (2020d) identified that mains water and/or rainwater is available and being used for drinking water purposes by 100% of survey respondents.
	People using groundwater for irrigation of vegetable gardens and / or fruit trees to grow produce for consumption	Consumption of fruit and vegetables irrigated by contaminated groundwater	Unlikely GHD identified two properties with registered groundwater bores within the plume extent for irrigation purposes to grow fruit and vegetables for consumption. A single round of produce testing of fruit and vegetables grown on one of these properties reported PFAS concentrations below the LOR (GHD 2020b).
	People using groundwater for watering livestock for human consumption	Consumption of meat or produce originating from livestock watered with contaminated groundwater	Unlikely GHD has not identified any properties with registered or unregistered groundwater bores within the plume extent that are used to water livestock for human consumption.
	People growing fruit and / or vegetables in open soil, which may interact with groundwater	Consumption of PFAS-impacted fruit and / or vegetables.	Unlikely A single round of produce testing of fruit and vegetables grown on- and off-site at selected properties within the PFAS plume area reported PFAS concentrations below the laboratory LOR (GHD 2020b).

Potential source	Receptor	Pathway	Pathway present?
	Landowners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS site using groundwater for recreational purposes such as filling of swimming pools.	Direct dermal contact with contaminated groundwater Incidental ingestion of contaminated groundwater	No PFAS concentrations in one sample from a private swimming pool, which is filled using groundwater from bore 6627-8333 within the PFAS plume extent down gradient, were below the adopted Tier 1 assessment criteria for recreational water in a domestic setting.
	Livestock, pets and plants / crops watered with groundwater down gradient of the CFS site in the vicinity of Dawesley Creek	Direct contact with contaminated groundwater Ingestion / uptake of contaminated groundwater Bioaccumulation through indirect contact	Unlikely GHD identified two properties with registered groundwater bores within the PFAS plume extent that are used to water lawns and gardens. A single round of testing of fruit and vegetables grown at one of these properties reported PFAS concentrations below the laboratory LOR (GHD 2020b).
	Down gradient off-site maintenance workers exposed to contact with PFAS contaminated groundwater	Direct dermal contact with contaminated groundwater Incidental ingestion of contaminated groundwater	No PFAS concentrations detected to date in groundwater in the assessment area did not exceeded the adopted human health Tier 1 assessment criteria for recreational water. Whilst it is possible that off-site maintenance workers could incidentally ingest contaminated groundwater, it is unlikely that they will ingest quantities detrimental to their health.
	Ecosystems of Dawesley Creek and Mt Barker Creek	Migration through porous media and discharge to water bodies / freshwater environments	Possible Dawesley Creek is likely to vary, both temporally and geographically, between a losing and gaining stream, depending on the relative elevations of groundwater and creek beds or alluvial aquifer water levels, which will in turn depend of preceding rainfall and streamflow conditions and possibly near-creek groundwater extraction-induced drawdown. Consequently, both recharge of contaminated surface water into aquifers and discharge of contaminated groundwater to the creek, or the root zone of riparian vegetation, are possible.

10. Conclusions

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

Flux tests, soil and concrete

- The results of concrete, soil, flux and concrete core leachability testing confirmed that Hotpad B and to a lesser extent Hotpad A as well as the concrete walls of on-site water storage tanks, especially Tank 1 and Tank 4, continue to represent an ongoing source of PFAS to the environment. PFAS concentrations in leachates from 16 out of 21 samples concrete core samples were above the adopted assessment criteria for freshwater, with 13 samples (HPA1, HPB1-PPB5, all Tank 1 and all Tank 4 samples) exceeding the criteria for drinking water and four samples exceeding the criteria for recreational water (HPB1-HPB4). During a simulated rainfall event, PFAS concentrations up to two orders of magnitude above the adopted catchment specific WQG for freshwater were reported for surface run-off from Hotpad B. These high concentrations reflected high PFAS concentrations in concrete core samples, leachates and to a lesser extent in soil samples from Hotpad B.
- Soil samples taken to the west of Hotpad A and B, between the CFS site and Dawesley Creek, reported elevated PFAS concentrations exceeding either the ecological direct and/or indirect exposure criteria for PFOS. These impacts have not been vertically or laterally delineated towards Dawesley Creek.
- All on-site soil sampling locations reported elevated PFAS concentrations. All locations reported PFOS above the adopted interim criteria for ecological indirect exposure, except for SB02 in the main store building.

Storage tank water

- PFAS concentrations in all seven water storage tanks at the south-western corner of the CFS site exceeded the adopted catchment specific WQG for PFOS and PFHxS in freshwater, as well as the health screening level for drinking water.
- The water in the storage tanks is considered a potential PFAS source as it could infiltrate the subsurface or run off into the surface water of Dawesley Creek during high rainfall events where excess water is discharged from the tanks.
- There is the potential for the PFAS to be absorbed by the tank walls, as shown by the concrete leaching test results for Tank 4. Additional concrete tanks core samples were being tested for PFAs (including leachability) at the time of completion of this report and the results will be included into the revised 2021 DSI report.

Sludge, seepage water and leachability test

- PFAS impact was detected in 51 out of 61 sludge stockpiles samples analysed and five of these samples exceeded the adopted PFOS interim criterion for ecological indirect exposure. Leachate results indicated that sludge material is acting as a source of PFAS to surface water and groundwater above the catchment specific WQG for PFOS and PFHxS.
- PFAS concentrations in five seepage water samples collected from the Brukunga mine waste rock dump to the west of Dawesley Creek exceeded the adopted catchment specific WQG, with two of these samples also exceeding the adopted health screening level for drinking water. The source of PFAS in the seepage water is likely from the sludge waste stockpiles. PFAS contaminated seepage water is potentially impacting Dawesley Creek surface water and groundwater.

- PFAS were found to readily leach from sludge and concrete with PFAS concentrations in the leachates being proportional to the PFAS concentrations in the solid sample.

Diversion drain

- PFAS concentrations in the diversion drain were below the LOR. As surface water samples collected above the inlet to the diversion drain reported PFOS and PFHxS concentrations below the catchment specific WQG, it is considered unlikely that PFAS concentrations in water within the diversion drain exceed these criteria.

Groundwater

- Groundwater flow in February and June 2020 was inferred to flow from higher elevated areas to the east and west of the CFS site towards Dawesley Creek, and in a generally southerly direction from the CFS site. Dawesley Creek generally flows towards the south and discharges into Mt Barker Creek located over 10 km south of the CFS site.
- An assessment of groundwater salinity indicated fresh to hyper-saline groundwater in the vicinity of the CFS site which may be suitable for potable use, irrigation, recreation and aesthetics, primary industries, livestock drinking water and aquaculture purposes (Gov SA 2019a).
- Groundwater PFHxS and PFOS concentrations exceeded the drinking water screening criterion in 7 out of a total of 26 tested groundwater monitoring wells in the vicinity of Brukunga Mine and in two out of five residential bores. The highest PFAS concentrations were reported in February 2020 for well H02, located adjacent the southern (down hydraulic gradient) boundary of the CFS site.
- Based on the February 2020 and June 2020 groundwater monitoring rounds results, PFAS in groundwater has been delineated in all directions against the drinking water screening criteria. However, based on surface water results it is considered likely that PFAS impacts in groundwater, associated with surface water bodies, are localised to impacted creek alignments.
- A Section 83A notification was submitted for the residential property on 296 Pyrites Road, Brukunga, SA (CT6053/276) in accordance with the Environmental Protection Act 1993 to the South Australian Protection Authority via email on 14 September 2020.

Surface water

- Background PFOS concentrations reported for Nairne Creek and upstream reaches of Mt Barker Creek and Bremer River, which were not impacted by Dawesley Creek, exceeded the PFAS NEMP fresh water 99% species protection level, indicating widespread PFAS impacts independent of the CFS site. Background concentrations in individual samples collected from upstream locations in Bremer River exceeded the PFAS NEMP drinking water guideline level, showing high variability between sampling locations and sampling events.
- Catchment specific WQG for PFOS and PFHxS were derived in accordance with ANZG (2018) using data from Mt Barker Creek as reference sites. The catchment specific WQG for slightly to moderately and highly disturbed systems were calculated using the 80th and 90th percentile of the PFOS and PFHxS concentrations in Mt Barker Creek, respectively, and were adopted in lieu of the PFAS NEMP fresh water 99% species protection level for PFOS.
- PFAS impacts associated with the CFS site, above the catchment specific WQG, were observed to extend beyond the South Eastern Freeway and beyond Jaensch Road in Hartley (between Callington Road and North Bremer Road), approximately 37 km

downstream from the CFS site and have not yet been delineated. It is noted that Nairne Creek, Bremer River and Mt Barker Creek are also contributing to PFAS in surface waters.

- The available flow data indicates that Dawesley Creek typically only contributes ≤ 20% to the flow in the downstream sections of Bremer River. However, the substantially higher PFOS and PFHxS concentrations measured in Dawesley Creek, relative to the upstream reaches of Mt Barker Creek, suggest that the majority of PFOS and PFHxS found downstream of the confluence of Mt Barker Creek and Bremer River is likely to be related to the CFS site.

Sediment

- Sediment within Dawesley Creek downstream of the CFS site exceeded the adopted assessment criteria for interim ecological indirect exposure and the health screening level for residential land use with access to soil.
- Impacts of PFAS concentrations in sediment have been delineated upstream of the CFS site at sampling location DC-UP01 and downstream of the CFS site at sampling location DC17A in Mt Barker Creek. The sediment impacts were confined to Dawesley Creek between the CFS site and the confluence of Dawesley Creek with Mt Barker Creek.

Risk assessment

- Incidental ingestion of sediment within Dawesley Creek by land owners and occupants of and visitors to properties located in the vicinity of Dawesley Creek downstream of the CFS site was the only identified potential SPR linkage where human receptors are exposed to PFAS concentrations above the adopted human health criteria. However, it is considered unlikely that human receptors will come into contact with PFAS quantities detrimental to their health. As a precaution, potential human receptors should be advised to avoid contact with identified PFAS sources.
- The risk to human receptors from consumption of fruit, vegetables and meat from livestock grown in the vicinity of Dawesley Creek downstream of the CFS site using contaminated surface water or groundwater could not be conclusively assessed due to lack of data.
- The risk to human receptors from consumption of fish and yabbies caught in PFAS-impacted surface water could not be assessed due to lack of data.
- For ecological receptors four potentially complete SPR linkages where ecosystems are exposed to PFAS concentrations above the adopted criteria have been identified. These include (1) ecosystems at the CFS site and the area between Dawesley Creek and the CFS site with access to / in contact with contaminated soil, (2) ecosystems within Dawesley Creek and the downstream reaches of Mt Barker Creek and Bremer River exposed to contaminated surface water and sediment (Dawesley Creek only), (3) ecosystems at locations where contaminated sludge originating from the water treatment plant has been or is being placed and (4) ecosystems at locations exposed to seepage water impacted with PFAS.

11. Recommendations

Based on the results of the PFAS investigations completed to date, the following recommendations were provided:

1. Undertake community information sessions on the results of PFAS investigations in the Brukunga area in accordance with the VSCAP milestone; advise stakeholders (landowners / occupants of properties located in the vicinity of Dawesley Creek downstream of the CFS STC) of PFAS impact in surface water and sediment in Dawesley Creek.
2. Conduct an Environmental Risk Assessment (ERA) to assess the potential risks to the environment that may be associated with the presence of PFAS in soil, sediment, biota, surface water, concrete, sludge and groundwater, both on-site and off-site within the wider Investigation Area. If data collected as part of the ERA indicates PFAS has bioaccumulated in biota that is being caught and/or consumed by the public such as fish, yabbies, eggs, meat, poultry etc; a Human Health Risk Assessment (HHRA) may also be warranted depending on the concentrations detected. The results of the ERA (and HHRA if required) will inform the development of Remediation Options Assessments (ROA) and Site Remediation Plans (SRP).
3. Prepare a remediation options assessment (ROA) to address mass flux from PFAS impacted infrastructure, soils and sludge.
4. Prepare a SRP to execute the selected remedial technologies to address PFAS mass flux from the site causing environmental harm and harm to human health (if warranted).
5. Undertake on-going monitoring of the CFS STC PFAS water filtration system in accordance with the developed SRP.
6. Further sampling of surface water and sediment downstream of the CFS State Training Centre site in Dawesley Creek, Mt Barker Creek and Bremer River to delineate PFAS impacts; as well as upstream reference locations to develop a temporal robust data set, to determine seasonal trends and to derive reliable catchment specific assessment criteria. Further sampling will be undertaken in accordance with the SAQP to be reviewed and endorsed by the CFS and the auditor.
7. Undertake “fingerprint” analysis of future surface water samples for the full “long” PFAS analytical suite to distinguish between different PFAS sources and to identify the relative contribution of the various PFAS sources to the PFAS load in Bremer River down gradient of its confluence with Mt Barker Creek.
8. Develop and instigate of a Construction Environment Management Plan (CEMP) if any intrusive works proposed in areas of the site where PFAS-impacted soils have been identified.

12. Limitations

This report has been prepared by GHD for SA Country Fire Service and may only be used and relied on by SA Country Fire Service and the auditor for the purpose agreed between GHD and the SA Country Fire Service as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than SA Country Fire Service arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

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

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.

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Analytical Results Tables

Table 1
Concrete Analytical Results

				PFAS in Concrete Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL				0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)				20,000	20,000	50,000				20,000	
PFAS NEMP 2020 Interim Ecological Direct Exposure					1,000	10,000					
PFAS NEMP 2020 Interim Ecological Indirect Exposure					10						
Location	**Date**	**Location Code**	**Field ID**								
Hotpad A (concrete)	02/10/19	Hotpad A	CONCRETE_1	66	47	5.1	0.6	<0.1	190	110	52
	06/05/20	SB06	SB06_Concrete	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
		SB08	SB08_Concrete	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
	17/11/20	HPA1	HPA1	1.9	2	0.2	0.1	<0.2	4.2	3.9	2.2
		HPA2	HPA2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
		HPA3	HPA3	<0.1	0.4	<0.1	<0.2	<0.2	0.4	0.4	0.4
		HPA4	HPA4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1
		HPA5	HPA5	<0.1	0.1	<0.1	0.9	<0.2	1	0.1	0.1
Hotpad B (concrete brick pavers)	02/10/19	Hotpad B	CONCRETE_2	0.9	4.3	<0.1	<0.1	<0.1	7.9	5.2	4.3
	06/05/20	SB05	SB05_Concrete	200	1,200	16	8.9	7.9	1,400	1,400	1,200
	24/11/20	HPB1	HPB1	44	140	4.8	1.6	2	190	180	140
		HPB2	HPB2	71	190	12	1.1	2	280	260	200
		HPB3	HPB3	55	150	7.6	2.1	1	220	200	160
		HPB4	HPB4	23	65	2.7	7.3	2	100	88	68
		HPB5	HPB5	0.2	3.7	0.1	3.8	1	9.4	4	3.9
Main Store	06/05/20	SB02	SB02_Concrete	0.2	0.2	<0.1	<0.1	<0.2	0.3	0.3	0.2
Tank 1	24/11/20	Tank1/01	12516828/Tank1/01b	1.9	18	0.3	2.2	0.8	23	20	18
		Tank1/02	12516828/Tank1/02b	2	9.3	0.4	2.2	2	15	11	9.7
		Tank1/03	12516828/Tank1/03b	0.7	0.5	<0.1	<0.1	<0.2	1.2	1.2	0.5
Tank 4	08/07/20	Tank 4 Concrete	Tank 4 Concrete	11	59	2.8	4.0	6.0	82	70	62
	24/11/20	Tank4/01	12516828/Tank4/01b	3.4	28	0.8	1.3	1	35	32	29
		Tank4/02	12516828/Tank4/02b	2.5	38	0.7	1.1	2.5	45	41	39
		Tank4/03	12516828/Tank4/03b	<0.1	0.2	<0.1	<0.1	<0.2	0.2	0.2	0.2
Tank 5	08/07/20	Tank 5 Concrete	Tank 5 Concrete	<0.1	0.7	<0.1	1.2	<0.2	1.9	0.7	0.7
Tank 7	18/11/20	Tank7/01	12516828/Tank7/01b	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
		Tank7/02	12516828/Tank7/02b	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
		Tank7/03	12516828/Tank7/03b	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1

Table 2
Flux Analytical Results

				PFAS in Waters Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
NHMRC 2019 Recreational Water PFAS Guidelines						10				2	
PFAS NEMP 2020 Health Drinking Water				0.07	0.07	0.56				0.07	
PFAS NEMP 2020 Freshwater - 99% protection level (1)					0.00023[§]	19					
Catchment specific WQG - highly disturbed systems (2)				0.0046	0.0066						
Location Code	**Date**	**Field ID**	**Time (min) ***								
Hotpad A	07/05/20	FX01	10 ^	0.01	0.01	0.01	<0.01	<0.02	0.04	0.03	0.03
Hotpad A	07/05/20	FX02	20	0.01	0.03	<0.01	<0.01	<0.02	0.05	0.05	0.03
Hotpad A	07/05/20	FX03	30	0.02	0.04	0.01	<0.01	<0.02	0.07	0.06	0.05
Hotpad A	07/05/20	FX04	40	<0.01[#]	0.01	<0.01	<0.01	<0.02	0.01	0.01	0.01
Hotpad A	07/05/20	FX05	50	0.02	0.06	<0.01	<0.01	<0.02	0.08	0.08	0.06
Hotpad A	07/05/20	FX06	60	<0.01[#]	0.02	<0.01	<0.01	<0.02	0.02	0.02	0.02
Hotpad A	07/05/20	FX07	70	<0.01[#]	0.01	<0.01	<0.01	<0.02	0.01	0.01	0.01
Hotpad B	18/05/20	FX08	30 ^	0.13	0.82	0.04	0.11	0.1	1.2	0.95	0.86
Hotpad B	18/05/20	FX13	82	0.06	0.42	0.01	<0.01	<0.02	0.49	0.48	0.44

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

[§] The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

* Elapsed time since start of simulated rainfall event in minutes.

^ Time when run-off from hotpad reached the sampling point.

[#] Concentration below the standard LOR (0.01 µg/L) may potentially exeed the catchment specific WQG.

Table 3
Water Storage Tank Analytical Results

Location Code	Date	Field ID	PFAS in Waters Short								PFAS - Perfluoroalkyl Carboxylic Acids									
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)	PFAS (Sum of Total)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.05
NHMRC 2019 Recreational Water PFAS Guidelines					10			2												
PFAS NEMP 2020 Health Drinking Water			0.07	0.07	0.56			0.07												
PFAS NEMP 2020 Freshwater - 99% protection level (1)				0.00023 §	19															
Catchment specific WQG - highly disturbed systems (2)			0.0046	0.0066																
Location Code	**Date**	**Field ID**																		
Tank1	28/10/20	Tank-1	0.08	0.41	0.02	0.02	<0.02	0.49	0.43	0.61	<0.02	<0.02	0.05	<0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5
Tank2	28/10/20	Tank-2	0.09	0.36	0.02	0.02	<0.02	0.46	0.38	0.62	<0.02	0.02	0.06	0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5
Tank3	28/10/20	Tank-3	0.08	0.34	0.02	0.01	<0.02	0.42	0.36	0.53	<0.02	<0.02	0.05	<0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5
Tank4	02/10/19	WATER_4	0.07	0.21	0.01	0.02	<0.01	0.28	0.22	0.37	-	-	-	-	-	-	-	-	-	-
Tank4	28/10/20	Tank-4	0.07	0.25	0.01	<0.01	<0.02	0.32	0.26	0.39	<0.02	<0.02	0.04	0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5
Tank5	28/10/20	Tank-5	0.09	0.37 *	0.02	0.01	<0.05 *	0.45	0.37	0.61	<0.10 *	0.02	0.06	0.01	<0.02 *	<0.02	<0.02	<0.05	<0.1	<0.5
Tank6	28/10/20	Tank-6	0.08	0.32	0.02	0.01	<0.02	0.41	0.34	0.55	<0.02	0.02	0.05	0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5
Tank7	28/10/20	Tank-7	0.07	0.28	0.02	0.01	<0.02	0.36	0.30	0.47	<0.02	<0.02	0.05	<0.01	<0.01	<0.02	<0.02	<0.05	<0.1	<0.5

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

§ The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

* Higher value adopted from QA/QC analysis

Table 3
Water Storage Tank Analytical Results

			PFAS - Perfluoroalkyl Sulfonic Acids				PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids	
			Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
			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	0.01	0.02	0.02	0.05	0.05	0.02	0.05	0.05	0.02	0.01	0.02
NHMRC 2019 Recreational Water PFAS Guidelines															
PFAS NEMP 2020 Health Drinking Water															
PFAS NEMP 2020 Freshwater - 99% protection level (1)															
Catchment specific WQG - highly disturbed systems (2)															
Location Code	**Date**	**Field ID**													
Tank1	28/10/20	Tank-1	0.02	0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02
Tank2	28/10/20	Tank-2	0.02	0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02
Tank3	28/10/20	Tank-3	0.02	0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02
Tank4	02/10/19	WATER_4	-	-	-	-	-	-	-	-	-	-	-	-	-
Tank4	28/10/20	Tank-4	0.01	<0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02
Tank5	28/10/20	Tank-5	0.02	0.02	<0.02 *	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.05 *	<0.05 *
Tank6	28/10/20	Tank-6	0.02	0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02
Tank7	28/10/20	Tank-7	0.02	0.01	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.02

Table 4
Soil Analytical Results

						Moisture	PFAS in Soils Short							
						Moisture Content (%)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)
						%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL						0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)							20,000	20,000	50,000				20,000	
PFAS NEMP 2020 Residential with garden/accessible soil (HIL A)							10	10	100				10 ^	
PFAS NEMP 2020 Interim Ecological Direct Exposure								1,000	10,000					
PFAS NEMP 2020 Interim Ecological Indirect Exposure								**10**						
Location Code	**Date**	**Field ID**	**Depth (m bgl)**	**Location**	**Criteria**									
Soil 1	02/10/19	Soil 1	surface	On-site	HIL D	4.5	<0.1	0.4	<0.1	<0.1	<0.1	0.4	0.4	0.4
Soil 2	02/10/19	Soil 2	surface	On-site	HIL D	2.3	1.0	**11**	0.3	0.1	<0.1	22	12	12
Soil 3	02/10/19	Soil 3	surface	On-site	HIL D	4.6	0.1	1.1	<0.1	0.1	0.1	4.5	1.2	1.1
SB01	06/05/20	SB01_0-0.2	0.0-0.2	Off-site industrial	HIL D	11	210	**1,400**	27	0.3	0.6	1,600	1,600	1,400
SB01	06/05/20	SB01_0.2-0.4	0.2-0.4	Off-site industrial	HIL D	16	210	**1,300**	30	0.6	1	1,500	1,500	1,300
SB01	06/05/20	SB01_0.9-1.1	0.9-1.1	Off-site industrial	HIL D	33	62	**2,100**	14	0.4	21	2,200	2,100	2,100
SB02	06/05/20	SB02_0.1-0.3	0.1-0.3	On-site Main Store	HIL D	6.3	0.4	1.9	<0.1	<0.1	<0.2	2.3	2.3	1.9
SB02	06/05/20	SB02_0.6-0.8	0.6-0.8	On-site Main Store	HIL D	44	0.6	3	<0.2	<0.2	<0.4	3.6	3.6	3.0
SB03	06/05/20	SB03_0-0.2	0.0-0.2	On-site	HIL D	4.0	130	**130**	14	2.1	2.6	280	260	140
SB03	06/05/20	SB03_0.4-0.6	0.4-0.6	On-site	HIL D	11	2.3	3.6	0.3	<0.1	<0.2	6.2	5.9	3.9
SB03	06/05/20	SB03_0.9-1.1	0.9-1.1	On-site	HIL D	12	<0.1	0.1	<0.1	<0.1	<0.2	0.1	0.1	0.1
SB04	06/05/20	SB04_0-0.2	0.0-0.2	Off-site industrial	HIL D	14	4.3	**19**	2.0	<0.1	2.9	29	24	21
SB05	06/05/20	SB05_0.1-0.2	0.1-0.2	On-site Hotpad B	HIL D	12	1.7	**27**	0.3	0.2	5.9	35	29	27
SB05	06/05/20	SB05_0.3-0.4	0.3-0.4	On-site Hotpad B	HIL D	15	2.7	**250**	1.4	0.6	1	260	250	250
SB05	06/05/20	SB05_0.8-1.0	0.8-1.0	On-site Hotpad B	HIL D	11	15	0.5	<0.1	<0.1	<0.2	15	15	0.5
SB06	06/05/20	SB06_0.4-0.6	0.4-0.6	On-site Hotpad A	HIL D	13	0.3	**25**	<0.1	0.1	<0.2	26	26	25
SB06	06/05/20	SB06_0.23-0.4	0.23-0.4	On-site Hotpad A	HIL D	9.3	<0.1	0.9	<0.1	<0.1	<0.2	0.9	0.9	0.9
SB06	06/05/20	SB06_1.0-1.2	1.0-1.2	On-site Hotpad A	HIL D	11	0.5	**26**	0.2	<0.1	<0.2	27	26	26
SB07	06/05/20	SB07_0-0.2	0.0-0.2	Off-site industrial	HIL D	16	18*	**170***	3.3*	<0.1	0.4	190*	190*	170*
SB07	06/05/20	SB07_0.4-0.6	0.4-0.6	Off-site industrial	HIL D	9.0	19	**740**	2.9	0.2	0.5	760	760	740
SB08	06/05/20	SB08_0.2-0.4	0.2-0.4	On-site Hotpad A	HIL D	11	6.5	**33**	0.9	<0.1	<0.2	40	39	34
SB08	06/05/20	SB08_0.4-0.6	0.4-0.6	On-site Hotpad A	HIL D	6.4	4.8	0.8	0.2	0.1	<0.2	6.0	5.7	1.0
Garden1	17/09/20	Garden1	surface	Off-site residential	HIL A	15	<0.1	0.3	<0.1	<0.1	<0.2	0.3	0.3	0.3
Garden2	17/09/20	Garden2	surface	Off-site residential	HIL A	24	<0.2*	0.5*	<0.2*	<0.5*	<0.5*	0.5*	0.5*	0.5*
Garden3	17/09/20	Garden3	surface	Off-site residential	HIL A	7.5	<0.1	0.3	<0.1	<0.1	<0.2	0.3	0.3	0.3
Garden4	17/09/20	Garden4	surface	Off-site residential	HIL A	15	<0.1	1.4	<0.1	<0.1	<0.2	1.4	1.4	1.4

^ If the concentration of PFHxS > PFOS this guideline value needs to be adjusted accordingly. Please refer to Section 8.5.2.1 of the PFAS NEMP 2.0 guideline for further information.

* Higher value adopted from QA/QC analysis

Table 5
Sludge Analytical Results

				Moisture	PFAS in Soils Short							
				Moisture Content (%)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL				0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)					20,000	20,000	50,000				20,000	
PFAS NEMP 2020 Interim Ecological Direct Exposure						1,000	10,000					
PFAS NEMP 2020 Interim Ecological Indirect Exposure						10						
Location Code	**Date**	**Field ID**	**Location**									
Sludge_1	02/10/19	Sludge_1	Southern Bench		0.3	0.5	<0.1	<0.1	<0.1	0.8	0.8	0.5
SS01	08/05/20	SS01	Northern Bench	50	0.2	0.2	<0.2	<0.2	<0.4	0.4	0.4	0.2
SS02	08/05/20	SS02	Northern Bench	18	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS03	08/05/20	SS03	Northern Bench	12	<0.1	0.1	<0.1	<0.1	<0.2	0.1	0.1	0.1
SS04	08/05/20	SS04	Northern Bench	19	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS05	08/05/20	SS05	Northern Bench	13	<0.1	0.4	<0.1	<0.1	<0.2	0.4	0.4	0.4
SS06	08/05/20	SS06	Northern Bench	19	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS07	08/05/20	SS07	Northern Bench	11	<0.1	0.2	<0.1	<0.1	<0.2	0.2	0.2	0.2
SS08	08/05/20	SS08	Northern Bench	12	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS09	08/05/20	SS09	Northern Bench	20	<0.1	2.3	0.2	<0.1	<0.2	2.4	2.3	2.4
SS10	08/05/20	SS10	Northern Bench	13	0.3	2.2	0.9	<0.1	<0.2	3.4	2.4	3.1
SS11	08/05/20	SS11	Northern Bench	18	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS12	08/05/20	SS12	Northern Bench	18	<0.1	3.6	0.8	<0.1	<0.2	4.4	3.6	4.4
SS13	08/05/20	SS13	Northern Bench	18	<0.1	0.3	<0.1	<0.1	<0.2	0.3	0.3	0.3
SS14	08/05/20	SS14	Northern Bench	17	<0.1	0.2	0.1	<0.1	<0.2	0.3	0.2	0.3
SS15	08/05/20	SS15	Northern Bench	16	0.7	65	5.6	<0.1	<0.2	71	66	71
SS16	08/05/20	SS16	Northern Bench	23	0.2	18	1.3	<0.1	<0.2	19	18	19
SS17	08/05/20	SS17	Northern Bench	19	0.3	36	2.2	<0.1	<0.2	39	36	38
SS18	08/05/20	SS18	Northern Bench	39	<0.2	0.3	<0.2	<0.2	<0.4	0.3	0.3	0.3
SS19	08/05/20	SS19	Northern Highwall	51	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2
SS20	08/05/20	SS20	Northern Highwall	38	<0.2	0.4	<0.2	<0.2	<0.4	0.4	0.4	0.4
SS21	08/05/20	SS21	Northern Highwall	43	<0.2	1.9	<0.2	<0.2	<0.4	1.9	1.9	1.9
SS22	08/05/20	SS22	Northern Highwall	34	<0.2	0.5	<0.2	<0.2	<0.4	0.5	0.5	0.5
SS23	08/05/20	SS23	South Extension WRD	36	<0.2	0.3	<0.2	<0.2	<0.4	0.3	0.3	0.3
SS24	08/05/20	SS24	South Extension WRD	42	<0.2	0.3	<0.2	<0.2	<0.4	0.3	0.3	0.3
SS25	08/05/20	SS25	South Extension WRD	13	<0.1	0.2	<0.1	<0.1	<0.2	0.2	0.2	0.2
SS26	08/05/20	SS26	South Extension WRD	14	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SS27	08/05/20	SS27	South Extension WRD	9.7	0.4	18	0.1	<0.1	<0.2	19	18	18
SS28	08/05/20	SS28	South Extension WRD	38	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2
SS29	08/05/20	SS29	South Extension WRD	45	<0.2	0.8	<0.2	<0.2	<0.4	0.8	0.8	0.8
SS30	08/05/20	SS30	South Extension WRD	42	<0.2	0.2	<0.2	<0.2	<0.4	0.2	0.2	0.2
SW01	07/05/20	SW01_0.1-0.3	Southern Bench	36	0.3	0.6	<0.2	<0.2	<0.4	0.9	0.9	0.6

Table 5
Sludge Analytical Results

				Moisture	PFAS in Soils Short							
				Moisture Content (%)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL				0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
PFAS NEMP 2020 Health Industrial/Commercial HIL D)					20,000	20,000	50,000				20,000	
PFAS NEMP 2020 Interim Ecological Direct Exposure						1,000	10,000					
PFAS NEMP 2020 Interim Ecological Indirect Exposure						10						
Location Code	**Date**	**Field ID**	**Location**									
SW01	07/05/20	SW01_1.9-2.0	Southern Bench	20	0.3	0.3	<0.1	<0.1	<0.2	0.6	0.6	0.3
SW02	07/05/20	SW02_0.1-0.3	Southern Bench	32	0.3	0.5	<0.2	<0.2	<0.4	0.9	0.9	0.5
SW02	07/05/20	SW02_0.9-1.1	Southern Bench	38	0.5	0.7	<0.2	<0.2	<0.4	1.2	1.2	0.7
SW03	06/05/20	SW03_0-0.2	Southern Bench	44	0.4	0.6	<0.2	<0.2	<0.4	1.1	1.1	0.6
SW03	06/05/20	SW03_1.5-1.7	Southern Bench	41	0.2	0.4	<0.2	<0.2	<0.4	0.6	0.6	0.4
SW04	06/05/20	SW04_1.0-1.3	Southern Bench	44	0.6	1.1	<0.2	<0.2	<0.4	1.7	1.7	1.1
SW04	06/05/20	SW04_2.0-2.1	Southern Bench	44	0.3	0.8	<0.2	<0.2	<0.4	1.2	1.2	0.8
SW04	06/05/20	SW04_4.5-4.6	Southern Bench	50	<0.2	0.4	<0.2	<0.2	<0.4	0.4	0.4	0.4
SW05	06/05/20	SW05_0-0.2	Southern Bench	48	0.4	0.6	<0.2	<0.2	<0.4	0.9	0.9	0.6
SW05	06/05/20	SW05_1.0-1.1	Southern Bench	52	0.5	0.5	<0.2	<0.2	<0.4	1.1	1.1	0.5
SW06	06/05/20	SW06_4.1-4.2	Southern Bench	40	0.3	0.8	<0.2	<0.2	<0.4	1.0	1.0	0.8
SW06	06/05/20	SW06_4.3-4.4	Southern Bench	13	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
SW07	07/05/20	SW07_0.2-0.3	Southern Bench	41	<0.2	0.3	<0.2	<0.2	<0.4	0.3	0.3	0.3
SW07	07/05/20	SW07_2.5-2.8	Southern Bench	39	0.4	1.1	<0.2	<0.2	<0.4	1.6*	1.6*	1.1
SW08	07/05/20	SW08_0.5-0.6	Southern Bench	50	0.4	1	<0.2	<0.2	<0.4	1.4	1.4	1.0
SW08	07/05/20	SW08_2.3-2.4	Southern Bench	58	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2
SW09	07/05/20	SW09_0.1-0.2	Southern Bench	44	0.9	1.6	<0.2	<0.2	<0.4	2.5	2.5	1.6
SW09	07/05/20	SW09_5.5-5.7	Southern Bench	13	<0.1	0.3	<0.1	<0.1	<0.2	0.3	0.3	0.3
SW10	07/05/20	SW10_0.8-0.9	Emergency Sludge Overflow Pond	24	3.9	1.2	0.4	<0.1	<0.2	5.5	5.1	1.7
SW10	07/05/20	SW10_1.5-1.7	Emergency Sludge Overflow Pond	54	0.7	<0.2	<0.2	<0.2	<0.4	0.7	0.7	<0.2
SW11	07/05/20	SW11_0-0.1	Emergency Sludge Overflow Pond	16	0.6	1.2	0.1	<0.1	<0.2	1.9	1.8	1.3
SW11	07/05/20	SW11_2.0-2.3	Emergency Sludge Overflow Pond	65*	0.6*	0.4*	<0.2	<0.2	<0.4	1.0*	1.0*	0.4*
SW12	07/05/20	SW12_0-0.2	Emergency Sludge Overflow Pond	30	<0.2	1.2	<0.2	<0.2	<0.4	1.2	1.2	1.2
SW13	07/05/20	SW13_0-0.2	Emergency Sludge Overflow Pond	41	1.6	5	<0.2	<0.2	<0.4	6.6	6.6	5.0
SW14	07/05/20	SW14_0-0.2	Emergency Sludge Overflow Pond	32	0.3	2.1	0.2	<0.2	<0.4	2.6	2.4	2.3
SW15	07/05/20	SW15_0-0.1	Emergency Sludge Overflow Pond	58	1.8	29	0.3	<0.2	0.4	31	31	29
SW16	07/05/20	SW16_0-0.2	Sludge Drying Ponds	42	0.5	2.6	<0.2	<0.2	<0.4	3.1	3.1	2.6
SW17	07/05/20	SW17_0-0.2	Sludge Drying Ponds	36	1.0	1.3	<0.2	<0.2	<0.4	2.4	2.4	1.3
SW18	07/05/20	SW18_0-0.2	Sludge Drying Ponds	33	0.5	0.8	<0.2	<0.2	<0.4	1.3	1.3	0.8
SW19	07/05/20	SW19_0-0.2	Sludge Drying Ponds	40	<0.2	0.5	<0.2	<0.2	<0.4	0.5	0.5	0.5

*Higher value adopted from QAQC results

Table 6a
Sludge Leaching Test Analytical Results

Sample Type	Location Code	Date	Field ID	PFAS in Soils Short								PFAS in ASLP Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	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	0.2	0.1	0.1	0.1	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)				20,000	20,000	50,000				20,000									
PFAS NEMP 2020 Interim Ecological Direct Exposure					1,000	10,000													
PFAS NEMP 2020 Interim Ecological Indirect Exposure					10														
NHMRC 2019 Recreational Water PFAS Guidelines												2	2	10				2	
PFAS NEMP 2020 Health Drinking Water												0.07	0.07	0.56				0.07	
PFAS NEMP 2020 Freshwater - 99% protection level (1)													0.00023 §	19					
Catchment specific WQG - highly disturbed systems (2)												0.0046	0.0066						
Sample Type	**Location Code**	**Date**	**Field ID**																
Surface sludge	SS15	08/05/20	SS15	0.7	65	5.6	<0.1	<0.2	71	66	71	0.03	0.59	0.21	<0.01	<0.02	0.82	0.61	0.80
	SS17	08/05/20	SS17	0.3	36	2.2	<0.1	<0.2	39	36	38	0.01	0.32	0.09	<0.01	<0.02	0.42	0.33	0.41
	SS27	08/05/20	SS27	0.4	18	0.1	<0.1	<0.2	19	18	18	<0.01 *	0.29	<0.01	<0.01	<0.02	0.29	0.29	0.29
Waste stockpile sludge	SW04	06/05/20	SW04_1.0-1.3	0.6	1.1	<0.2	<0.2	<0.4	1.7	1.7	1.1	0.01	0.02	<0.01	<0.01	<0.02	0.03	0.03	0.02
	SW09	07/05/20	SW09_0.1-0.2	0.9	1.6	<0.2	<0.2	<0.4	2.5	2.5	1.6	0.02	0.02	<0.01	<0.01	<0.02	0.04	0.04	0.02
	SW13	07/05/20	SW13	1.6	5.0	<0.2	<0.2	<0.4	6.6	6.6	5.0	0.05	0.08	<0.01	<0.01	<0.02	0.13	0.13	0.08

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

§ The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

* Concentration below the standard LOR (0.01 µg/L) may potentially exeed the catchment specific WQG.

Table 6b
Concrete Core Leaching Test Analytical Results

				PFAS in Concrete Short								PFAS in ASLP Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	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	0.2	0.1	0.1	0.1	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)				20,000	20,000	50,000				20,000									
PFAS NEMP 2020 Interim Ecological Direct Exposure					1,000	10,000													
PFAS NEMP 2020 Interim Ecological Indirect Exposure					10														
NHMRC 2019 Recreational Water PFAS Guidelines												2	2	10				2	
PFAS NEMP 2020 Health Drinking Water												0.07	0.07	0.56				0.07	
PFAS NEMP 2020 Freshwater - 99% protection level (1)													0.00023 §	19					
Catchment specific WQG - highly disturbed systems (2)												0.0046	0.0066						
Sampling Location	**Date**	**Location Code**	**Field ID**																
Hotpad A (concrete slab)	17/11/20	HPA1	HPA1	1.9	2	0.2	0.1	<0.2	4.2	3.9	2.2	0.087	0.071	0.0099	0.011	<0.002	0.18	0.16	0.081
		HPA2	HPA2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	0.002	0.003	<0.001	0.005	<0.002	0.01	0.004	0.003
		HPA3	HPA3	<0.1	0.4	<0.1	<0.2	<0.2	0.4	0.4	0.4	0.003	0.011	<0.001	0.005	<0.002	0.019	0.015	0.011
		HPA4	HPA4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	0.002	0.002	<0.001	0.006	<0.002	0.01	0.004	0.002
		HPA5	HPA5	<0.1	0.1	<0.1	0.9	<0.2	1	0.1	0.1	0.005	0.005	0.004	0.063	0.005	0.082	0.010	0.008
Hotpad B (concrete brick pavers)	24/11/20	HPB1	HPB1	44	140	4.8	1.6	2	190	180	140	2.1	5.0	0.18	0.058	0.039	7.3	7.0	5.1
		HPB2	HPB2	71	190	12	1.1	2	280	260	200	3.7	3.8	0.32	0.032	0.02	7.9	7.5	4.1
		HPB3	HPB3	55	150	7.6	2.1	1	220	200	160	2.6	4.5	0.23	0.056	0.023	7.4	7.1	4.7
		HPB4	HPB4	23	65	2.7	7.3	2	100	88	68	0.90	1.6	0.090	0.21	0.02	2.8	2.5	1.7
		HPB5	HPB5	0.2	3.7	0.1	3.8	1	9.4	4	3.9	0.011	0.064	0.006	0.11	0.02	0.2	0.075	0.069
Tank 1	24/11/20	Tank1/01	12516828/Tank1/01	1.9	18	0.3	2.2	0.8	23	20	18	0.032	0.16	0.007	0.018	0.01	0.23	0.19	0.16
		Tank1/02	12516828/Tank1/02	2	9.3	0.4	2.2	2	15	11	9.7	0.024	0.069	0.005	0.007	0.01	0.12	0.093	0.074
		Tank1/03	12516828/Tank1/03	0.7	0.5	<0.1	<0.1	<0.2	1.2	1.2	0.5	0.042	0.16	0.009	0.025	0.034	0.27	0.21	0.17
Tank 4	08/07/20	Tank 4 Concrete	Tank 4 Concrete	11	59	2.8	4.0	6.0	82	70	62	0.20	0.61	0.04	0.03	<0.02	0.88	0.81	0.65
	24/11/20	Tank4/01	12516828/Tank4/01	3.4	28	0.8	1.3	1	35	32	29	0.75	0.56	0.065	0.057	0.083	1.5	1.3	0.63
		Tank4/02	12516828/Tank4/02	2.5	38	0.7	1.1	2.5	45	41	39	0.064	0.66	0.015	0.026	0.027	0.79	0.72	0.68
		Tank4/03	12516828/Tank4/03	<0.1	0.2	<0.1	<0.1	<0.2	0.2	0.2	0.2	0.024	0.13	0.006	0.005	0.01	0.17	0.15	0.13
Tank 5	08/07/20	Tank 5 Concrete	Tank 5 Concrete	<0.1	0.7	<0.1	1.2	<0.2	1.9	0.7	0.7	<0.01 *	0.01	<0.01	0.01	<0.02	0.03	0.01	0.01
Tank 7	18/11/20	Tank7/01	12516828/Tank7/01	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
		Tank7/02	12516828/Tank7/02	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
		Tank7/03	12516828/Tank7/03	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

§ The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

* Concentration below the standard LOR (0.01 µg/L) may potentially exeed the catchment specific WQG.

Table 7
Seepage Water Analytical Results

				PFAS in Waters Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.0002	0.0002	0.0002	0.0004	0.0004	0.0002	0.0002	0.0002
NHMRC 2019 Recreational Water PFAS Guidelines				2	2	10				2	
PFAS NEMP 2020 Health Drinking Water				0.07	0.07	0.56				0.07	
PFAS NEMP 2020 Freshwater - 99% protection level (1)					0.00023 [§]	19					
Catchment specific WQG - highly disturbed systems (2)				0.0046	0.0066						
Location Code	**Date**	**Field ID**	**Location Description**								
WW01	08/07/20	WW01	Foot of TSF dam, east of ASP [#]	0.0009	<0.0002	0.0003	<0.0004	<0.0004	0.001	0.0009	0.0003
WW02	08/07/20	WW02	Foot of TSF dam, east of ASP [#]	0.0025*	0.0003	0.001	<0.0004	<0.0004	0.0037*	0.0028*	0.001
WW03	08/07/20	WW03	Foot of South WRD, west of DC ^	0.001	0.0071	0.0004	<0.0004	<0.0004	0.0088	0.0085	0.0075
WW04	08/07/20	WW04	Foot of South WRD, west of DC ^	0.028	0.12	0.037	<0.0004	0.0005	0.19	0.15	0.16
WW05	08/07/20	WW05	North Cut, west of DC ^	0.0049	0.0004	0.0039	<0.0004	<0.0004	0.0091	0.0053	0.0043
WW06	08/07/20	WW06	North Cut, west of DC ^	0.0078	0.035	0.0094	<0.0004	<0.0004	0.052	0.043	0.045
WW07	08/07/20	WW07	South Cut, west of DC ^	0.088	0.023	0.083	<0.0004	<0.0004	0.19	0.11	0.11

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

[§] The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

[#] At the foot of the dam of the former tailings storage facility to the east of the acid seepage ponds and east of Dawesley Creek.

* Higher value adopted from QA/QC analysis

^ DC - Dawesley Creek

Table 8
Surface Water Field Parameters

					Field Parameters						
Location Code	**Date**	**Location ID**	**Field ID**	**Location Description**	pH (Field)	Electrical conductivity (Field)	Total Dissolved Solids (TDS) (Calculated)[#]	Dissolved Oxygen (Field) (filtered)	Redox (Field)	Redox (SHE)*	Temperature (Field)
					pH Units	µS/cm	mg/L	mg/L	mV	mV	°C
DIV01	18/05/20	DIV01	DD01	Underground diversion drain at CFS site	7.52	725	471	7.26	224	423	11.3
DC-UP01	23/07/20	DC-UP01	DC-UP01	Dawesley Ck - up gradient CFS site	7.96	1,301	846	8.78	188	387	10.3
DC-UP02	23/07/20	DC-UP02	DC-UP02	Dawesley Ck - up gradient CFS site	7.96	1,340	871	9.98	182	381	10.7
Creek_4	08/05/20	Creek_4	Creek 4	Dawesley Ck - adjacent CFS site	5.29	7,570	4,921	3.55	361	560	15.4
Creek_5	08/05/20	Creek_5	Creek 5	Dawesley Ck - adjacent CFS site	4.59	6,360	4,134	6.15	373	572	13.3
Creek_6	08/05/20	Creek_6	Creek 6	Dawesley Ck - adjacent CFS site	5.25	7,915	5,145	2.55	394	593	13.6
DC01	12/02/20	DC01	DC01	Dawesley Ck - down gradient CFS site	4.73	3,590	2,334	5.20	324	523	19.2
BV01	12/02/20	BV01	BV01	Dawesley Ck - down gradient CFS site	7.19	3,800	2,470	6.04	195	394	20.4
DC02	07/05/20	DC02	DC02	Dawesley Ck - down gradient CFS site	8.57	1,170	761	8.57	13	212	14.8
DC02A	17/08/20	DC02A	DC02A	Dawesley Ck - down gradient CFS site	7.63	2,843	1,848	8.97	36	235	10.2
DC03	08/05/20	DC03	DC03	Dawesley Ck - down gradient CFS site	9.44	1,492	970	12.82	0	199	14.4
DC04	08/05/20	DC04	DC04	Dawesley Ck - down gradient CFS site	9.47	1,210	787	9.99	-2	197	14.0
DC05	08/05/20	DC05	DC05	Dawesley Ck - down gradient CFS site	7.85	1,792	1,165	7.49	4	203	12.4
DC06	18/05/20	DC06	DC06	Dawesley Ck - down gradient CFS site	7.34	2,587	1,682	8.32	247	446	8.4
DC06A	18/05/20	DC06A	DC06A	Dawesley Ck - down gradient CFS site	7.33	2,995	1,947	8.20	230	429	8.5
DC06B	18/05/20	DC06B	DC06B	Dawesley Ck - down gradient CFS site	7.39	2,559	1,663	8.58	226	425	9.1
DC07	08/05/20	DC07	DC07	Dawesley Ck - down gradient CFS site	8.65	1,979	1,286	7.03	4	203	12.8
DC08	09/06/20	DC08	DC08	Dawesley Ck - down gradient CFS site	7.64 ^	1,411 ^	917 ^	17.95 ^	170 ^	369 ^	2.7 ^
DC09	09/06/20	DC09	DC09	Dawesley Ck - down gradient CFS site	7.28	2,456	1,596	9.78	119	318	8.3
DC10	09/06/20	DC10	DC10	Dawesley Ck - down gradient CFS site	7.46	2,404	1,563	9.99	125	324	8.2
DC11	09/06/20	DC11	DC11	Dawesley Ck - down gradient CFS site	7.61	2,411	1,567	10.00	145	344	9.3
DC13	09/06/20	DC13	DC13	Dawesley Ck - down gradient CFS site	7.74	1,960	1,274	6.67	120	319	10.6
DC14	09/06/20	DC14	DC14	Dawesley Ck - down gradient CFS site	8.31	1,982	1,288	9.31	199	398	10.2
DC15	09/06/20	DC15	DC15	Dawesley Ck - down gradient CFS site	8.23	1,658	1,078	10.91	180	379	10.6
DC16	23/07/20	DC16	DC 16	Dawesley Ck - down gradient CFS site	7.41	2,202	1,431	8.91	231	430	9.3
DC17	23/07/20	DC17	DC 17	Dawesley Ck - down gradient CFS site	7.54	2,166	1,408	6.97	237	436	10.0
DC17A	10/08/20	DC17A	DC17A	Mt Barker Ck - down gradient CFS site	8.04	1,297	843	8.78	-160	39	8.9
DC18	23/07/20	DC18	DC 18	Bremer River - down gradient CFS site	7.82	1,917	1,246	6.88	223	422	11.1
DC19	23/07/20	DC19	DC 19	Bremer River - down gradient CFS site	7.73	1,407	915	9.03	215	414	10.7
BR01	23/07/20	BR01	BR01	Bremer River - background **	9.21	2,975	1,934	12.88	220	419	16.2
BR02	23/07/20	BR02	BR02	Bremer River - background **	8.06	6,820	4,433	5.47	236	435	11.5
	11/09/20	BR02_A	BR02_1A	Bremer River - background **	7.57	5,642	3,667	8.42	-137	62	13.6
	17/09/20		BR02_2A	Bremer River - background **	8.08	7,002	4,551	3.87	-10	189	13.8
	11/09/20	BR02_B	BR02_1B	Bremer River - background **	7.47	5,503	3,577	5.63	-181	18	12.8
	17/09/20		BR02_2B	Bremer River - background **	7.87	8,844	5,749	1.10	-46	153	13.7
	11/09/20	BR02_C	BR02_1C	Bremer River - background **	7.47	5,457	3,547	9.24	-157	42	12.5
	17/09/20		BR02_2C	Bremer River - background **	8.01	6,923	4,500	4.97	-50	149	13.6
BR03	11/09/20	BR03_A	BR03_1A	Bremer River - background **	7.84	6,283	4,084	8.29	-73	126	14.8
	17/09/20		BR03_2A	Bremer River - background **	8.75	9,402	6,111	8.21	72	271	16.9
	11/09/20	BR03_B	BR03_1B	Bremer River - background **	7.80	6,265	4,072	11.43	-100	99	14.8
	17/09/20		BR03_2B	Bremer River - background **	8.65	9,953	6,469	8.86	76	275	17.2
	11/09/20	BR03_C	BR03_1C	Bremer River - background **	7.68	6,213	4,038	9.40	-66	134	14.7
	17/09/20		BR03_2C	Bremer River - background **	8.47	15,330	9,965	2.03	74	273	19
MBC01	23/07/20	MBC01	MBC01	Mt Barker Ck - background ^^	8.04	1,966	1,278	10.89	234	433	11.6
	11/09/20	MBC01_A	MBC01_1A	Mt Barker Ck - background ^^	7.92	1,474	958	9.46	-69	130	16.8
	17/09/20		MBC01_2A	Mt Barker Ck - background ^^	8.29	1,546	1,005	8.42	108	307	15.5
	11/09/20	MBC01_B	MBC01_1B	Mt Barker Ck - background ^^	7.86	1,472	957	10.40	-76	123	16.7
	17/09/20		MBC01_2B	Mt Barker Ck - background ^^	8.80	1,511	982	10.30	98	297	15.5
	11/09/20	MBC01_C	MBC01_1C	Mt Barker Ck - background ^^	7.77	1,474	958	10.47	-87	112	16.7
	17/09/20		MBC01_2C	Mt Barker Ck - background ^^	8.34	1,548	1,006	7.84	16	215	15.6
MBC02	23/07/20	MBC02	MBC02	Mt Barker Ck - background ^^	7.88	1,735	1,128	12.15	190	389	9.2
	11/09/20	MBC02_A	MBC02_1A	Mt Barker Ck - background ^^	7.76	1,224	796	11.10	-134	65	15.8
	17/09/20		MBC02_2A	Mt Barker Ck - background ^^	8.07	1,150	748	9.30	126	325	14.1
	11/09/20	MBC02_B	MBC02_1B	Mt Barker Ck - background ^^	7.80	1,225	796	11.19	-126	73	15.8
	17/09/20		MBC02_2B	Mt Barker Ck - background ^^	8.14	1,150	748	9.71	115	314	14.7
	11/09/20	MBC02_C	MBC02_1C	Mt Barker Ck - background ^^	7.64	1,209	786	11.59	-121	78	15.3
	17/09/20		MBC02_2C	Mt Barker Ck - background ^^	8.06	1,150	748	7.83	111	310	14.1
NC01	23/07/20	NC01	NC01	Nairne Ck - background [##]	8.45	1,342	872	10.55	224	423	12.4
NC02	23/07/20	NC02	NC02	Nairne Ck - background [##]	8.03	1,187	772	10.36	229	428	11.1

[#] TDS values were calculated by multiplying the electrical conductivity values with a conversion factor of 0.65

* Redox potential relative to the standard hydrogen electrode (SHE). Redox potential (SHE) = field redox potential (Ag/AgCl electrode with saturated KCl solution) + 199 mV

[^] WQM reading taken from sample on ice days later, results could be inaccurate. Not included in minimum or maximum values.

** Bremer River up gradient of confluence with Mt Barker Creek (between DC17A and DC18)

^^ Mt Barker Creek up gradient of confluence with Dawesley Creek (between DC17 and DC17A)

[##] Nairne Creek up gradient of confluence with Dawesley Creek (between DC11 and DC13)

Table 9
Surface Water Analytical Results

					PFAS in Waters Short								PFAS - Perfluoroalkyl Carboxylic Acids (PFCA)								
					Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perflourododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)
					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	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0004	0.0004	0.001	0.002	0.002	0.002	0.002
NHMRC 2019 Recreational Water PFAS Guidelines					2	2	10			2											
PFAS NEMP 2020 Health Drinking Water					0.07	0.07	0.56			0.07											
PFAS NEMP 2020 Freshwater - 99% protection level (1)						0.00023 §	19														
Catchment specific WQG - highly disturbed systems (2)					0.0046	0.0066															
Catchment specific WQG - slightly to moderately disturbed systems (3)					0.0044	0.0048															
Location Code	**Date**	**Location ID**	**Field ID**	**Location Description**																	
ASP	02/10/19	ASP	ASP_1	Acid seepage pond	0.68	0.48	0.05	<0.01 #	<0.01 #	1.2	0.52	1.8	-	-	-	-	-	-	-	-	-
ATP	02/10/19	ATP	ATP_1	Acid treatment plant discharge channel	0.43	0.28	0.03	<0.01	<0.01	0.72	0.32	1.2	-	-	-	-	-	-	-	-	-
DIV01	18/05/20	DIV01	DD01	UG diversion drain at CFS site	<0.01 #	<0.01 #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-
DC-UP01 ^	23/07/20	DC-UP01	DC-UP01	Dawesley Ck - up gradient	0.0024	0.0021	0.0023	<0.0004	<0.0004	0.0046	0.0044	0.0069	-	-	-	-	-	-	-	-	-
DC-UP02 ^	23/07/20	DC-UP02	DC-UP02	Dawesley Ck - up gradient	0.0022	0.0020	0.0025	<0.0004	<0.0004	0.0042	0.0045	0.0067	-	-	-	-	-	-	-	-	-
PB_1	02/10/19	PB_1	PB_1	Dawesley Ck - up gradient	<0.01 #	<0.01 #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-
PB_2	02/10/19	PB_2	PB_2	Dawesley Ck - up gradient	0.04	<0.01 #	<0.01	<0.01	<0.01	0.04	<0.01	0.38	-	-	-	-	-	-	-	-	-
Creek_1	02/10/19	Creek_1	CREEK_1	Dawesley Ck - adjacent CFS site	0.06	<0.01 #	<0.01	<0.01	<0.01	0.06	<0.01	0.28	-	-	-	-	-	-	-	-	-
Creek_4	06/05/20	Creek_4	Creek 4	Dawesley Ck - adjacent CFS site	0.17	0.12	0.01	<0.01	<0.02	0.29	0.13	0.3	-	-	-	-	-	-	-	-	-
Creek_2	02/10/19	Creek_2	CREEK_2	Dawesley Ck - adjacent CFS site	1.6	0.18	0.09	<0.01	<0.01	1.8	0.27	3.4	-	-	-	-	-	-	-	-	-
Creek_5	06/05/20	Creek_5	Creek 5	Dawesley Ck - adjacent CFS site	2.2	0.94	0.23	<0.01	<0.02	3.1	1.2	3.4	-	-	-	-	-	-	-	-	-
Creek_6	06/05/20	Creek_6	Creek 6	Dawesley Ck - adjacent CFS site	2	0.66	0.14	<0.01	<0.02	2.6	0.8	2.8	-	-	-	-	-	-	-	-	-
Creek_3	02/10/19	Creek_3	CREEK_3	Dawesley Ck - adjacent CFS site	2.4	6.5	0.23	0.02	<0.01	8.9	6.7	11	-	-	-	-	-	-	-	-	-
Pond_4	02/10/19	Pond_4	POND_4	Old Dawesley Ck alignment	1.4	1.4	0.11	<0.01	<0.01	2.8	1.5	3.8	-	-	-	-	-	-	-	-	-
Pond_0	02/10/19	Pond_0	POND_0	Old Dawesley Ck alignment	0.14	0.14	0.01	<0.01	<0.01	0.28	0.15	0.38	-	-	-	-	-	-	-	-	-
DC01	11/02/20	DC01	DC01w	Dawesley Ck - down gradient	0.16	0.099	0.02	<0.01	<0.01	0.26	0.12	0.28	0.04	0.05	0.15	0.02	<0.01	<0.02	<0.02	<0.05	<0.1
BV01	11/02/20	BV01	BV01w	Dawesley Ck - down gradient	0.22	0.11	0.02	<0.01	<0.01	0.33	0.13	0.35	-	-	-	-	-	-	-	-	-
DC02	08/05/20	DC02	DC02	Dawesley Ck - down gradient	0.01	0.03	<0.01	<0.01	<0.02	0.04	0.03	0.04	-	-	-	-	-	-	-	-	-
DC02A ^	17/08/20	DC02A	DC02A	Dawesley Ck - down gradient	0.07	0.06	0.01	<0.0004	<0.0004	0.13	0.067	0.14	-	-	-	-	-	-	-	-	-
DC03	08/05/20	DC03	DC03	Dawesley Ck - down gradient	0.02	0.05	<0.01	<0.01	<0.02	0.07	0.05	0.07	-	-	-	-	-	-	-	-	-
DC04	08/05/20	DC04	DC04	Dawesley Ck - down gradient	0.02	0.06	<0.02	<0.02	<0.02	0.08	0.06	0.08	-	-	-	-	-	-	-	-	-
DC05	08/05/20	DC05	DC05	Dawesley Ck - down gradient	2.23 *	0.98 *	0.19 *	<0.05 *	<0.05 *	3.21 *	1.17 *	3.4 *	<0.1*	0.12*	0.35*	0.12*	-	-	-	-	-
DC06	18/05/20	DC06	DC06	Dawesley Ck - down gradient	0.08 *	0.17	<0.02	<0.02	<0.02	0.24	0.17	0.24	<0.1*	<0.02*	0.06*	<0.02*	-	-	-	-	-
DC06A	18/05/20	DC06A	DC06A	Dawesley Ck - down gradient	0.07	0.09	<0.02	<0.02	<0.02	0.16	0.09	0.16	-	-	-	-	-	-	-	-	-
DC06B	18/05/20	DC06B	DC06B	Dawesley Ck - down gradient	0.06	0.08	<0.02	<0.02	<0.02	0.14	0.08	0.14	-	-	-	-	-	-	-	-	-
DC07	08/05/20	DC07	DC07	Dawesley Ck - down gradient	0.05	0.09	<0.02	<0.02	<0.02	0.14	0.09	0.14	-	-	-	-	-	-	-	-	-
DC08	09/06/20	DC08	DC08	Dawesley Ck - down gradient	0.06	0.08	<0.02	<0.02	<0.02	0.14	0.08	0.14	-	-	-	-	-	-	-	-	-
DC09	08/07/20	DC09	DC09	Dawesley Ck - down gradient	0.12 *	0.13	0.0092 *	<0.0004	<0.0004	0.25 *	0.14	0.26 *	0.01*	0.012*	0.030*	0.005*	-	-	-	-	-
DC10	08/07/20	DC10	DC10	Dawesley Ck - down gradient	0.11	0.11	0.0080	<0.0004	<0.0004	0.22	0.12	0.23	-	-	-	-	-	-	-	-	-
DC11	08/07/20	DC11	DC11	Dawesley Ck - down gradient	0.11	0.13	0.0086	<0.0004	<0.0004	0.24	0.14	0.25	-	-	-	-	-	-	-	-	-
DC13	08/07/20	DC13	DC13	Dawesley Ck - down gradient	0.088	0.097	0.0065	<0.0004	<0.0004	0.18	0.10	0.19	-	-	-	-	-	-	-	-	-
DC14	08/07/20	DC14	DC14	Dawesley Ck - down gradient	0.081	0.081	0.0062	<0.0004	<0.0004	0.16	0.087	0.17	0.01	0.01	0.02	0.0048	<0.001	<0.002	<0.002	<0.005	<0.01
DC15	08/07/20	DC15	DC15	Dawesley Ck - down gradient	0.066	0.08	0.0057	<0.0004	<0.0004	0.15	0.085	0.15	0.01	0.009	0.016	0.0045	<0.001	<0.002	<0.002	<0.005	<0.01
DC16 ^	23/07/20	DC16	DC 16	Dawesley Ck - down gradient	0.072	0.087	0.0062	<0.0004	<0.0004	0.16	0.093	0.17	0.01	0.008	0.021	0.0048	<0.001	<0.002	<0.002	<0.005	<0.01
DC17 ^	23/07/20	DC17	DC 17	Dawesley Ck - down gradient	0.070	0.078	0.0054	<0.0004	<0.0004	0.15	0.083	0.15	0.01	0.008	0.018	0.0046	<0.001	<0.002	<0.002	<0.005	<0.01
DC17A ^	10/08/20	DC17A	DC17A	Mt Barker Ck - down gradient	0.0064	0.0140	0.0029 *	<0.0004	<0.0004	0.021	0.017	0.024	<0.01*	0.004*	0.006*	<0.002*	-	-	-	-	-
DC18 ^	23/07/20	DC18	DC 18	Bremer River - down gradient	0.014	0.0120	0.0032	<0.0004	<0.0004	0.027	0.016	0.030	0.008	0.003	0.0064	0.002	<0.001	<0.002	<0.002	<0.005	<0.01
DC19 ^	23/07/20	DC19	DC 19	Bremer River - down gradient	0.015 *	0.020 *	0.0034 *	<0.005 *	<0.005 *	0.035 *	0.016 *	0.049 *	0.006	0.003	0.0070*	0.002	<0.002*	<0.002	<0.002	<0.005	<0.01

Table 9
Surface Water Analytical Results

Location Code	Date	Location ID	Field ID	Location Description	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)
					PFAS in Waters Short								PFAS - Perfluoroalkyl Carboxylic Acids (PFCA)								
					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	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.002	0.0004	0.0004	0.001	0.002	0.002	0.002	0.002
NHMRC 2019 Recreational Water PFAS Guidelines					2	2	10			2											
PFAS NEMP 2020 Health Drinking Water					0.07	0.07	0.56			0.07											
PFAS NEMP 2020 Freshwater - 99% protection level (1)						0.00023 §	19														
Catchment specific WQG - highly disturbed systems (2)					0.0046	0.0066															
Catchment specific WQG - slightly to moderately disturbed systems (3)					0.0044	0.0048															
Location Code	**Date**	**Location ID**	**Field ID**	**Location Description**																	
BR01 ^	23/07/20	BR01	BR01	Bremer River - background **	0.0440	0.0270	0.0036	<0.0004	<0.0004	0.0710	0.0300	0.0750	-	-	-	-	-	-	-	-	-
BR02 ^	23/07/20	BR02	BR02	Bremer River - background **	0.0002	<0.0002	<0.0002	<0.0004	<0.0004	0.0002	<0.0002	0.0002	-	-	-	-	-	-	-	-	-
	11/09/20	BR02_A	BR02_1A	Bremer River - background **	0.0038	0.0008	<0.0002	<0.0004	<0.0004	0.0046	0.0008	0.0046	0.006 ^	<0.0002 ^	<0.0004 ^	<0.0004 ^	<0.001	<0.002	<0.002	<0.005	<0.01
		BR02_B	BR02_1B	Bremer River - background **	0.0036	0.0007	<0.0002	<0.0004	<0.0004	0.0043	0.0007	0.0043	0.006	<0.002	<0.0004	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
		BR02_C	BR02_1C	Bremer River - background **	0.0034	0.0006	<0.0002	<0.0004	<0.0004	0.0040	0.0006	0.0040	0.006	<0.002	<0.0004	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
	17/09/20	BR02_A	BR02_2A	Bremer River - background **	0.0032	0.0007	<0.0002	<0.0004	<0.0004	0.0039	0.0007	0.0039	0.005	<0.002	<0.0004	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
		BR02_B	BR02_2B	Bremer River - background **	0.0027	0.0006	<0.0002	<0.0004	<0.0004	0.0033	0.0006	0.0033	0.005	<0.002	<0.0004	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
		BR02_C	BR02_2C	Bremer River - background **	0.0026	0.0007	<0.0002	<0.0004	<0.0004	0.0033	0.0007	0.0033	0.006	<0.002	<0.0004	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
BR03 ^	11/09/20	BR03_A	BR03_1A	Bremer River - background **	0.0330	0.0072	0.0010	<0.0004	<0.0004	0.0400	0.0085	0.0420	0.01	<0.002	0.0048	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
		BR03_B	BR03_1B	Bremer River - background **	0.0310	0.0074	0.0010	<0.0004	<0.0004	0.0380	0.0085	0.0390	0.01	<0.002	0.0049	<0.0004	<0.001	<0.002	<0.002	<0.005	<0.01
		BR03_C	BR03_1C	Bremer River - background **	0.0380*	0.0108*	0.0010	<0.005 *	<0.005 *	0.0480*	0.0108*	0.0580*	0.01	<0.002	0.0060*	0.0004*	<0.002*	<0.002	<0.002	<0.005	<0.01
	17/09/20	BR03_A	BR03_2A	Bremer River - background **	0.0730*	0.0160*	0.0022	<0.005 *	<0.005 *	0.0890*	0.0160	0.1120*	0.01	<0.002	0.011*	0.0006*	<0.001	<0.002	<0.002	<0.005	<0.01
		BR03_B	BR03_2B	Bremer River - background **	0.0610	0.0160	0.0020	<0.0004	<0.0004	0.0770	0.0180	0.0790	0.01	<0.002	0.0092	0.0006	<0.001	<0.002	<0.002	<0.005	<0.01
		BR03_C	BR03_2C	Bremer River - background **	0.0600	0.0160	0.0020	<0.0004	<0.0004	0.0760	0.0180	0.0780	0.01	<0.002	0.0091	0.0005	<0.001	<0.002	<0.002	<0.005	<0.01
MBC01 ^	23/07/20	MBC01	MBC01	Mt Barker Ck - background ^^	0.0021	0.0025	0.0031	<0.0004	<0.0004	0.0046	0.0055	0.0076	-	-	-	-	-	-	-	-	-
	11/09/20	MBC01_A	MBC01_1A	Mt Barker Ck - background ^^	0.0037	0.0038	0.0032	<0.0004	<0.0004	0.0075	0.0070	0.0110	0.007	0.003	0.0053	0.0008	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC01_B	MBC01_1B	Mt Barker Ck - background ^^	0.0037	0.0040	0.0032	<0.0004	<0.0004	0.0078	0.0072	0.0110	0.007	0.003	0.0048	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC01_C	MBC01_1C	Mt Barker Ck - background ^^	0.0040	0.0032	0.0035	<0.0004	<0.0004	0.0072	0.0067	0.0110	0.007	0.003	0.0048	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
	17/09/20	MBC01_A	MBC01_2A	Mt Barker Ck - background ^^	0.0050*	0.0070*	0.0043	<0.005 *	<0.005 *	0.0120*	0.0110*	0.0230*	0.008	0.003	0.0070*	0.001	<0.002*	<0.002	<0.002	<0.005	<0.01
		MBC01_B	MBC01_2B	Mt Barker Ck - background ^^	0.0046	0.0045	0.0042	<0.0004	<0.0004	0.0091	0.0087	0.0130	0.008	0.002	0.0047	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC01_C	MBC01_2C	Mt Barker Ck - background ^^	0.0044	0.0040	0.0044	<0.0004	<0.0004	0.0084	0.0084	0.0130	0.008	0.003	0.005	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
MBC02 ^	23/07/20	MBC02	MBC02	Mt Barker Ck - background ^^	0.0040*	0.0040*	0.0034	<0.005 *	<0.005 *	0.0080*	0.0065*	0.0210*	<0.01*	<0.002*	0.005*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*
	11/09/20	MBC02_A	MBC02_1A	Mt Barker Ck - background ^^	0.0040*	0.0050*	0.0043*	<0.005 *	<0.005 *	0.0090*	0.0090*	0.0220*	0.006	0.003*	0.0090*	0.0010*	<0.002*	<0.002	<0.002	<0.005	<0.01
		MBC02_B	MBC02_1B	Mt Barker Ck - background ^^	0.0037	0.0045	0.0040	<0.0004	<0.0004	0.0082	0.0085	0.0120	0.006	0.003	0.0063	0.0009	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC02_C	MBC02_1C	Mt Barker Ck - background ^^	0.0036	0.0042	0.0038	<0.0004	<0.0004	0.0078	0.0080	0.0120	0.006	0.003	0.0065	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
	17/09/20	MBC02_A	MBC02_2A	Mt Barker Ck - background ^^	0.0038	0.0071	0.0050	<0.0004	<0.0004	0.0110	0.0120	0.0160	0.007	0.003	0.0066	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC02_B	MBC02_2B	Mt Barker Ck - background ^^	0.0035	0.0066	0.0049	<0.0004	<0.0004	0.0100	0.0120	0.0150	0.007	0.003	0.0056	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
		MBC02_C	MBC02_2C	Mt Barker Ck - background ^^	0.0032	0.0042	0.0043	<0.0004	<0.0004	0.0075	0.0086	0.0120	0.007	0.003	0.0057	0.001	<0.001	<0.002	<0.002	<0.005	<0.01
NC01 ^	23/07/20	NC01	NC01	Nairne Ck - background ##	0.0049	0.0054	0.0009	<0.0004	<0.0004	0.0100	0.0062	0.0110	-	-	-	-	-	-	-	-	-
NC02 ^	23/07/20	NC02	NC02	Nairne Ck - background ##	0.0047	0.0061	0.0010	<0.0004	<0.0004	0.0110	0.0071	0.0120	-	-	-	-	-	-	-	-	-

(1) 99% species protection level - applies to bioaccumulation risk in slightly to moderately disturbed systems and to direct ecological risk in high conservation value systems.
(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.
(3) Catchment specific WQG for slightly to moderately disturbed systems - 80th percentile of background concentrations in reference subcatchment - applies to Nairne Ck, Mt Barker Ck and Bremer River.
§ The PFAS NEMP Freshwater 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.
# Concentration below the standard LOR (0.01 µg/L) may potentially exeed the catchment specific WQG for PFOS and PFHxS.
^ Trace level analysis; EQL = 0.0002 µg/L for PFHxS, PFOS, PFOA and sums; EQL = 0.0004 µg/L or 0.005 µg/L for 6:2 FTS and 8:2 FTS
* Higher value adopted from QA/QC analysis
** Bremer River up gradient of confluence with Mt Barker Creek (between DC17A and DC18)
^^ Mt Barker Creek up gradient of confluence with Dawesley Creek (between DC17 and DC17A)
Nairne Creek up gradient of confluence with Dawesley Creek (between DC11 and DC13)

Table 9
Surface Water Analytical Results

					PFCA		PFAS - Perfluoroalkyl Sulfonic Acids				PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids			
					Perfluorotetradecanoic acid (PFTeDA)	Perfluoro-n-hexadecanoic acid (PFHxDA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					0.005	0.005	0.0004	0.001	0.001	0.002	0.002	0.005	0.005	0.002	0.005	0.005	0.002	0.001	0.0004	0.0004	0.002
NHMRC 2019 Recreational Water PFAS Guidelines																					
PFAS NEMP 2020 Health Drinking Water																					
PFAS NEMP 2020 Freshwater - 99% protection level (1)																					
Catchment specific WQG - highly disturbed systems (2)																					
Catchment specific WQG - slightly to moderately disturbed systems (3)																					
Location Code	**Date**	**Location ID**	**Field ID**	**Location Description**																	
ASP	02/10/19	ASP	ASP_1	Acid seepage pond	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ATP	02/10/19	ATP	ATP_1	Acid treatment plant discharge channel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIV01	18/05/20	DIV01	DD01	UG diversion drain at CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC-UP01 ^	23/07/20	DC-UP01	DC-UP01	Dawesley Ck - up gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC-UP02 ^	23/07/20	DC-UP02	DC-UP02	Dawesley Ck - up gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB_1	02/10/19	PB_1	PB_1	Dawesley Ck - up gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PB_2	02/10/19	PB_2	PB_2	Dawesley Ck - up gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_1	02/10/19	Creek_1	CREEK_1	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_4	06/05/20	Creek_4	Creek 4	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_2	02/10/19	Creek_2	CREEK_2	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_5	06/05/20	Creek_5	Creek 5	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_6	06/05/20	Creek_6	Creek 6	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek_3	02/10/19	Creek_3	CREEK_3	Dawesley Ck - adjacent CFS site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pond_4	02/10/19	Pond_4	POND_4	Old Dawesley Ck alignment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pond_0	02/10/19	Pond_0	POND_0	Old Dawesley Ck alignment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC01	11/02/20	DC01	DC01w	Dawesley Ck - down gradient	<0.5	-	0.03	0.03	<0.01	<0.02	<0.1	<0.05	<0.1	<0.02	<0.05	<0.5	<0.02	<0.01	<0.01	<0.01	<0.01
BV01	11/02/20	BV01	BV01w	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC02	08/05/20	DC02	DC02	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC02A ^	17/08/20	DC02A	DC02A	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC03	08/05/20	DC03	DC03	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC04	08/05/20	DC04	DC04	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC05	08/05/20	DC05	DC05	Dawesley Ck - down gradient	-	-	0.11*	-	-	-	-	-	-	-	-	-	-	<0.05*	<0.05*	<0.05*	<0.05*
DC06	18/05/20	DC06	DC06	Dawesley Ck - down gradient	-	-	<0.02*	-	-	-	-	-	-	-	-	-	-	<0.05*	<0.05*	<0.05*	<0.05*
DC06A	18/05/20	DC06A	DC06A	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC06B	18/05/20	DC06B	DC06B	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC07	08/05/20	DC07	DC07	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC08	09/06/20	DC08	DC08	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC09	08/07/20	DC09	DC09	Dawesley Ck - down gradient	-	-	0.011*	-	-	-	-	-	-	-	-	-	-	<0.005*	<0.005*	<0.005*	<0.005*
DC10	08/07/20	DC10	DC10	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC11	08/07/20	DC11	DC11	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC13	08/07/20	DC13	DC13	Dawesley Ck - down gradient	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC14	08/07/20	DC14	DC14	Dawesley Ck - down gradient	<0.05	-	0.0088	0.009	0.003	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
DC15	08/07/20	DC15	DC15	Dawesley Ck - down gradient	<0.05	-	0.0071	0.007	0.002	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
DC16 ^	23/07/20	DC16	DC 16	Dawesley Ck - down gradient	<0.05	-	0.0087	0.009	0.003	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
DC17 ^	23/07/20	DC17	DC 17	Dawesley Ck - down gradient	<0.05	-	0.0087	0.009	0.003	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
DC17A ^	10/08/20	DC17A	DC17A	Mt Barker Ck - down gradient	-	-	0.002*	-	-	-	-	-	-	-	-	-	-	<0.005*	<0.005*	<0.005*	<0.005*
DC18 ^	23/07/20	DC18	DC 18	Bremer River - down gradient	<0.05	-	0.003	0.002	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
DC19 ^	23/07/20	DC19	DC 19	Bremer River - down gradient	<0.05	<0.005*	0.004*	0.002	<0.002*	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.005*	<0.005*	<0.005*	<0.005*

Table 9
Surface Water Analytical Results

					PFCA		PFAS - Perfluoroalkyl Sulfonic Acids				PFAS - Perfluoroalkyl Sulfonamide							PFAS - Fluorotelomer Sulfonic Acids			
					Perfluorotetradecanoic acid (PFTeDA)	Perfluoro-n-hexadecanoic acid (PFHxDA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					0.005	0.005	0.0004	0.001	0.001	0.002	0.002	0.005	0.005	0.002	0.005	0.005	0.002	0.001	0.0004	0.0004	0.002
NHMRC 2019 Recreational Water PFAS Guidelines																					
PFAS NEMP 2020 Health Drinking Water																					
PFAS NEMP 2020 Freshwater - 99% protection level (1)																					
Catchment specific WQG - highly disturbed systems (2)																					
Catchment specific WQG - slightly to moderately disturbed systems (3)																					
Location Code	**Date**	**Location ID**	**Field ID**	**Location Description**																	
BR01 ^	23/07/20	BR01	BR01	Bremer River - background **	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0004	<0.0004	-
BR02 ^	23/07/20	BR02	BR02	Bremer River - background **	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0004	<0.0004	-
	11/09/20	BR02_A	BR02_1A	Bremer River - background **	<0.05	-	0.0010	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR02_B	BR02_1B	Bremer River - background **	<0.05	-	0.0010	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR02_C	BR02_1C	Bremer River - background **	<0.05	-	0.0010	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
	17/09/20	BR02_A	BR02_2A	Bremer River - background **	<0.05	-	0.0009	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR02_B	BR02_2B	Bremer River - background **	<0.05	-	0.0008	<0.001	<0.001	<0.002	<0.01	<0.02	<0.05	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR02_C	BR02_2C	Bremer River - background **	<0.05	-	0.0007	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
BR03 ^	11/09/20	BR03_A	BR03_1A	Bremer River - background **	<0.05	-	0.0030	0.003	0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR03_B	BR03_1B	Bremer River - background **	<0.05	-	0.0030	0.003	0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR03_C	BR03_1C	Bremer River - background **	<0.05	<0.005*	0.0030*	0.003	0.001	<0.002	<0.01	<0.005	<0.05*	<0.002	<0.005	<0.05	<0.002	<0.005*	<0.005*	<0.005*	<0.005*
	17/09/20	BR03_A	BR03_2A	Bremer River - background **	<0.05	-	0.0047	0.005	0.003*	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.005*	<0.005*	<0.005*	<0.005*
		BR03_B	BR03_2B	Bremer River - background **	<0.05	-	0.0047	0.005	0.003	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		BR03_C	BR03_2C	Bremer River - background **	<0.05	-	0.0044	0.005	0.002	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
MBC01 ^	23/07/20	MBC01	MBC01	Mt Barker Ck - background ^^	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0004	<0.0004	-
	11/09/20	MBC01_A	MBC01_1A	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC01_B	MBC01_1B	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC01_C	MBC01_1C	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
	17/09/20	MBC01_A	MBC01_2A	Mt Barker Ck - background ^^	<0.05	-	0.0030	0.001	<0.002*	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.005*	<0.005*	<0.005*	<0.005*
		MBC01_B	MBC01_2B	Mt Barker Ck - background ^^	<0.05	-	0.0030	0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC01_C	MBC01_2C	Mt Barker Ck - background ^^	<0.05	-	0.0030	0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
MBC02 ^	23/07/20	MBC02	MBC02	Mt Barker Ck - background ^^	<0.005*	<0.005*	0.0050*	<0.002*	<0.002*	<0.002*	<0.002*	<0.005*	<0.005*	<0.002*	<0.005*	<0.005*	<0.002*	<0.005*	<0.005*	<0.005*	<0.005*
	11/09/20	MBC02_A	MBC02_1A	Mt Barker Ck - background ^^	<0.05	<0.005*	0.0020	<0.002*	<0.002*	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.005*	<0.005*	<0.005*	<0.005*
		MBC02_B	MBC02_1B	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC02_C	MBC02_1C	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
	17/09/20	MBC02_A	MBC02_2A	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC02_B	MBC02_2B	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
		MBC02_C	MBC02_2C	Mt Barker Ck - background ^^	<0.05	-	0.0020	<0.001	<0.001	<0.002	<0.01	<0.005	<0.01	<0.002	<0.005	<0.05	<0.002	<0.001	<0.0004	<0.0004	<0.002
NC01 ^	23/07/20	NC01	NC01	Nairne Ck - background ##	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NC02 ^	23/07/20	NC02	NC02	Nairne Ck - background ##	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 10
Groundwater Gauging Data and Well Construction Details

Well	TOC (mAHD)	TOC (m above ground level)	Location relative to CFS site	Date	Depth to Water (m bTOC)	Depth to Water (m bgl)	Groundwater Elevation (mAHD)	Well Depth (m bTOC)	Top of Screen (m bTOC)	Length of Screen (m)
BH18	365.840	1.023	Up gradient, west	11/02/20	2.559	1.536	363.281	20		
BH19	365.710	1.020	Up gradient, west	12/02/20	2.051	1.031	363.659	5		5
BH22	367.010	1.002	Cross gradient, west	11/02/20	2.284	1.282	364.726	5		
GAMW-03	382.800	0.964	Up gradient, north-west	11/02/20	18.030	17.066	364.770	25	18	7
H01	349.990	0.798	Up gradient, west	12/02/20	2.730	1.932	347.260	15.5	12.5	3
H02	343.400	0.573	Down gradient	11/02/20	1.568	0.995	341.832	12	8	4
H04a	339.540	0.231	Down gradient	11/02/20	0.604	0.373	338.936	4	1	3
H04b	339.800	0.797	Down gradient	11/02/20	1.755	0.958	338.045	13.3	9.3	4
H06a	340.600	0.864	Down gradient	11/02/20	1.339	0.475	339.261	4.4	1.4	3
H09	333.000	0.748	Down gradient	11/02/20	3.080	2.332	329.920	12	6	6
H12	339.600	-	Down gradient	11/02/20	2.019	-	337.581	6	3	3
H13	333.400	-	Down gradient	11/02/20	0.934	-	332.466	3.5	1.5	2
KAN12	365.500	0.238	Up gradient, west	11/02/20	1.339	1.101	364.161	25	24	1
KAN41	381.600	0.562	Up gradient, east	11/02/20	13.158	12.596	368.442	20	19	1
KAN45	378.600	0.620	Up gradient, east	12/02/20	6.586	5.966	372.014	15.5	14.5	1
KAN52	382.600	0.790	Cross gradient, east	11/02/20	16.844	16.054	365.756	18	17	1
C04a	363.180	0.690	Cross gradient, east	16/06/20	4.270	3.580	358.910	14	11	3
GW01	349.859	-0.075	Up gradient, north	15/06/20	1.141	1.216	348.718	15.5	12.5	3
GW02	386.661	-0.231	Up gradient, east	15/06/20	14.348	14.579	372.313	18.5	12.5	6
GW03	380.353	0.787	Up gradient, east	16/06/20	9.480	8.693	370.873	21.8	18.8	3
GW04	385.275	0.821	Cross gradient, east	16/06/20	17.992	17.171	367.283	25	15	10
GW05	307.012	-0.032	Down gradient	15/06/20	4.232	4.264	302.780	8	5	3
GW06	297.669	0.676	Down gradient	15/06/20	6.862	6.186	290.807	10	5.5	4.5
GW07	303.330	-0.056	Down gradient	16/06/20	11.136	11.192	292.194	23	20	3
H15	355.926	-0.077	Cross gradient, east	16/06/20	12.069	12.146	343.857	30	27	3
KAN23	418.192	-0.106	Cross gradient, west	15/06/20	19.734	19.840	398.458			
KAN26	433.547	-0.114	Cross gradient, west	19/06/20	11.810	11.924	421.737			
6627-5944			Down gradient	17/08/20 17/09/20	Well fitted with pump, unable to measure SWL or Well depth. WaterConnect records indicate max depth of 28.35 m.					
6627-7126 (Hawthorn 1)			Down gradient	19/06/20	Well fitted with pump, unable to measure SWL or Well depth. WaterConnect records do not include depth measurements.					
6627-7520			Down gradient	10/03/20	Well fitted with pump, unable to measure SWL or Well depth. WaterConnect records indicatae max depth of 81.40 m.					
6627-8333			Down gradient	12/02/20	Well fitted with pump, unable to measure SWL or Well depth. WaterConnect records indicate max depth of 31.00 m.					
6627-11131			Down gradient	24/09/20	Well fitted with pump, unable to measure SWL or Well depth. WaterConnect records indicate max depth of 105.00 m.					

Table 11
Groundwater Field Parameters

			Field Parameters							Sample Comments
			pH (Field)	Electrical conductivity (Field)	Total Dissolved Solids (TDS)[#]	Dissolved Oxygen (Field) (filtered)	Redox (Field)	Redox (SHE)*	Temperature (Field)	
			pH Units	µS/cm	mg/L	mg/L	mV	mV	°C	
Location Code	**Date**	**Location relative to CFS site**								
6627-5944	17/08/20	Down gradient	6.47	4,549	2,957	2.24	-21	178	18.1	Clear, low turbidity, no sediment load, no odour/sheen.
	17/09/20	Down gradient	6.43	3,677	2,390	2.14	-40	159	18.1	
6627-8333	12/02/20	Down gradient	6.31	3,474	2,258	2.64	19	218	18.9	
6627-7126	19/06/20	Down gradient	9.69	5,552	3,609	4.94	-216	-17	17.4	Clear, low turbidity, low sediment load, no odour/sheen.
6627-7520	10/03/20	Down gradient	6.39	4,063	2,641	4.96	486	685	21.0	
6627-11131	24/09/20	Down gradient	7.04	3,570	2,321	6.80	-66	685	18.7	
BH18	12/02/20	Up gradient, west	2.87	14,240	9,256	0.78	344	543	20.5	
BH19	12/02/20	Up gradient, west	2.39	11,110	7,222	3.17	440	639	21.9	
BH22	12/02/20	Cross gradient, west	3.56	8,900	5,785	4.47	254	453	20.1	
GAMW-03	12/02/20	Up gradient, north-west	4.24	1,250	813	4.88	343	542	16.9	
H01	12/02/20	Up gradient, west	2.68	8,220	5,343	4.49	512	711	21.5	
H02	12/02/20	Down gradient	5.74	6,090	3,959	7.93	413	612	19.4	
H04a	12/02/20	Down gradient	3.11	9,990	6,494	0.90	343	542	20.8	
H04b	12/02/20	Down gradient	2.74	8,160	5,304	2.44	509	708	20.1	
H06a	12/02/20	Down gradient	3.32	9,630	6,260	2.12	314	513	20.0	
H09	12/02/20	Down gradient	5.91	4,460	2,899	8.35	165	364	20.4	
H12	12/02/20	Down gradient	2.94	27,410	17,817	1.00	387	586	15.3	
H13	12/02/20	Down gradient	2.69	34,000	22,100	1.32	373	572	17.9	
KAN12	12/02/20	Up gradient, west	3.13	6,720	4,368	0.55	252	451	20.2	
KAN41	12/02/20	Up gradient, east	4.65	9,390	6,104	0.49	148	347	17.6	
KAN45	12/02/20	Up gradient, east	3.96	5,130	3,335	0.87	281	480	16.9	
KAN52	12/02/20	Cross gradient, east	3.09	12,070	7,846	0.80	302	501	17.5	
C04a	16/06/20	Cross gradient, east	6.5 [§]	2,476	1,609	2.45	-170	29	17.1	Yellow/brown, medium turbidity, low sediment load, no odour/sheen.
GW01	15/06/20	Up gradient, north	6.49 ^	8,926	5,802	2.45	38	237	14.4	Clear/pale brown, low turbidity, no sediment load, no odour/sheen.
GW02	15/06/20	Up gradient, east	11.66 ^	20,641	13,417	1.42	-73	126	14.8	Clear/pale brown, low turbidity, no sediment load, no odour/sheen.
GW03	16/06/20	Up gradient, east	9.85 ^	7,104	4,618	5.05	41	240	16.1	Clear/pale brown, low turbidity, no sediment load, no odour/sheen.
GW04	16/06/20	Cross gradient, east	11.26 ^	6,887	4,477	3.83	-135	64	15.9	Clear/brown, low to medium turbidity, low sediment load (schist dust), no odour/sheen
GW05	15/06/20	Down gradient	11.09 ^	744	484	3.59	-39	160	15.2	Grey. Medium turbidity, medium sediment load, no odour/sheen.
GW06	15/06/20	Down gradient	8.06 ^	5,778	3,756	1.80	29	228	16.1	Clear/pale brown, low/medium turbidity, no sediment load, no odour/sheen.
GW07	16/06/20	Down gradient	11.46 ^	1,262	820	4.80	-193	7	16.7	Pale grey, low to medium turbidity, no sediment load, no odour/sheen.
H15	16/06/20	Cross gradient, east	6.9 [§]	812	528	3.42	-169	30	15.5	Clear/grey-brown, low turbidity, no sediment load, no odour/sheen.
KAN23	15/06/20	Cross gradient, west	7.0 [§]	3,494	2,271	1.46	30	229	16.4	Clear, low turbidity, fine sand in bottom of hydrasleeve, sulphur odour, no sheen.
KAN26	19/06/20	Cross gradient, west	8.81 ^	1,202	781	6.54	-196	3	15.9	Clear, low turbidity, low sediment load, no odour/sheen.

[#] TDS values were calculated by multiplying the electrical conductivity values with a conversion factor of 0.65

* Redox potential relative to the standard hydrogen electrode (SHE). Redox potential (SHE) = field redox potential (Ag/AgCl electrode with saturated KCl solution) + 199 mV

[§] Value measured in the laboratory.

^ The field pH values recorded in June 2020 indicated a faulty pH probe and were not representative of site conditions.

Table 12
Groundwater Analytical Results

				Inorganics	PFAS in Waters Short							
				Total Dissolved Solids	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
				mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				5	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
NHMRC 2019 Recreational Water PFAS Guidelines					2	2	10				2	
NHMRC 2008 / ADWG 2011 Recreational Water - domestic setting only (1)					0.7	0.7	5.6				0.7	
PFAS NEMP 2020 Health Drinking Water					0.07	0.07	0.56				0.07	
PFAS NEMP 2020 Freshwater - 99% protection level (2)						0.00023 §	19					
Catchment specific WQG - highly disturbed systems (3)					0.0046	0.0066						
Location Code	**Date**	**Field ID**	**Location relative to CFS site**									
6627-5944	17/08/20	6627-5944	Down gradient		0.047 ^*	0.063 ^*	0.050 ^*	0.001 ^	<0.005 ^*	0.15 ^*	0.110 ^*	0.068 ^*
6627-5944	17/09/20	6627-5944_B	Down gradient		0.038 ^*	0.046 ^*	0.0042 ^*	0.001 ^	<0.005 ^*	0.129 ^*	0.084 ^*	0.050 ^*
6627-7126	19/06/20	Hawthorn 1	Down gradient		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
6627-7520	10/03/20	6627-7520	Down gradient		<0.01 #	<0.01 #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
6627-8333	12/02/20	6627-8333	Down gradient	2,100	0.07	0.08	<0.01	<0.01	<0.01	0.15	0.15	0.08
6627-11131	24/09/20	6627-11131	Down gradient		<0.002 ^*	<0.002 ^*	<0.002 ^*	<0.005 ^*	<0.005 ^*	<0.0002 ^	<0.002 ^*	<0.0002 ^
BH19	12/02/20	BH19	Up gradient, west	24,000	<0.01 #	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
BH22	12/02/20	BH22	Cross gradient, west	13,000	0.07	0.09	0.10	<0.01	<0.01	0.25	0.16	0.18
GAMW-03	12/02/20	GAMW-03	Up gradient, north-west	1,000	0.02	0.03	<0.01	0.02	<0.01	0.06	0.04	0.03
H01	12/02/20	H01	Up gradient, west		0.03	0.02	<0.01	<0.01	<0.01	0.05	0.05	0.02
H02	12/02/20	H02	Down gradient	5,600	0.38	0.04	0.02	<0.01	<0.01	0.44	0.42	0.06
H04a	12/02/20	H04a	Down gradient	18,000	0.15	0.02	0.02	<0.01	<0.01	0.19	0.17	0.04
H04b	12/02/20	H04b	Down gradient	7,600	0.04	0.02	<0.01	<0.01	<0.01	0.07	0.07	0.02
H06a	12/02/20	H06a	Down gradient	17,000	0.12	0.03	0.02	<0.01	<0.01	0.17	0.16	0.05
H09	12/02/20	H09	Down gradient	4,700	<0.01 #	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
H12	12/02/20	H12	Down gradient	140,000	<0.01 #	0.03	<0.02	<0.02	<0.01	0.03	0.03	0.03
H13	12/02/20	H13	Down gradient	150,000	<0.01 #	0.08	<0.02	<0.02	<0.01	0.08	0.08	0.08
KAN12	12/02/20	KAN12	Up gradient, west	11,000	0.05	0.03	0.04	<0.01	<0.01	0.12	0.08	0.07
KAN41	12/02/20	KAN41	Up gradient, east	18,000	<0.01 #	0.02	<0.01	0.04	<0.01	0.06	0.02	0.02
KAN45	12/02/20	KAN45	Up gradient, east	5,800	0.06	0.02	0.02	<0.01	<0.01	0.11	0.09	0.05
KAN52	12/02/20	KAN52	Cross gradient, east	18,000	<0.01 #	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
C04a	16/06/20	C04a	Cross gradient, east		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW01	15/06/20	GW01	Up gradient, north		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW02	15/06/20	GW02	Up gradient, east		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW03	16/06/20	GW03	Up gradient, east		<0.01 #	0.01	<0.01	<0.01	<0.02	0.01	0.01	0.01
GW04	16/06/20	GW04	Cross gradient, east		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW05	15/06/20	GW05	Down gradient		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW06	15/06/20	GW06	Down gradient		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW07	16/06/20	GW07	Down gradient		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
H15	16/06/20	H15	Cross gradient, east		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
KAN23	15/06/20	KAN23	Cross gradient, west		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
KAN26	19/06/20	KAN26	Cross gradient, west		<0.01 #	<0.01 #	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01

(1) The NHMRC 2008 recreational guideline values (10x ADWG 2011 drinking water guideline values) apply to domestic settings (e.g. private residential bores) only.

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) Catchment specific WQG for highly disturbed systems - 90th percentile of background concentrations in reference subcatchment - applies to Dawesley Creek.

§ The 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

^ Trace level analysis; EQL = 0.0002 µg/L for PFHxS, PFOS, PFOA and sums; EQL = 0.0004 µg/L or 0.005 µg/L for 6:2 FTS and 8:2 FTS

* Higher value adopted from QA/QC analysis

Concentration below the standard LOR (0.01 µg/L) may potentially exeed the catchment specific WQG for PFOS and PFHxS.

Table 13
Sediment Analytical Results

					Moisture	PFAS in Soils Short							
					Moisture Content (%)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
					%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PFAS NEMP 2020 Health Industrial/Commercial (HIL D)						20,000	20,000	50,000				20,000	
PFAS NEMP 2020 Residential with garden/accessible soil (HIL A)						10	10	100				10 ^	
PFAS NEMP 2020 Interim Ecological Direct Exposure							1,000	10,000					
PFAS NEMP 2020 Interim Ecological Indirect Exposure							**10**						
Location Code	**Date**	**Field ID**	**Location Description**	**Criteria**									
DC-UP01	23/07/20	DC-UP01S	Dawesley Ck - up gradient	HIL A	66	<0.3	1.4	<0.3	<0.3	<0.6	1.4	1.4	1.4
DC-UP02	23/07/20	DC-UP02S	Dawesley Ck - up gradient	HIL A	36	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
Creek_4	06/05/20	Creek 4	Dawesley Ck - adjacent CFS site	HIL D	55	4.6	**33**	0.6	<0.2	<0.4	38	38	34
Creek_5	06/05/20	Creek 5	Dawesley Ck - adjacent CFS site	HIL D	73	160	**810**	32	<0.5	<1	1,000	970	840
Creek_6	06/05/20	Creek 6	Dawesley Ck - adjacent CFS site	HIL D	45	55 *	**500 ***	5.5 *	<0.2	<0.4	540 *	540 *	510 *
DC01	11/02/20	DC01s	Dawesley Ck - down gradient	HIL D	74	2.5	**25**	0.2	<0.1	<0.1	27	27	25
BV01	11/02/20	BV01s	Dawesley Ck - down gradient	HIL A	87	8.2	**62**	1.2	<0.5	<0.5	71	70	63
DC02A	17/08/20	DC02AS	Dawesley Ck - down gradient	HIL A	66.4 *	1.8 *	**40.3 ***	0.2	<0.5 *	<0.5 *	35	42.1 *	34
DC03	06/05/20	DC03	Dawesley Ck - down gradient	HIL A	77	3.0	**58**	1.6	1.0	<1	64	61	60
DC04	06/05/20	DC04	Dawesley Ck - down gradient	HIL A	69	1.4	**44**	0.9	<0.5	<1	46	45	45
DC05	06/05/20	DC05	Dawesley Ck - down gradient	HIL A	31	0.3	7.0	<0.2	<0.2	<0.4	7.3	7.3	7
DC06A	18/05/20	DC06A	Dawesley Ck - down gradient	HIL A	80	0.8	**28**	<0.5	<0.5	<1	29	29	28
DC06B	18/05/20	DC06B	Dawesley Ck - down gradient	HIL A	52	0.5	**15**	<0.2	<0.2	<1	15	15	15
DC07	08/05/20	DC07	Dawesley Ck - down gradient	HIL A	63	0.7	**27**	0.8	<0.2	<0.4	29	28	28
DC08	09/06/20	DC08	Dawesley Ck - down gradient	HIL A	74	2.1	**65**	1.0	<0.5	<1	69	68	66
DC09	08/07/20	DC09S	Dawesley Ck - down gradient	HIL A	41 *	1.3	**37 ***	0.1	0.6 *	<0.5 *	39 *	38 *	37 *
DC10	08/07/20	DC10S	Dawesley Ck - down gradient	HIL A	64	1.5	**59**	0.5	<0.1	<0.2	61	60	59
DC11	08/07/20	DC11S	Dawesley Ck - down gradient	HIL A	38	1.4	**31**	0.2	<0.1	<0.2	33	33	32
DC13	08/07/20	DC13S	Dawesley Ck - down gradient	HIL A	25	0.1	3.1	<0.1	<0.1	<0.2	3.2	3.2	3.1
DC14	08/07/20	DC14S	Dawesley Ck - down gradient	HIL A	36	0.3	9.8	<0.1	<0.1	<0.2	10	10	9.8
DC15	08/07/20	DC15S	Dawesley Ck - down gradient	HIL A	57	0.6	**27**	0.8	0.5	<0.2	29	27	27
DC16	23/07/20	DC16S	Dawesley Ck - down gradient	HIL A	69	1.3	**34**	0.2	<0.3	<0.6	35	35	34
DC17	23/07/20	DC17S	Dawesley Ck - down gradient	HIL A	70	1.7	**48**	0.2	<0.3	<0.6	50	49	48
DC17A	10/08/20	DC17AS	Mt Barker Ck - down gradient	HIL A	46 *	<0.2 *	4.3 *	0.3 *	<0.5 *	<0.5 *	4.6 *	4.3 *	3.9 *
DC18	23/07/20	DC18S	Bremer River - down gradient	HIL A	46	0.2	5.8	0.3	<0.2	<0.4	6.3	6.0	6.0
DC19	23/07/20	DC19S	Bremer River - down gradient	HIL A	32.7 *	<0.2 *	0.4	<0.2 *	<0.5 *	<0.5 *	0.4	0.4	0.4
BR01	23/07/20	BR01S	Bremer River - background **	HIL A	36	0.4	1.2	0.2	<0.1	<0.2	1.7	1.6	1.4
MBC01	23/07/20	MBC01S	Mt Barker Ck - background ^^	HIL A	62	<0.3	1.4	<0.3	<0.3	<0.6	1.4	1.4	1.4
MBC02	23/07/20	MBC02S	Mt Barker Ck - background ^^	HIL A	67 *	<0.3 *	2.2	0.4	<0.5 *	<0.6 *	2.5	2.2	2.5
NC01	23/07/20	NC01S	Nairne Ck - background ##	HIL A	46	<0.2	0.9	<0.2	<0.2	<0.4	0.9	0.9	0.9
NC02	23/07/20	NC02S	Nairne Ck - background ##	HIL A	54	<0.2	0.4	<0.2	<0.2	<0.4	0.4	0.4	0.4

^ If the concentration of PFHxS > PFOS this guideline value needs to be adjusted accordingly. Please refer to Section 8.5.2.1 of the PFAS NEMP 2.0 guideline for further information.

* Higher value adopted from QA/QC analysis

** Bremer River up gradient of confluence with Mt Barker Creek (between DC17A and DC18)

^^ Mt Barker Creek up gradient of confluence with Dawesley Creek (between DC17 and DC17A)

Nairne Creek up gradient of confluence with Dawesley Creek (between DC11 and DC13)

Table 14
Pre and Post TOPA Groundwater Analytical Results

			PFAS - Perfluoroalkyl Sulfonic Acids						PFAS - Perfluoroalkyl Carboxylic Acids									
			Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluorooctanoic acid (PFOA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.05	0.1	0.5
NHMRC 2019 Recreational Water PFAS Guidelines						2		2							10			
PFAS NEMP 2020 Health Drinking Water						0.07		0.07							0.56			
PFAS NEMP 2.0 2020 Freshwater - 99% protection level (1)								0.00023[§]							19			
Catchment specific WQG - highly disturbed systems (2)						0.0046		0.0066										
Location Code	**Date**	**Sample Type**																
Pre-TOPA																		
BH22	12/02/20	groundwater	<0.01	<0.01	<0.01	0.07	<0.02	0.09	<0.02	<0.02	0.02	0.02	<0.01	<0.02	0.10	<0.05	<0.1	<0.5
DC01	11/02/20	surface water	0.03	0.03	<0.01	0.16	<0.02	0.099	0.02	0.04	0.02	0.099	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
H02	12/02/20	groundwater	0.25	0.19	<0.01	0.38	<0.02	0.04	0.08	0.25	0.03	0.38	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
H04a	12/02/20	groundwater	0.03	0.03	<0.01	0.15	<0.02	0.02	0.03	0.05	0.02	0.1	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
H06a	12/02/20	groundwater	0.02	0.03	<0.01	0.12	<0.02	0.03	<0.02	0.04	0.01	0.09	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
Post-TOPA																		
BH22	12/02/20	groundwater	<0.01	<0.01	<0.01	0.06	<0.02	0.06	<0.02	<0.02	0.02	0.02	<0.01	<0.02	0.08	<0.05	<0.1	<0.5
DC01	11/02/20	surface water	0.03	0.03	<0.01	0.15	<0.02	0.10	0.04	0.05	0.02	0.15	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
H02	12/02/20	groundwater	0.22	0.14	<0.01	0.28	<0.02	0.02	0.1	0.23	0.03	0.34	<0.01	<0.02	0.01	<0.05	<0.1	<0.5
H04a	12/02/20	groundwater	0.03	0.03	<0.01	0.13	<0.02	<0.01	0.03	0.04	0.02	0.11	<0.01	<0.02	0.02	<0.05	<0.1	<0.5
H06a	12/02/20	groundwater	0.03	0.02	<0.01	0.09	<0.02	<0.01	0.02	0.04	0.01	0.09	<0.01	<0.02	<0.01	<0.05	<0.1	<0.5

(1) 99% species protection level - applies to bioaccumulation risk to slightly to moderately disturbed systems and to direct ecological risk to high conservation value systems.

(2) WQG for PFOS bioaccumulation risk - 90th percentile of background concentrations in Mt Barker Creek - applies to Dawesley Creek.

[§] The 99% species protection level for PFOS was not applied. It was replaced with the catchment specific WQG.

Table 14
Pre and Post TOPA Groundwater Analytical Results

			PFAS - Perfluoroalkyl Sulfonamide								PFAS - Fluorotelomer Sulfonic Acids				Sums
			Perfluorooctane sulfonamide (FOSA)	Perfluoroundecanoic acid (PFUnDA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.1	0.02	0.05	0.1	0.5	0.02	0.02	0.05	0.01	0.01	0.01	0.01	0.01
NHMRC 2019 Recreational Water PFAS Guidelines															2
PFAS NEMP 2020 Health Drinking Water															0.07
PFAS NEMP 2.0 2020 Freshwater - 99% protection level (1)															
Catchment specific WQG - highly disturbed systems (2)															
Location Code	**Date**	**Sample Type**													
Pre-TOPA															
BH22	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.16
DC01	11/02/20	surface water	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.259
H02	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.42
H04a	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.17
H06a	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.15
Post-TOPA															
BH22	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.12
DC01	11/02/20	surface water	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.25
H02	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.30
H04a	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.13
H06a	12/02/20	groundwater	<0.1	<0.02	<0.05	<0.1	<0.5	<0.02	<0.02	<0.05	<0.01	<0.01	<0.01	<0.01	0.09

Table 15
Biota Analytical Results

			PFAS in Biota Short							
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL			1	1	1	1	1	1	1	1
FSANZ 2017 Fruit (all) Trigger Point					5.1				0.6	
FSANZ 2017 Vegetables (all) Trigger Point					8.8				1.1	
FSANZ 2017 Meat Mammalian Trigger Point					28				3.5	
Location Code	**Date**	**Field ID**								
CFS State Training Centre	30/03/20	CFS Apple 1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
260 Pyrites Road	10/03/20	Capsicum_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Corn_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Eggplant_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Kale_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Potato_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Pumpkin_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Rockmelon_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
260 Pyrites Road	10/03/20	Tomato_1	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5
220 Pyrites Road	10/03/20	Lamb_1	<1	<1	<1	<1	<1	<1	<1	<1

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Table 16
Blank Analytical Results

			PFAS in Waters Short							
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*	0.0004 - 0.01*	0.0004 - 0.02*	0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*
Field ID	**Date**	**Sample Type**								
FB01	06/05/20	Field_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB01	06/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB02	06/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB01	06/05/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
WB01	06/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
FB02	07/05/20	Field_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
FXB01	07/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB03	07/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB04	07/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB02	07/05/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
FB03	08/05/20	Field_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB05	08/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB06	08/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
FXB2	18/05/20	Field_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB02	18/05/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB02	18/05/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB03	09/06/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB05	16/06/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB05	16/06/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB06	19/06/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
TB06	19/06/20	Trip_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB	08/07/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
TB	08/07/20	Trip_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB07	23/07/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
TB07	23/07/20	Trip_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB08	10/08/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
TB08	10/08/20	Trip_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB09	17/08/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
TB09	17/08/20	Trip_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
FB10	11/09/20	Field_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB10	11/09/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
FB11	17/09/20	Field_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB11	17/09/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
FB12	24/09/20	Field_B	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
RB12	24/09/20	Rinsate	<0.0002	<0.0002	<0.0002	<0.0004	<0.0004	<0.0002	<0.0002	<0.0002
FB13	28/10/20	Field_B	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
RB13	28/10/20	Rinsate	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
FB01	17/11/20	Field_B	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
RB01	17/11/20	Rinsate	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
RB02	18/11/20	Rinsate	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
FB02	24/11/20	Field_B	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
RB03	24/11/20	Rinsate	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
W1	17/11/20	Field_B (DI water)	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
W2	18/11/20	Field_B (Mains water)	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
FD01		Field_B (Mains water)	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
W3	24/11/20	Field_B (Mains water)	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
FD02		Field_B (Mains water)	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001

* Range of EQL values for trace and standard analysis

Table 17
Water RPD Results

			PFAS in Water												
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)
			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			0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*	0.0004 - 0.01*	0.0004 - 0.02*	0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*	0.02	0.01	0.01	0.01	0.01
Date	**Field ID**	**Matrix**													
08/05/20	DC05	water	0.04	0.09	<0.01	<0.01	<0.02	0.13	0.09	0.13	-	-	-	-	-
08/05/20	QC12	water	2.1	0.64	0.14	<0.01	<0.02	2.7	0.78	2.9	-	-	-	-	-
RPD (%)			193	151				182	159	183					
08/05/20	DC05	water	0.04	0.09	<0.01	<0.01	<0.02	0.13	0.09	0.13	-	-	-	-	-
08/05/20	QC12A	water	2.23	0.98	0.19	<0.05	<0.05	3.21	1.17	-	-	-	-	-	-
RPD (%)			193	166				184	171						
18/05/20	DC06	water	0.07	0.17	<0.01	<0.01	<0.02	0.24	0.17	0.24	-	-	-	-	-
18/05/20	QA16	water	0.07	0.07	<0.01	<0.01	<0.02	0.14	0.07	0.14	-	-	-	-	-
RPD (%)			0	83				53	83	53					
18/05/20	DC06	water	0.07	0.17	<0.01	<0.01	<0.02	0.24	0.17	0.24	-	-	-	-	-
18/05/20	QA16A	water	0.08	0.11	<0.01	<0.05	<0.05	0.19	0.11	-	-	-	-	-	-
RPD (%)			13	43				23	43						
08/05/20	FX13	water	0.06	0.42	0.01	<0.01	<0.02	0.48	0.44	0.49	-	-	-	-	-
08/05/20	QA18	water	0.05	0.33	0.01	<0.01	<0.02	0.39	0.35	0.40	-	-	-	-	-
RPD (%)			18	24	0			21	23	20					
08/05/20	FX13	water	0.06	0.42	0.01	<0.01	<0.02	0.48	0.44	0.49	-	-	-	-	-
08/05/20	QA18A	water	0.06	0.40	0.01	<0.05	<0.05	0.46	0.41	-	-	-	-	-	-
RPD (%)			0	5	0			4	7						
18/05/20	DIV01	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
18/05/20	QA19	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
RPD (%)															
18/05/20	DIV01	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
18/05/20	QA19A	water	<0.02	<0.01	<0.01	<0.05	<0.05	<0.01	<0.01	-	-	-	-	-	-
RPD (%)															
09/06/20	DC08	water	0.06	0.08	<0.01	<0.01	<0.02	0.14	0.08	0.14	-	-	-	-	-
09/06/20	QA20	water	0.06	0.07	<0.01	<0.01	<0.02	0.13	0.07	0.13	-	-	-	-	-
RPD (%)			0	13				7	13	7					
09/06/20	DC08	water	0.06	0.08	<0.01	<0.01	<0.02	0.14	0.08	0.14	-	-	-	-	-
09/06/20	QA20A	water	0.09	0.15	<0.01	<0.05	<0.05	0.24	0.15	0.28	-	-	-	-	-
RPD (%)			40	61				53	61	67					

Table 17
Water RPD Results

			PFAS in Water												
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)
			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			0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*	0.0004 - 0.01*	0.0004 - 0.02*	0.0002 - 0.01*	0.0002 - 0.01*	0.0002 - 0.01*	0.02	0.01	0.01	0.01	0.01
Date	**Field ID**	**Matrix**													
15/06/20	GW01	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
15/06/20	QA20	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
RPD (%)															
15/06/20	GW01	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
15/06/20	QA20A	water	<0.02	<0.01	<0.01	<0.05	<0.05	<0.01	<0.01		-	-	-	-	-
RPD (%)															
19/06/20	Hawthorn1	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
19/06/20	QA21	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
RPD (%)															
19/06/20	Hawthorn1	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
19/06/20	QA21A	water	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	-	-	-	-	-
RPD (%)															
08/07/20	DC09	water	0.11	0.13	0.0088	<0.0004	<0.0004	0.23	0.14	0.24	-	-	-	-	-
08/07/20	QA25	water	0.12	0.13	0.0092	<0.0004	<0.0004	0.25	0.14	0.26	-	-	-	-	-
RPD (%)			9	0	4			8	0	8					
08/07/20	DC09	water	0.110	0.13	0.0088	<0.0004	<0.0004	0.230	0.14	0.24	-	-	-	-	-
08/07/20	QA25A	water	0.068	0.119	0.007	<0.005	<0.005	0.187	0.126	-	-	-	-	-	-
RPD (%)			47	9	23			21	11						
08/07/20	WW02	water	0.0024	0.0003	0.001	<0.0004	<0.0004	0.0026	0.001	0.0036	-	-	-	-	-
08/07/20	QA26	water	0.0025	0.0003	0.0009	<0.0004	<0.0004	0.0028	0.001	0.0037	-	-	-	-	-
RPD (%)			4	0	11			7	0	3					
08/07/20	WW02	water	0.0024	0.0003	0.001	<0.0004	<0.0004	0.0026	0.001	0.0036	-	-	-	-	-
08/07/20	QA26A	water	<0.002	<0.002	<0.002	<0.005	<0.005	<0.002	-	-	-	-	-	-	-
RPD (%)															
23/07/20	DC 19	water	0.014	0.012	0.0029	<0.0004	<0.0004	0.026	0.015	0.029	-	-	-	-	-
23/07/20	QC27	water	0.011	0.013	0.0034	<0.0004	<0.0004	0.024	0.016	0.027	-	-	-	-	-
RPD (%)			24	8	16			8	6	7					
23/07/20	DC 19	water	0.014	0.012	0.0029	<0.0004	<0.0004	0.026	0.015	0.029	-	-	-	-	-
23/07/20	QC27A	water	0.014	0.020	0.0030	<0.005	<0.005	0.034	0.023	0.046	-	-	-	-	-
RPD (%)			0	50	3			27	42	45					
23/07/20	DC 19	water	0.014	0.012	0.0029	<0.0004	<0.0004	0.026	0.015	0.029	-	-	-	-	-
23/07/20	QC29A	water	0.015	0.020	0.0030	<0.005	<0.005	0.035	0.023	0.049	-	-	-	-	-
RPD (%)			7	50	3			30	42	51					

Table 18
Sediment RPD Results

			PFAS in Soils Short							
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL			0.2*	0.2*	0.2*	0.2*	0.4*	0.2*	0.2*	0.2*
Date	**Field ID**	**Matrix Type**								
06/05/20	DC05	sediment	0.3	7.0	<0.2	<0.2	<0.4	7.3	7.0	7.3
06/05/20	QC11	sediment	<0.2	3.5	<0.2	<0.2	<0.4	3.5	3.5	3.5
RPD (%)				67				70	67	70
06/05/20	DC05	sediment	0.3	7.0	<0.2	<0.2	<0.4	7.3	7.0	7.3
06/05/20	QC11A	sediment	<0.2	4.3	<0.2	<0.5	<0.5	4.3		
RPD (%)				48				52		
08/05/20	Creek_6	sediment	49	160	3.2	<0.2	<0.4	210	160	210
08/05/20	QC13	sediment	55	290	5.1	<0.2	<0.4	340	300	350
RPD (%)			12	58	46			47	61	50
08/05/20	Creek_6	sediment	49	160	3.2	<0.2	<0.4	210	160	210
08/05/20	QC13A	sediment	39	500	5.5	<0.2	<0.4	540	510	540
RPD (%)			23	103	53			88	104	88
09/06/20	DC08	sediment	2.1	65	1.0	<0.5	<1	68	66	69
09/06/20	QA20	sediment	1.7	53	0.6	<0.5	<1	55	54	56
RPD (%)			21	20	50			21	20	21
08/07/20	DC09S	sediment	1.3	22	0.10	<0.1	<0.2	23	22	24
08/07/20	QA25S	sediment	1.1	37	0.10	0.6	<0.2	38	37	39
RPD (%)			17	51	0			49	51	48
08/07/20	DC09S	sediment	1.3	22	0.1	<0.1	<0.2	23	22	24
08/07/20	QA25AS	sediment	0.5	14.2	<0.2	<0.5	<0.5	14.7		
RPD (%)			89	43				44		
23/07/20	DC19S	sediment	<0.1	0.40	<0.1	<0.1	<0.2	0.4	0.4	0.40
23/07/20	QC27S	sediment	<0.1	0.20	<0.1	<0.1	<0.2	0.2	0.2	0.20
RPD (%)				67				67	67	67
23/07/20	DC19S	sediment	<0.1	0.40	<0.1	<0.1	<0.2	0.40	0.40	0.40
23/07/20	QC27AS	sediment	<0.2	0.30	<0.2	<0.5	<0.5	0.30	0.30	0.30
RPD (%)				29				29	29	29
23/07/20	MBC02S	sediment	<0.2	2.2	0.40	<0.2	<0.4	2.2	2.5	2.5
23/07/20	QC28S	sediment	<0.3	1.8	0.20	<0.3	<0.6	1.8	2.1	2.1
RPD (%)				20	67			20	17	17
23/07/20	MBC02S	sediment	<0.2	2.2	0.40	<0.2	<0.4	2.2	2.5	2.5
23/07/20	QC28AS	sediment	<0.2	1.2	0.30	<0.5	<0.5	1.2	1.5	1.9
RPD (%)				59	29			59	50	27
10/08/20	DC17AS	sediment	<0.1	2.9	<0.1	<0.1	<0.2	2.9	2.9	2.9
10/08/20	QC29S	sediment	<0.2	3.9	<0.2	<0.2	<0.4	3.9	3.9	3.9
RPD (%)				29				29	29	29
10/08/20	DC17AS	sediment	<0.1	2.9	<0.1	<0.1	<0.2	2.9	2.9	2.9
10/08/20	QC29AS	sediment	<0.2	4.3	0.30	<0.5	<0.5	4.3	4.6	4.6
RPD (%)				39				39	45	45
17/08/20	DC02AS	sediment	1.2	34	0.20	<0.1	<0.2	35	34	35
17/08/20	QC30S	sediment	1.0	26	0.20	<0.1	<0.2	27	26	27
RPD (%)			18	27	0			26	27	26
17/08/20	DC02AS	sediment	1.2	34	0.20	<0.1	<0.2	35	34	35
17/08/20	QC30AS	sediment	1.8	40.3	0.20	<0.5	<0.5	42.1	40.5	42.3
RPD (%)			40	17	0			18	17	19

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: unlimited (1 - 10 x EQL) and 50 (> 10 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

* Some EQL values were higher or lower than this number.

Table 19
Soil RPD Results

Date	Field ID	Matrix Type	PFAS in Soils Short							
			Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
EQL			0.2*	0.2*	0.2*	0.2*	0.4*	0.2*	0.2*	0.2*
06/05/20	SB02_0.1-0.3	soil	0.4	1.9	<0.1	<0.1	<0.2	2.3	1.9	2.3
06/05/20	QC02	soil	0.3	1.1	<0.1	<0.1	<0.2	1.4	1.1	1.4
RPD			29	53				49	53	49
06/05/20	SB02_0.1-0.3	soil	0.4	1.9	<0.1	<0.1	<0.2	2.3	1.9	2.3
06/05/20	QC02A	soil	0.2	1.3	<0.2	<0.5	<0.5	1.5	1.3	1.5
RPD			67	38				42	38	42
06/05/20	SB07_0-0.2	soil	15	140	2.6	<0.1	0.4	150	140	160
06/05/20	QC03	soil	18	170	3.3	<0.1	0.4	190	170	190
RPD			18	19	24		0	24	19	17
06/05/20	SB07_0-0.2	soil	15	140	2.6	<0.1	0.4	150	140	160
06/05/20	QC03A	soil	15.4	178	3.3	<0.5	1.2	193	181	198
RPD			3	24	24		100	25	26	21
06/05/20	SW04_1.0-1.3	soil	0.6	1.1	<0.2	<0.2	<0.4	1.7	1.1	1.7
06/05/20	QC04	soil	0.4	0.6	<0.2	<0.2	<0.4	1.0	0.6	1.0
RPD			40	59				52	59	52
06/05/20	SW04_1.0-1.3	soil	0.6	1.1	<0.2	<0.2	<0.4	1.7	1.1	1.7
06/05/20	QC04A	soil	0.4	0.7	<0.2	<0.5	<0.5	1.1	0.7	1.1
RPD			40	44				43	44	43
06/05/20	SB04_0-0.2	soil	4.3	19	2.0	<0.1	2.9	24	21	29
06/05/20	QC05	soil	2.6	13	1.2	<0.1	1.0	15	14	18
RPD			49	38	50		97	46	40	47
06/05/20	SB04_0-0.2	soil	4.3	19	2.0	<0.1	2.9	24	21	29
06/05/20	QC05A	soil	4.4	28.0	3.1	<0.5	10.8	32.4	-	-
RPD			2	38	43		115	30		
07/05/20	SW07_2.5-2.8	soil	0.4	1.1	<0.2	<0.2	<0.4	1.5	1.1	1.5
07/05/20	QC06	soil	0.4	1.1	<0.2	<0.2	<0.4	1.6	1.1	1.6
RPD			0	0				6	0	6
07/05/20	SW07_2.5-2.8	soil	0.4	1.1	<0.2	<0.2	<0.4	1.5	1.1	1.5
07/05/20	QC06A	soil	0.6	1.3	<0.2	<0.5	<0.5	1.9	1.3	1.9
RPD			40	17				24	17	24
07/05/20	SW11_2.0-2.3	soil	0.3	<0.2	<0.2	<0.2	<0.4	0.3	<0.2	0.3
07/05/20	QC08	soil	0.6	0.4	<0.2	<0.2	<0.4	1.0	0.4	1.0
RPD			67					108		108
07/05/20	SW11_2.0-2.3	soil	0.3	<0.2	<0.2	<0.2	<0.4	0.3	<0.2	0.3
07/05/20	QC08A	soil	<0.2	<0.2	<0.2	<0.5	<0.5	<0.2	-	-
RPD										
17/09/20	Garden2	soil	<0.1	0.4	<0.1	<0.1	<0.2	0.4	0.4	0.4
17/09/20	QC33	soil	<0.1	0.3	<0.1	<0.1	<0.2	0.3	0.3	0.3
RPD (%)				29				29	29	29
17/09/20	Garden2	soil	<0.1	0.4	<0.1	<0.1	<0.2	0.4	0.4	0.4
17/09/20	QC33A	soil	<0.2	0.5	<0.2	<0.5	<0.5	0.5	0.5	0.5
RPD (%)				22				22	22	22

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: unlimited (1 - 10 x EQL) and 50 (> 10 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

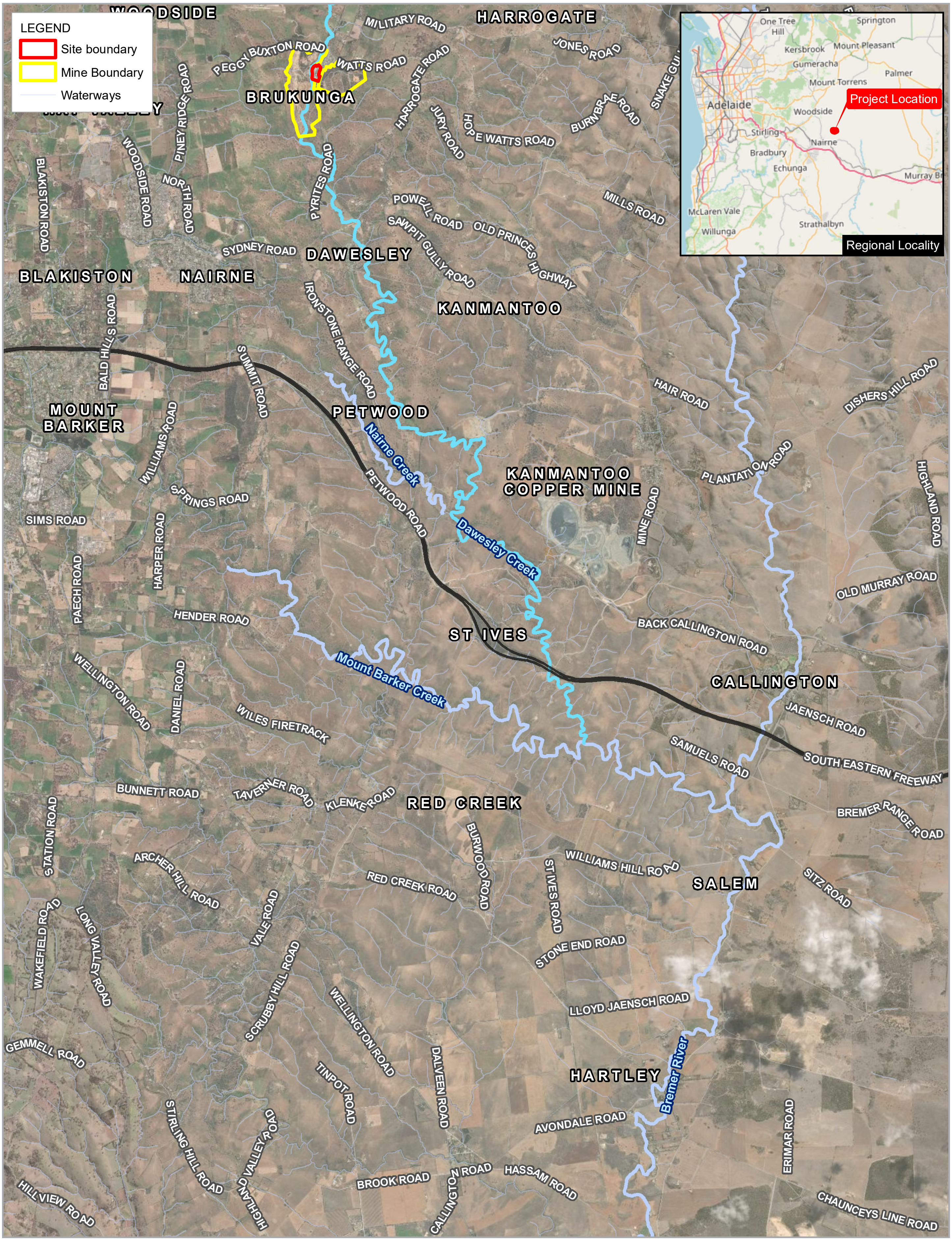
* Some EQL values were higher or lower than this number.

Table 20
Concrete RPD Results

Location Code	Field ID	Sample Type	PFAS in Concrete and Pavers LEAF/ASLP								PFAS in Concrete and Pavers Short							
			Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Tank7	12516828/Tank7/01a	Normal	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001								
	12516828/QAa	Field_D	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001								
RPD																		
Tank7	12516828/Tank7/01b	Normal									<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	12516828/QAb	Field_D									<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
RPD																		
Hot Pad B	HPB1	Normal	7.0	5.1	7.3	0.058	0.039	2.1	5.0	0.18	0.18	0.14	0.19	0.0016	0.0020	0.044	0.14	0.0048
	HPB/QA	Field_D	0.46	0.26	0.51	0.020	0.005	0.22	0.24	0.024	0.024	0.018	0.027	0.001	0.0005	0.0078	0.016	0.0010
RPD			175	181	174	97	155	162	182	153	153	154	150	46	120	140	159	131

Location Description	Field ID	Sample Type	PFAS in Water Short							
			Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Mains water used for concrete coring Tank 7	W2	Normal	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
	FD01	Field_D	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
RPD										
Mains water used for concrete coring Tanks 1 & 4	W3	Normal	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
	FD02	Field_D	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
RPD										

Figures



Paper Size ISO A4

0 1 2 3 4

Kilometres

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

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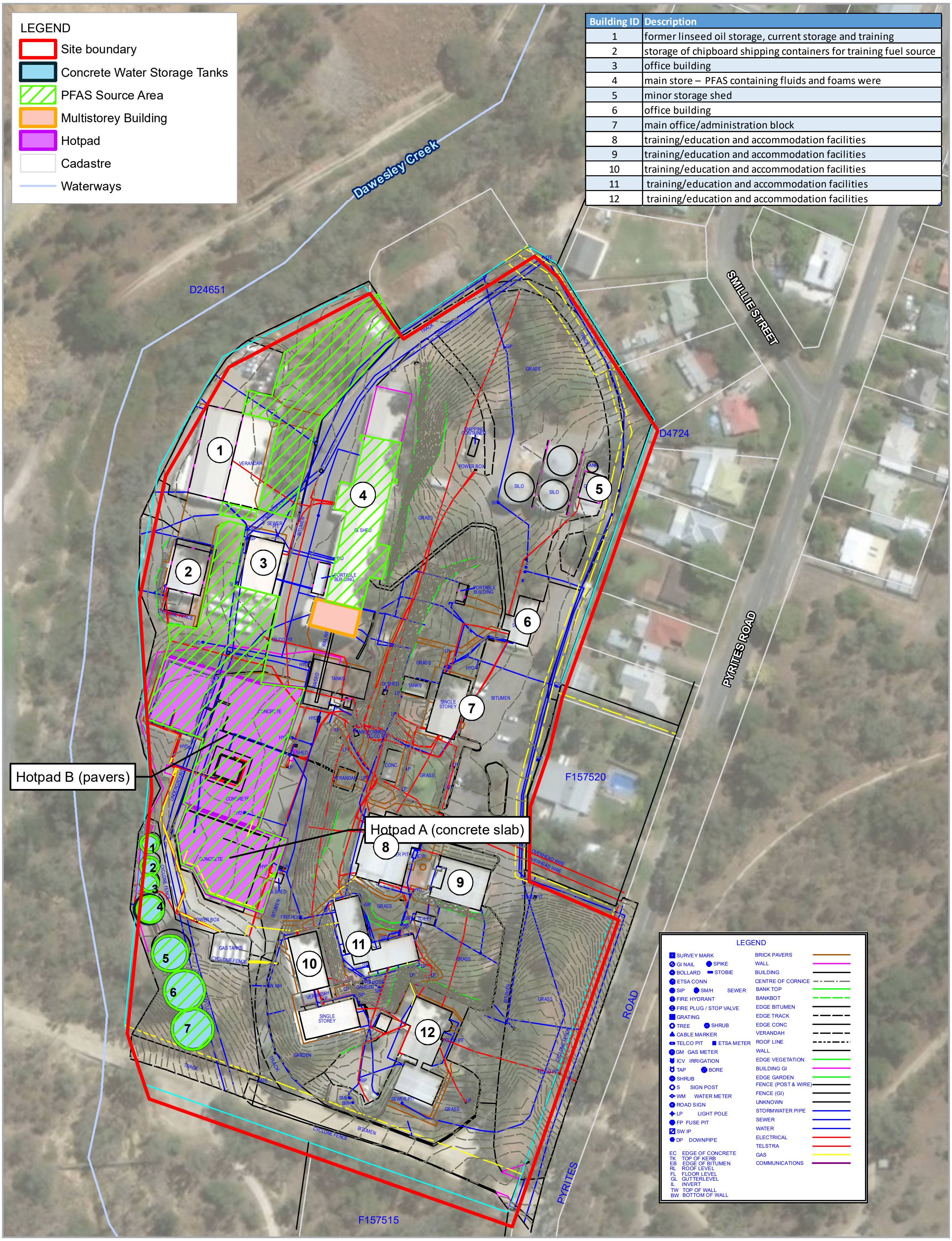
Project No.	**12516828**
Revision No.	**C**
Date	**20 Nov 2020**

Site location plan

FIGURE 1

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z023_SiteLocationPlan_Fig1_C.mxd

Data source: Aerial imagery - esri 2020 / Inset map - Open Street Map 2020 © OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Building ID	Description
1	former linseed oil storage, current storage and training
2	storage of chipboard shipping containers for training fuel source
3	office building
4	main store – PFAS containing fluids and foams were
5	minor storage shed
6	office building
7	main office/administration block
8	training/education and accommodation facilities
9	training/education and accommodation facilities
10	training/education and accommodation facilities
11	training/education and accommodation facilities
12	training/education and accommodation facilities

Paper Size ISO A4

0 20 40

Metres

N

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

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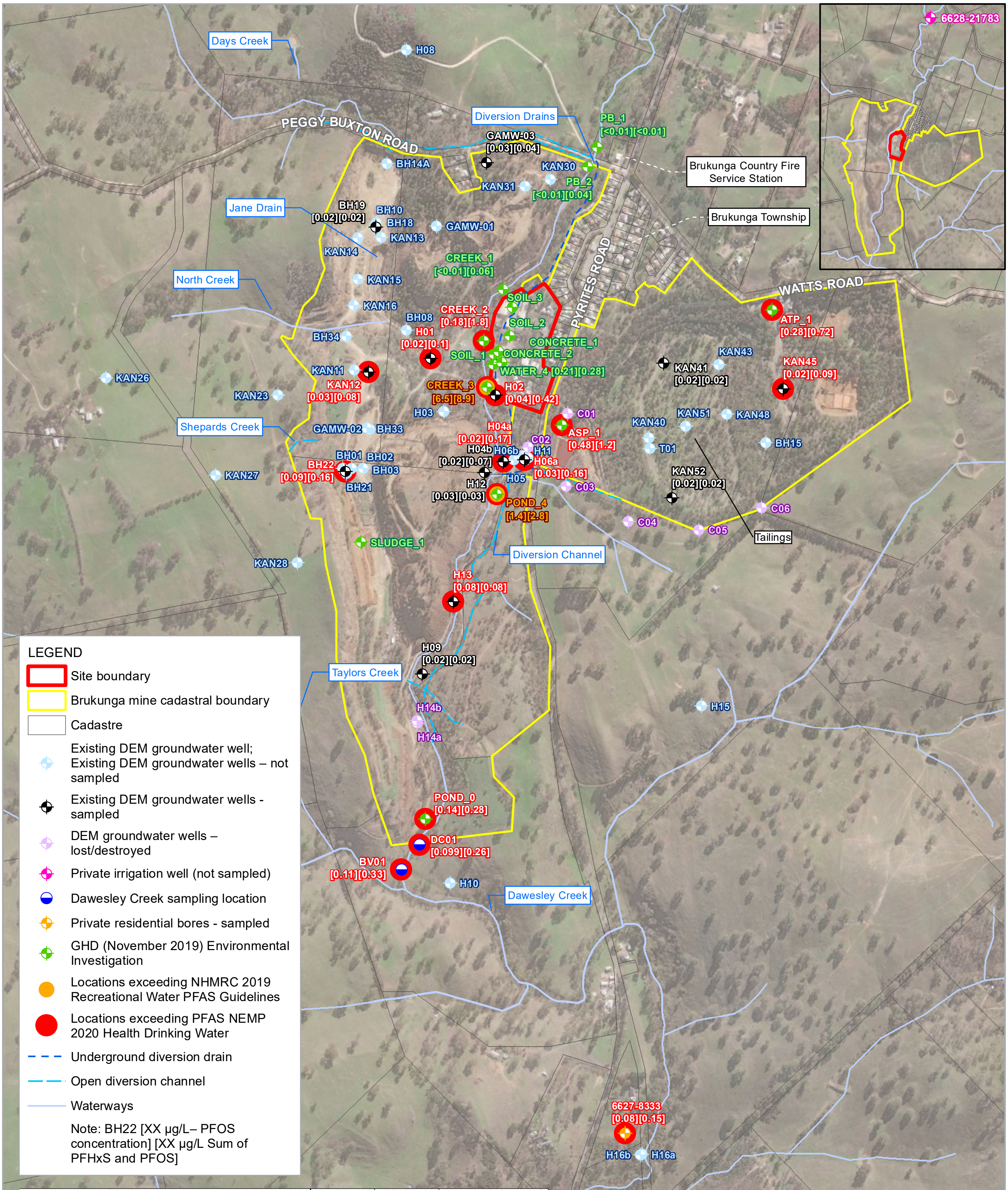
Site Layout Plan and PFAS Source Areas

Project No. 12516828
Revision No. F
Date 17 Mar 2021

FIGURE 2

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z022_SiteLayoutPlan.mxd

Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Water Assessment Criteria	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
PFAS NEMP 2020 Freshwater - 99% protection level	0.00023	19	
NHMRC 2019 Recreational Water PFAS Guidelines		10	2
NHMRC 2008 / ADWG 2011 Recreational Water - domestic setting*		5.6	0.7
PFAS NEMP 2020 Health Drinking Water		0.56	0.07

* applies to residential groundwater bores

Paper Size ISO A4

0 200 400

Metres

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

N

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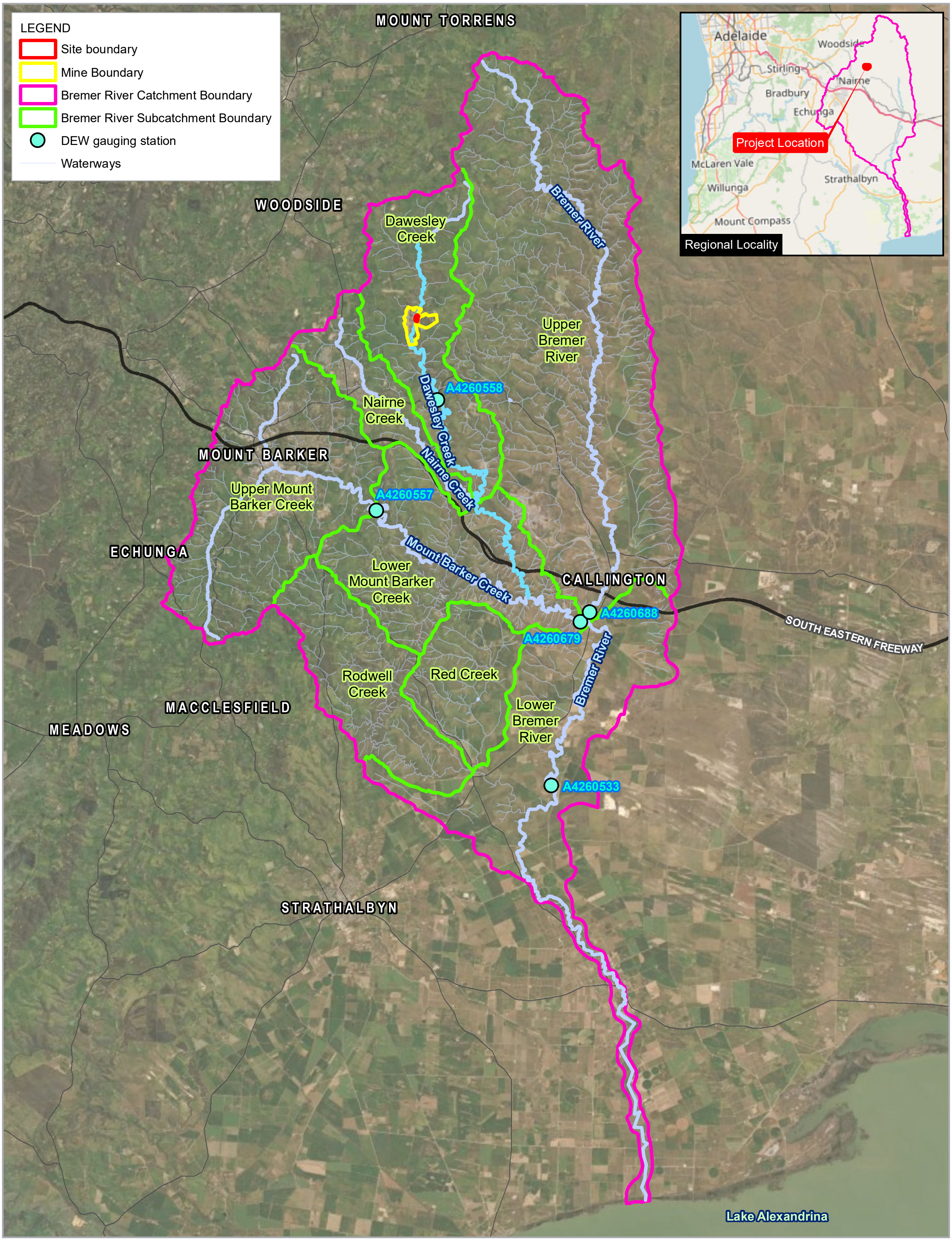
Previous Groundwater and Surface Water Results (Feb/Mar 2020)

Project No.	12516828
Revision No.	F
Date	16 Mar 2021

FIGURE 3

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z012_PreviousGroundwaterSurfaceWaterResults.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: eibbertson



Paper Size ISO A4

0 1 2 3 4

Kilometres

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

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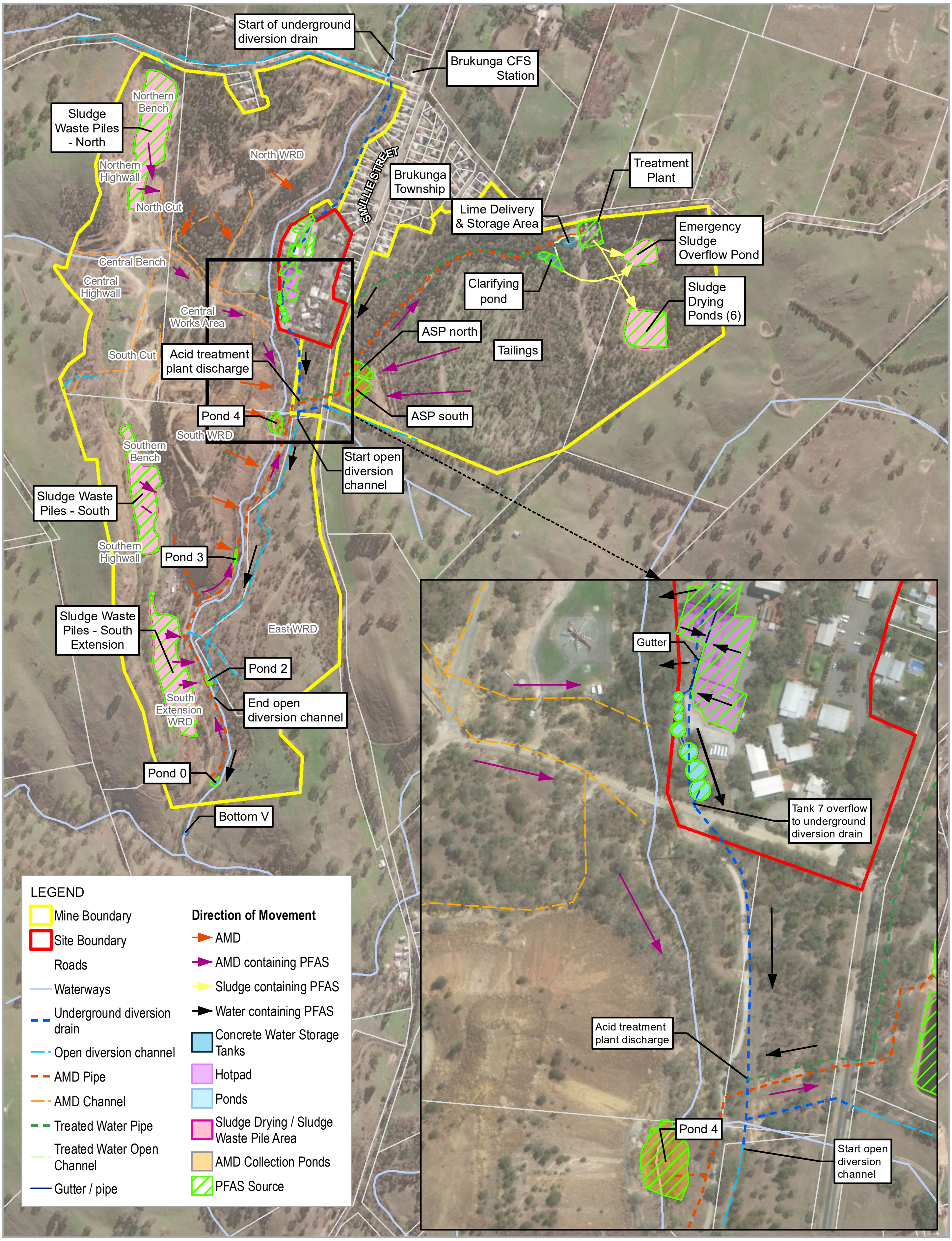
Bremer River Catchment and Subcatchments

Project No.	**12516828**
Revision No.	**D**
Date	**26 Feb 2021**

FIGURE 4

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z041_BremerRiverCatchment_Fig4_D.mxd

Data source: Aerial imagery - esri 2021 / Inset map - Open Street Map 2021 © OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Paper Size ISO A4

0 200 400

Metres

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

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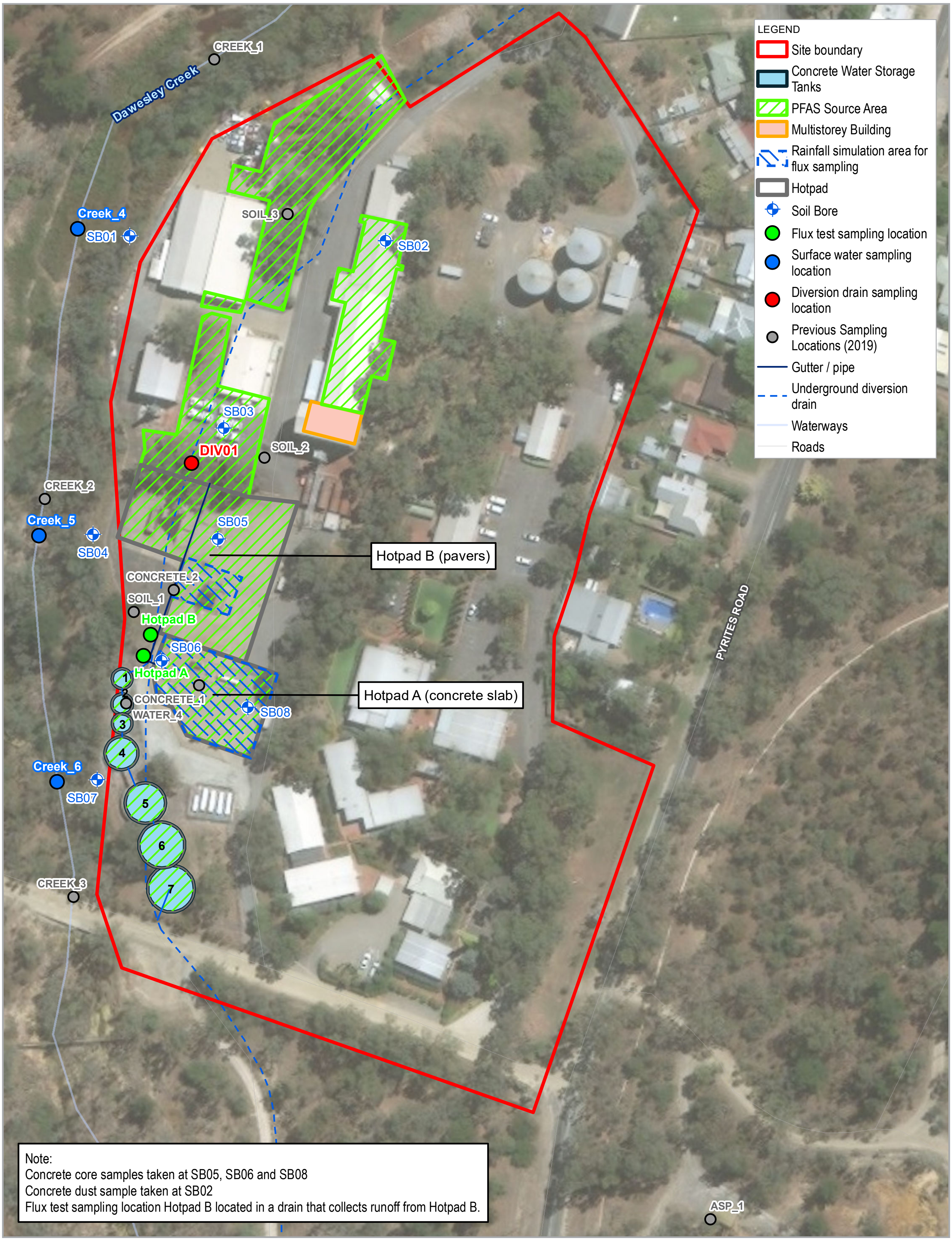
CFS State Training Centre Runoff Collection System and Brukunga Mine AMD Treatment System

Project No.	**12516828**
Revision No.	**F**
Date	**17 Mar 2021**

FIGURE 5

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z042_RunOffCollectionSystem.mxd Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Note:
Concrete core samples taken at SB05, SB06 and SB08
Concrete dust sample taken at SB02
Flux test sampling location Hotpad B located in a drain that collects runoff from Hotpad B.

Paper Size ISO A4

0 10 20 30 40

Meters

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

N

GHD

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Soil bore, concrete dust and flux test sampling location plan

Project No.	**12516828**
Revision No.	**K**
Date	**17 Mar 2021**

FIGURE 6a

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z020_SoilBoreLocationPlan.mxd Data source: Aerial imagery - esri 2019 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt

Paper Size ISO A4

0 4 8 12 16

Meters

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

N

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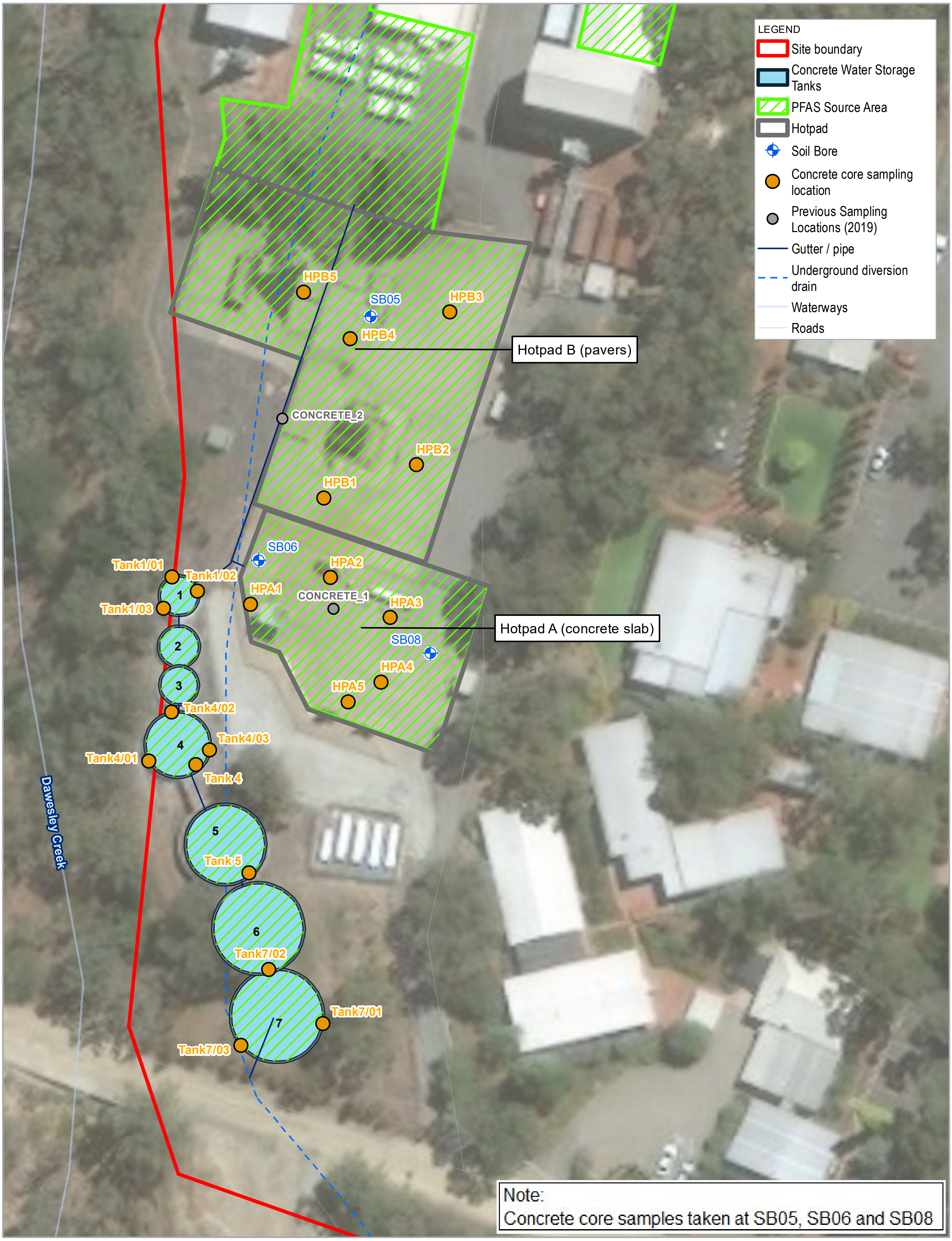
Off-site Residential Soil Sampling Location Plan: 296 Pyrites Road

Project No.	**12516828**
Revision No.	**B**
Date	**18 Feb 2021**

FIGURE 6b

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z039_OffSiteResidentialSamplingPlans_Fig6b_B.mxd Data source: Aerial imagery - esri 2019 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Note:
Concrete core samples taken at SB05, SB06 and SB08

Paper Size ISO A4

0 5 10 15 20

Meters

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

N

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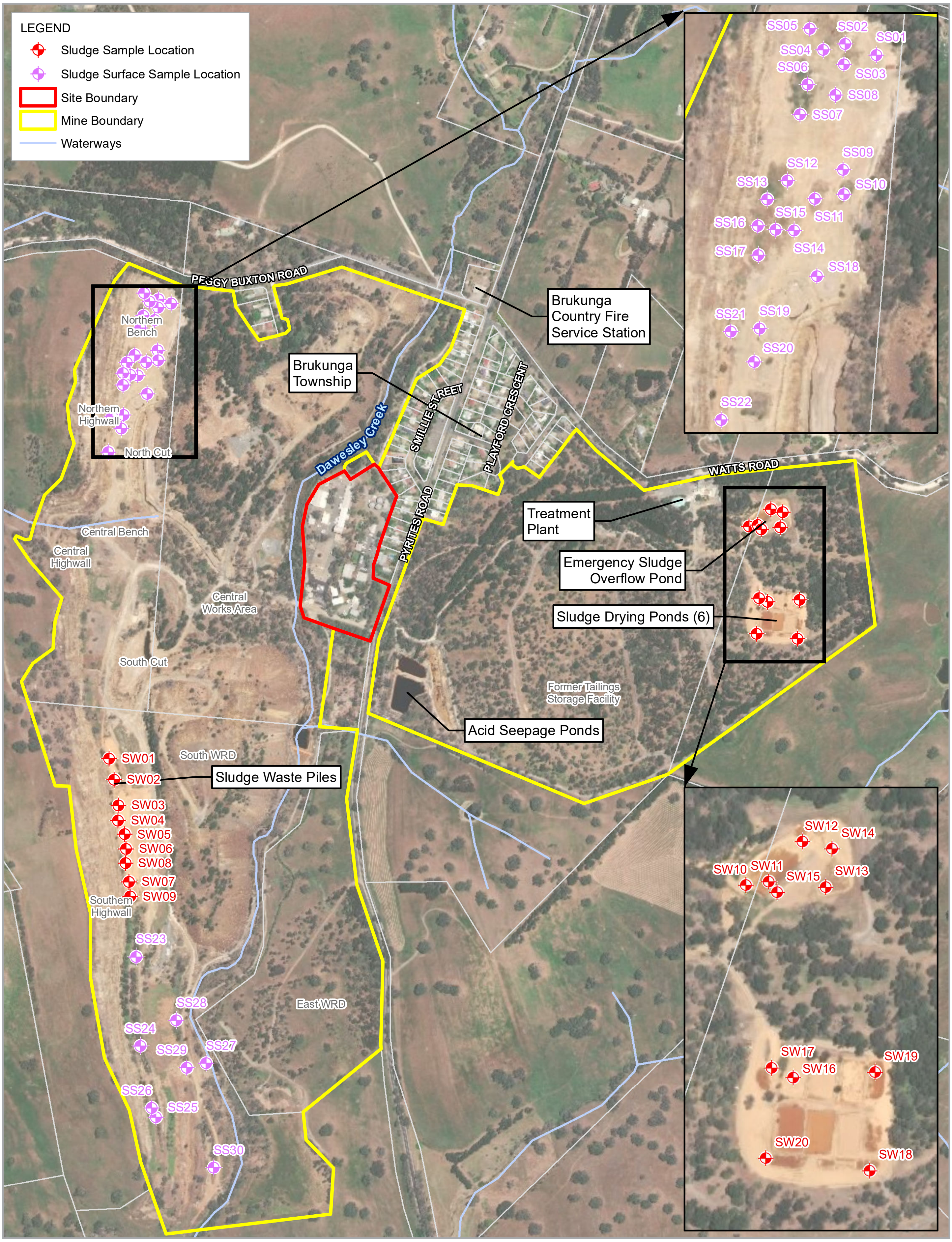
Concrete Core Sampling Location Plan

Project No.	**12516828**
Revision No.	**C**
Date	**16 Mar 2021**

FIGURE 6c

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z044_ConcreteSamplingLocations.mxd Data source: Aerial imagery - esri 2019 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: eibbertson



Paper Size ISO A4

0 200 400

Metres

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

N

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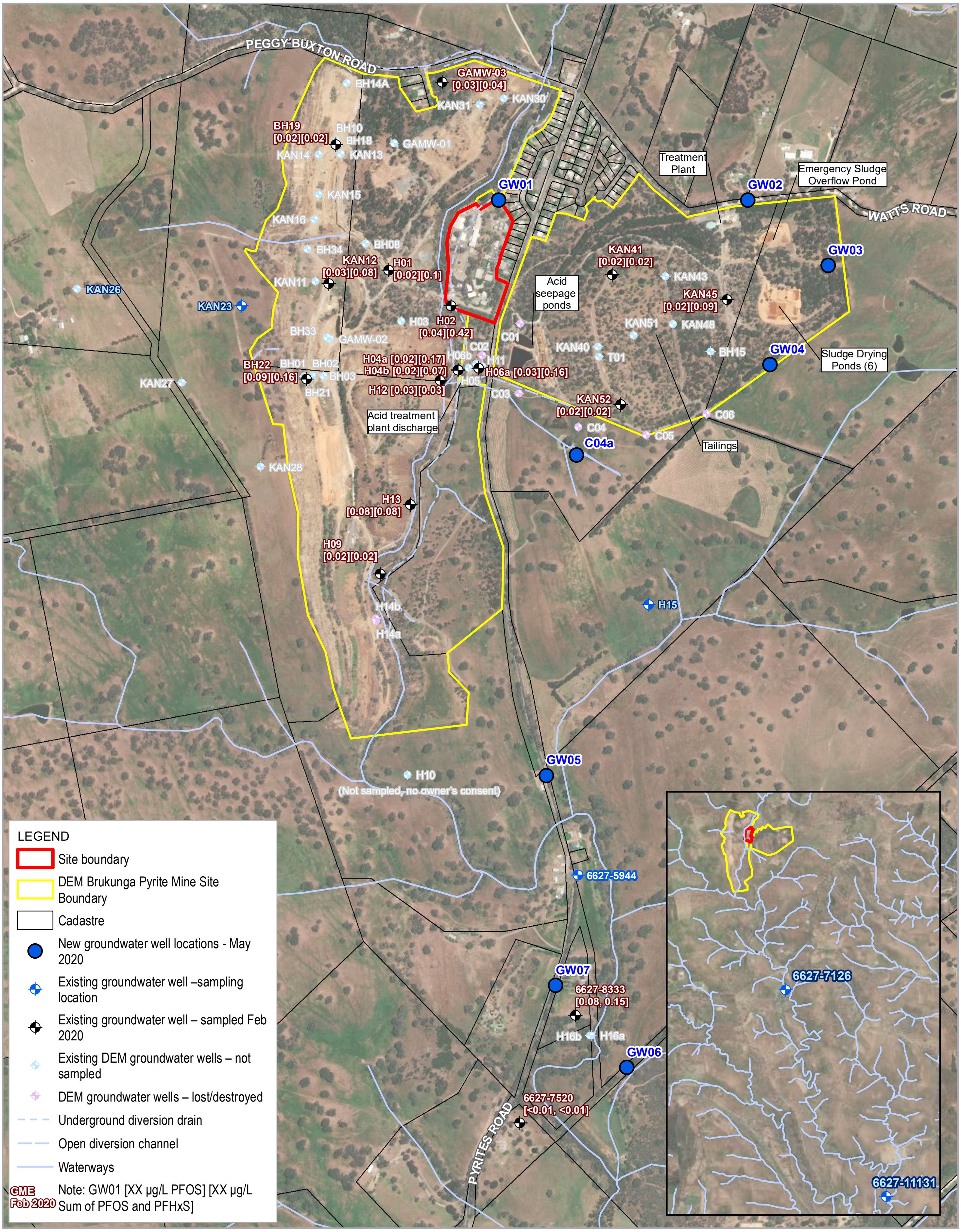
Project No. **12516828**
Revision No. **E**
Date **14 Jul 2020**

Sludge Sampling Location Plan

FIGURE 7

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z021_SludgeSamplingLocationPlan_Fig6_F.mxd

Data source: Aerial imagery - esri 2020 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



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

GHD

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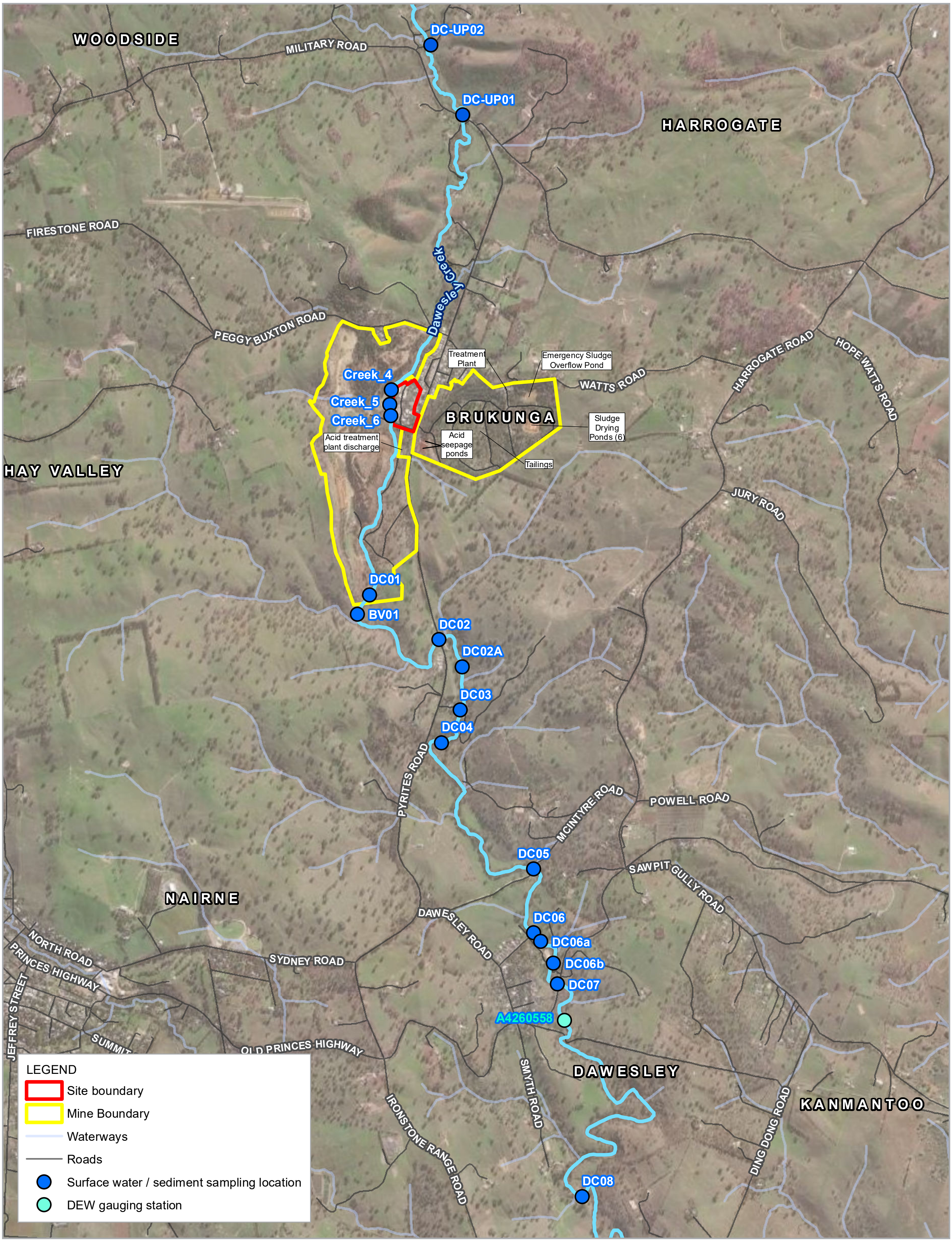
Project No. 12516828
Revision No. K
Date 18 Feb 2021

Groundwater sampling location plan

FIGURE 8

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z024_GroundwaterSamplingLocationPlan_Fig6_K.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Paper Size ISO A4

0 250 500 750 1,000

Meters

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

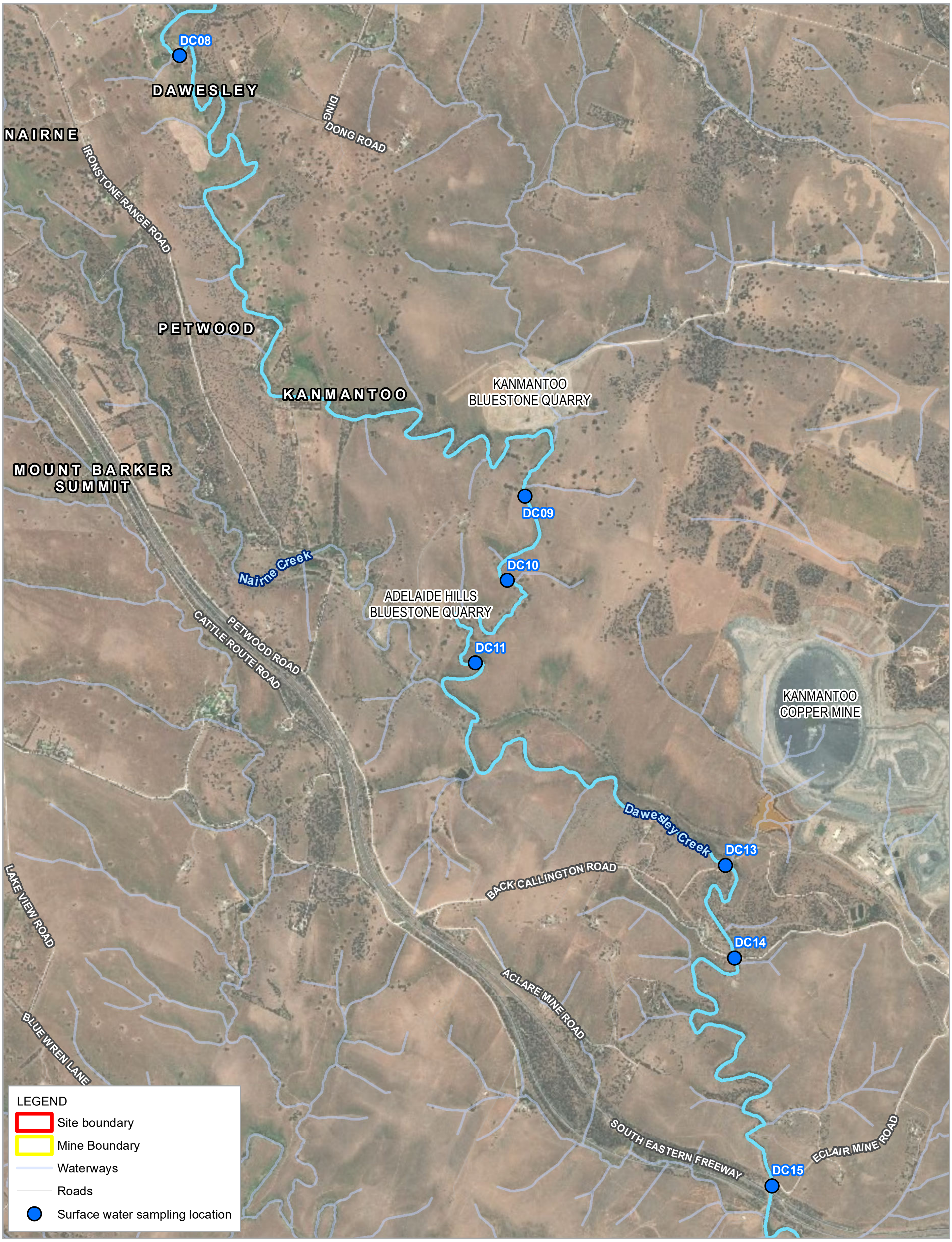
Surface Water / Sediment Sampling Locations

Project No.	12516828
Revision No.	I
Date	16 Mar 2021

FIGURE 9a

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z025_SurfaceWaterSamplingLocationPlan.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.
Created by: eibbertson



Paper Size ISO A4

0 300 600 900 1,200

Meters

N

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

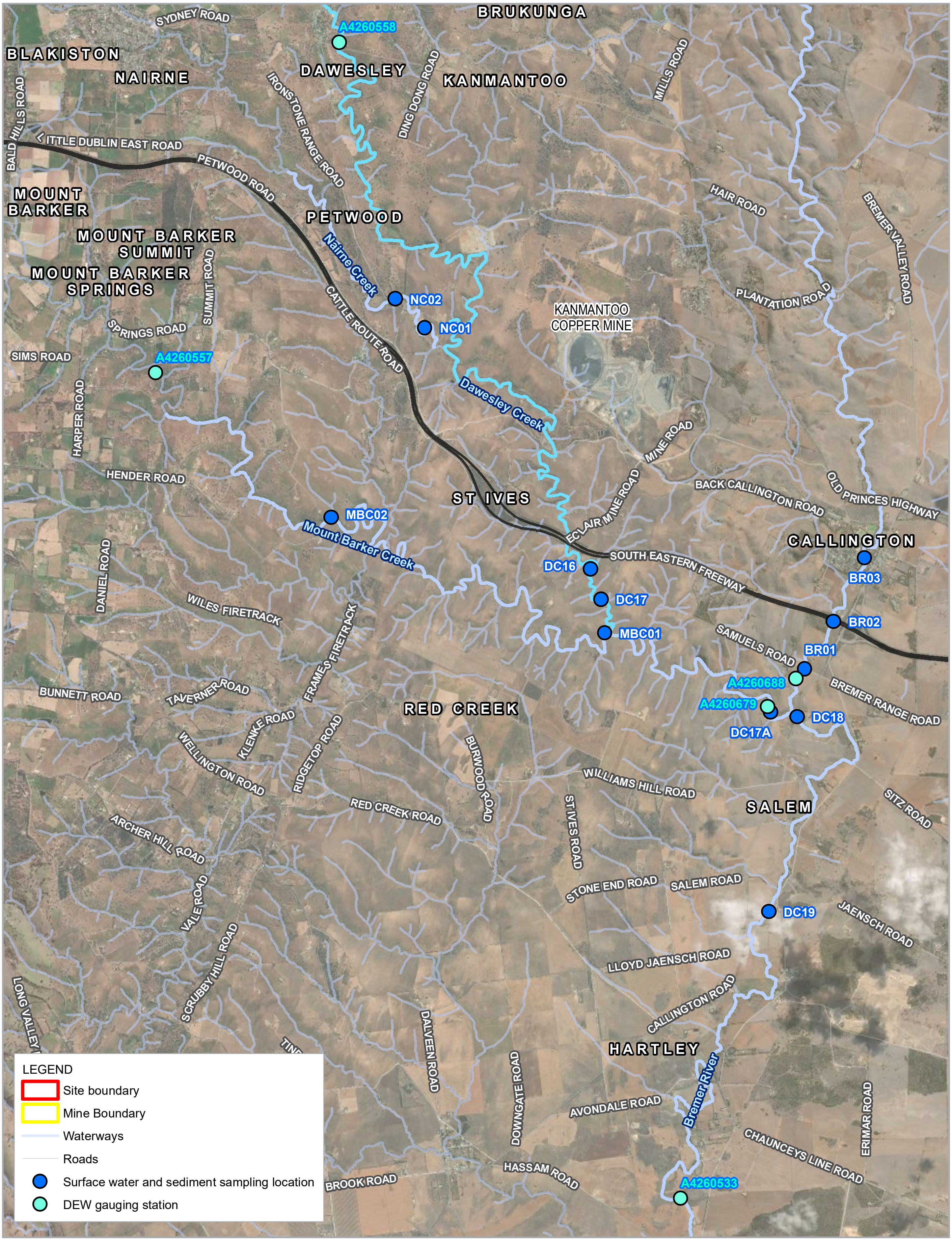
SA Country Fire Service
CFS Brukunga State Training Centre
DSI

Additional Surface Water / Sediment Sampling Locations (8 July 2020)

Project No.	12516828
Revision No.	B
Date	05 Aug 2020

FIGURE 9b

\\ghdnet\ghd\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z037_AdditionalSurfaceWaterSedimentSamplingLocationPlan_Fig4.1_B.mxd Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.
Created by: eibbertson



Paper Size ISO A4

0 0.45 0.9 1.35 1.8

Kilometres

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

N

SA Country Fire Service
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Surface Water / Sediment Sampling Locations (July - October 2020 sampling)

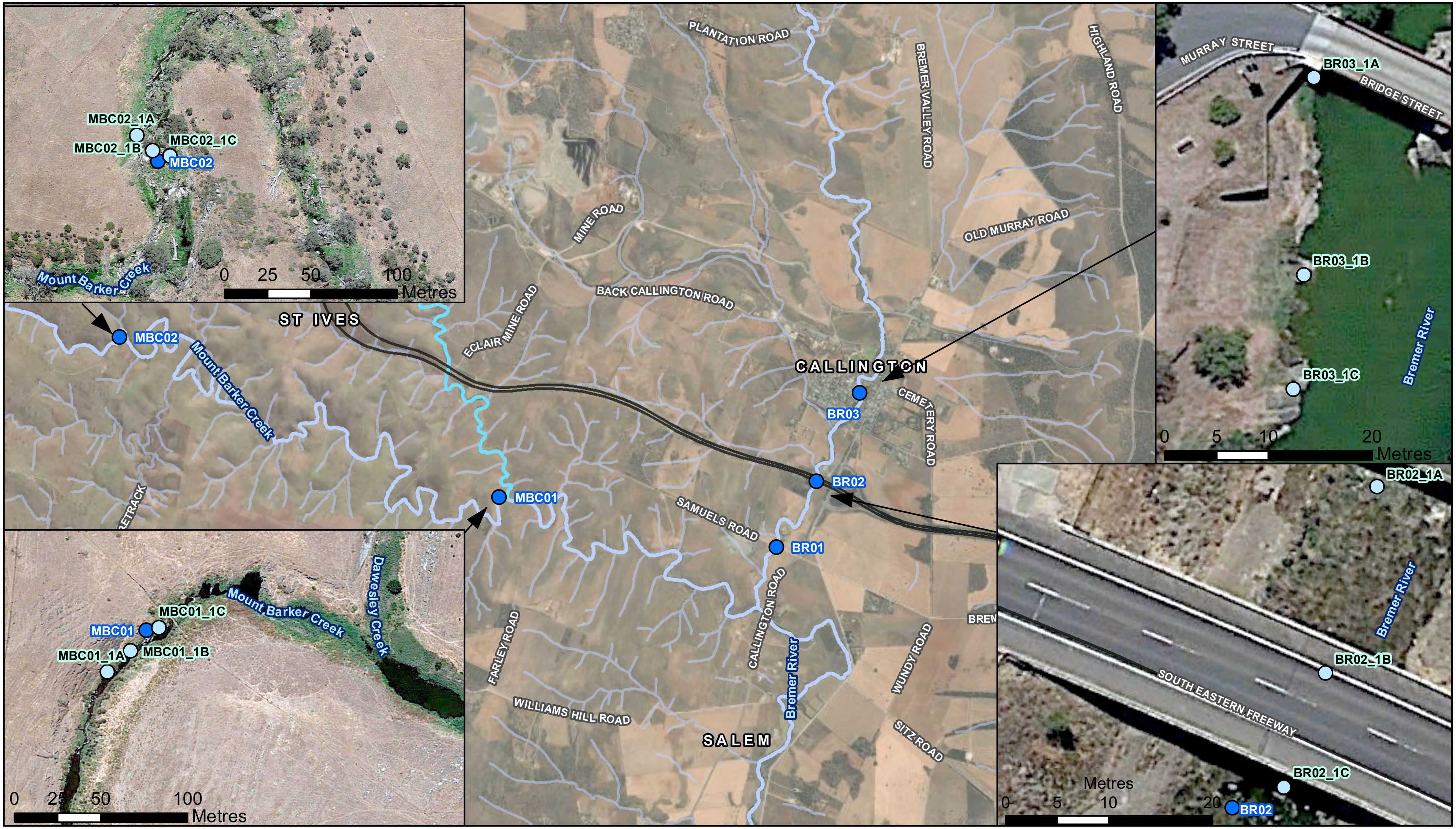
Project No.	12516828
Revision No.	H
Date	20 Nov 2020

FIGURE 9c

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z037_SurfaceWaterSedimentSamplingLocationPlan_Fig9c_H.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.

Created by: dschmidt



Legend

●	Surface water and sediment sampling location (July 2020)
○	Surface water sampling location (September 2020)
—	Roads
—	Waterways

Paper Size ISO A4

0 0.5 1 1.5
Kilometers

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

N

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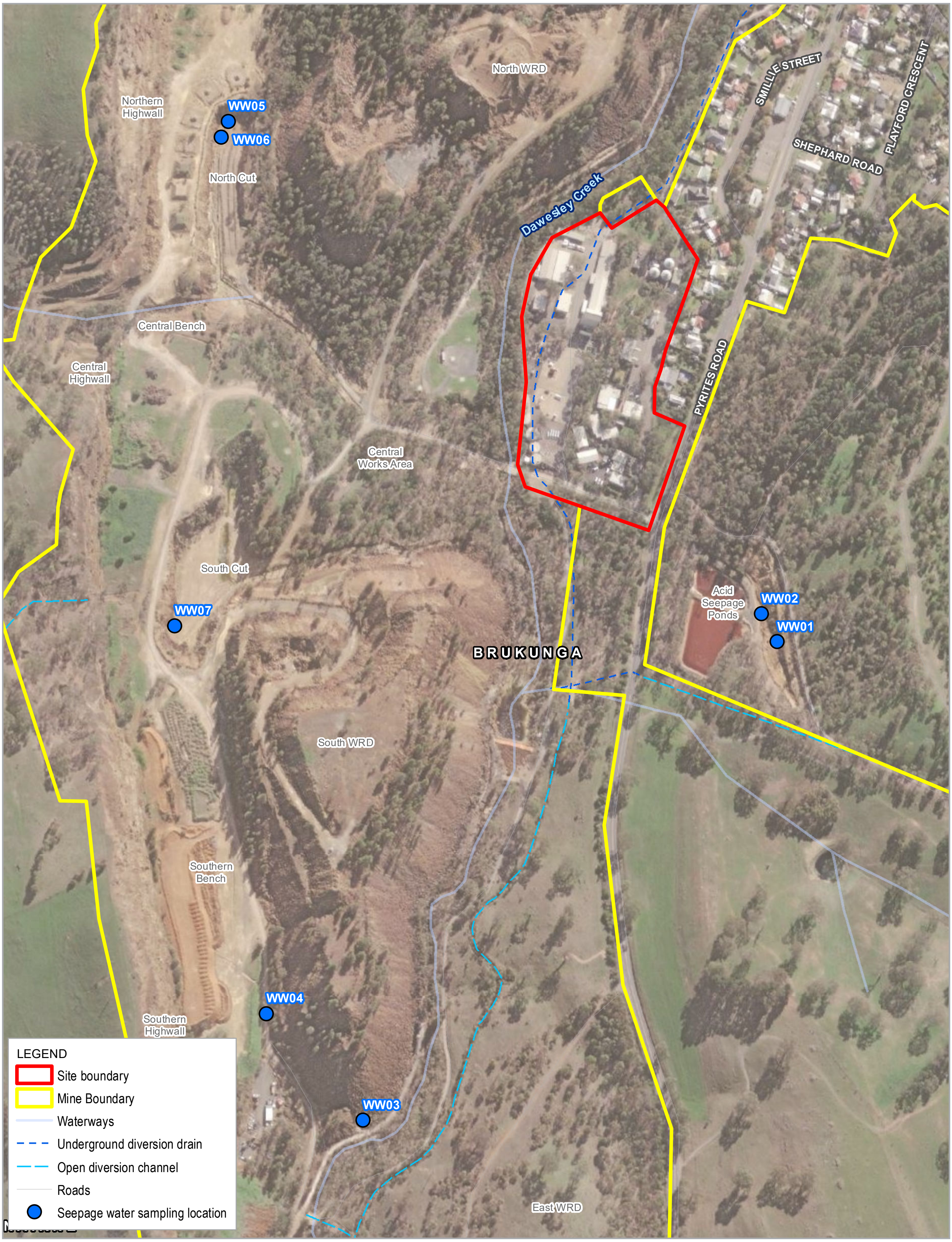
Surface Water Reference Site Sampling Locations

Project No. 12516828
Revision No. D
Date 16/03/2021

FIGURE 9d

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z043_SurfaceWaterReferenceSiteSamplingLocations.mxd
Print date: 16 Mar 2021 - 10:28

Data source: Inset Imagery ©2021 Google Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: eibbertson



Paper Size ISO A4

0 50 100 150 200

Meters

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

N

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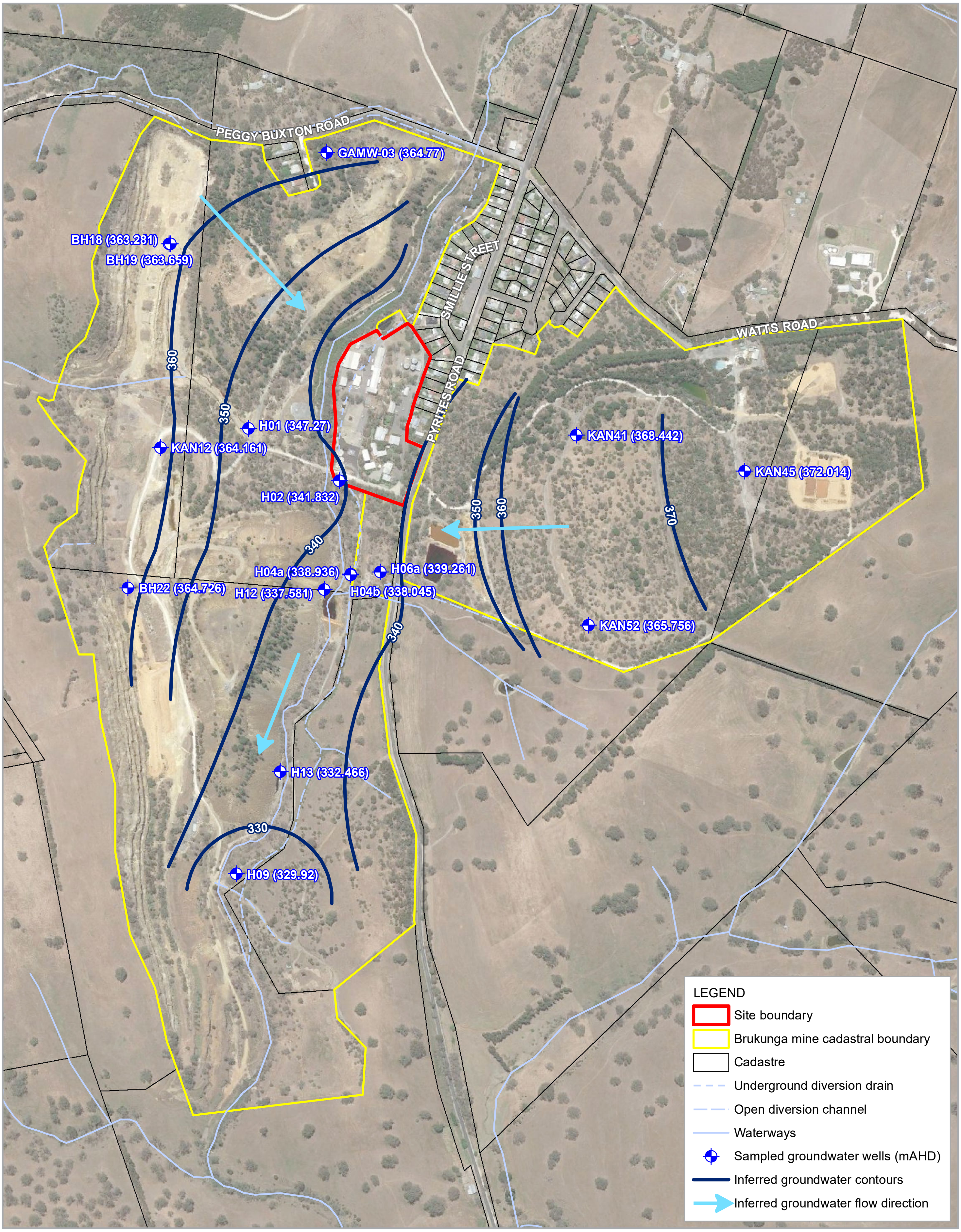
Seepage Water Sampling Locations Plan

Project No.	**12516828**
Revision No.	**D**
Date	**16 Mar 2021**

FIGURE 10

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z032_SeepageWaterSamplingLocationPlan.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.
Created by: eibbertson



Paper Size ISO A4

0 100 200

Metres

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

N

SA Country Fire Service
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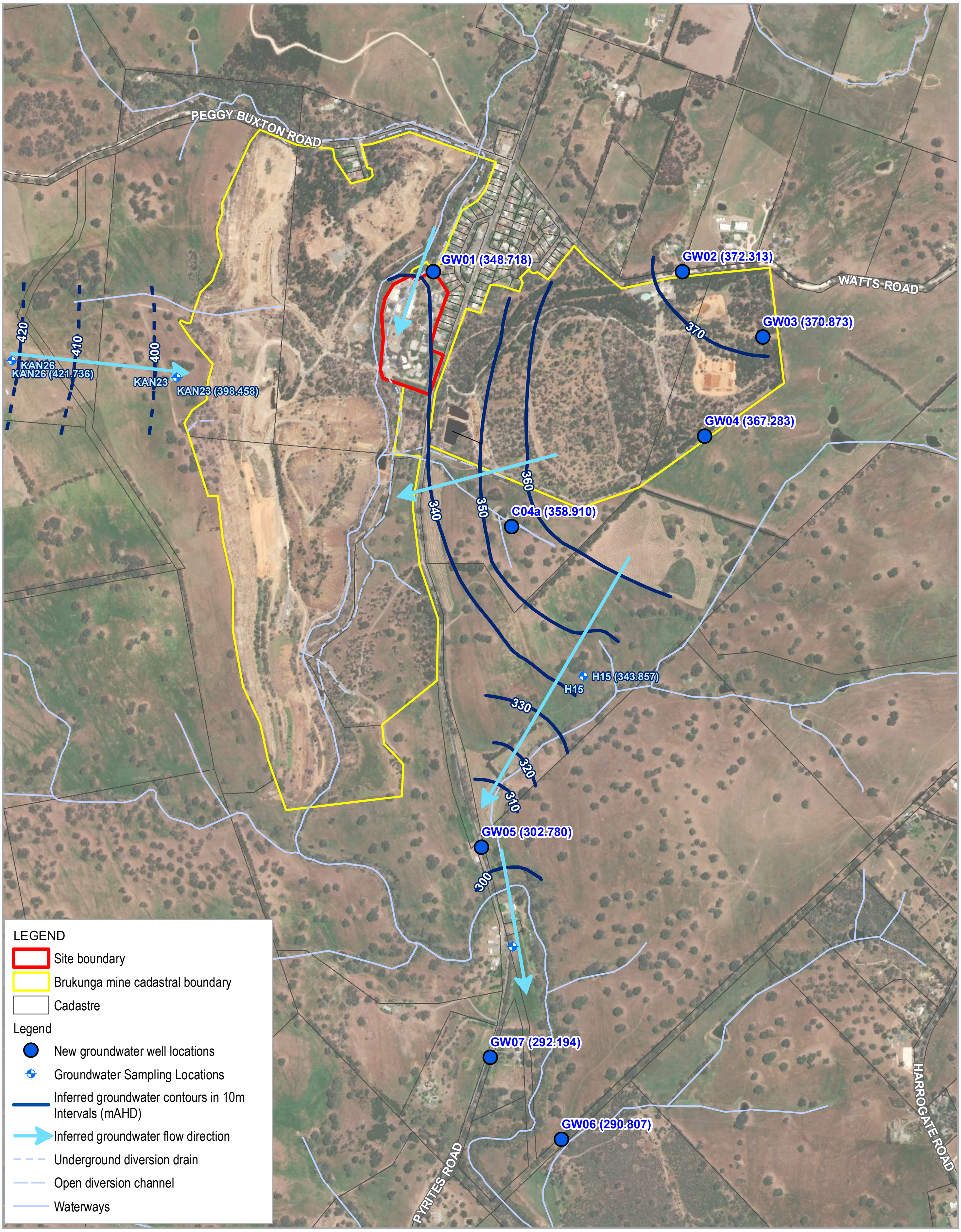
Groundwater Contour Plan (February 2020)

Project No. 12516828
Revision No. -
Date 08 Feb 2021

FIGURE 11a

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z017_GroundwaterContourPlan_Fig9a_A.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Paper Size ISO A4
0 200 400
Metres

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

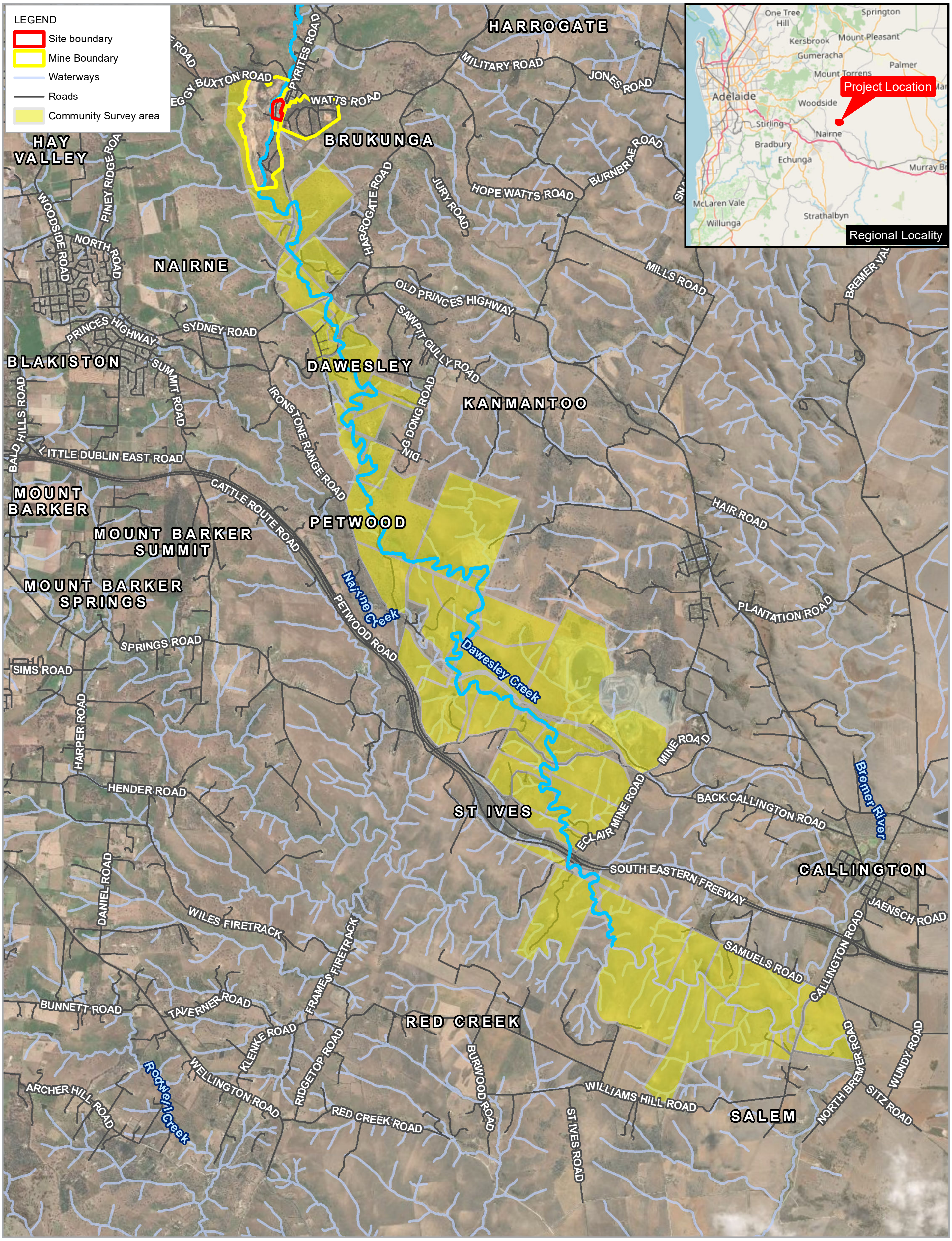
Groundwater Contour Plan
(June 2020)

Project No.	**12516828**
Revision No.	**I**
Date	**18 Feb 2021**

FIGURE 11b

\\ghdnet\ghd\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z030_GroundwaterContourPlan_Fig9b_I.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014, Contour - GHD 2020.
Created by: dschmidt



Paper Size ISO A4

0 0.75 1.5 2.25 3

Kilometers

N

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

GHD

SA Country Fire Service
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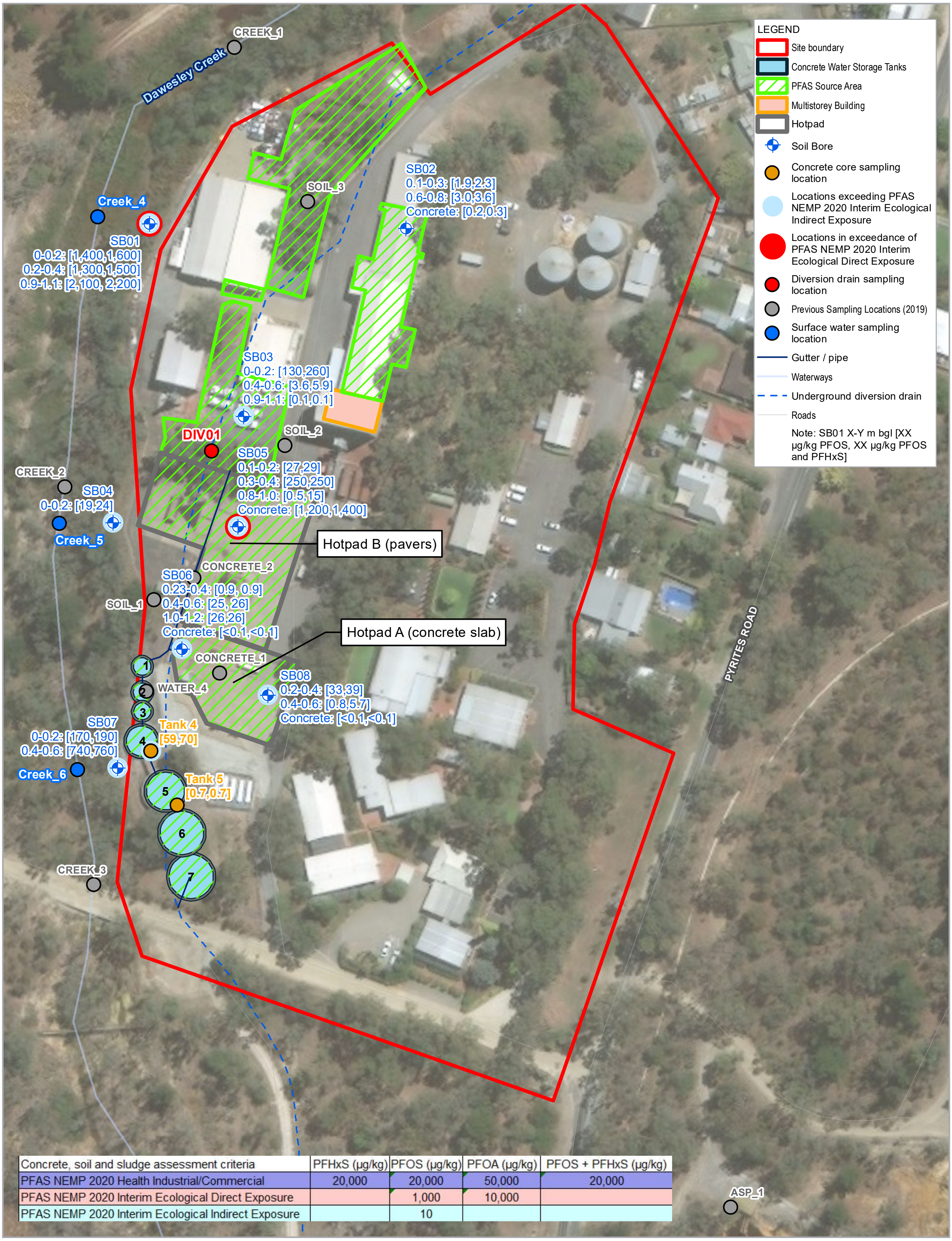
Project No.	**12516828**
Revision No.	**D**
Date	**18 Feb 2021**

Community Survey Plan

FIGURE 12

\\ghdnet\ghd\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z036_CommunitySurveyPlan_Fig10_D.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map © OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Concrete, soil and sludge assessment criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 10 20 30 40

Meters

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
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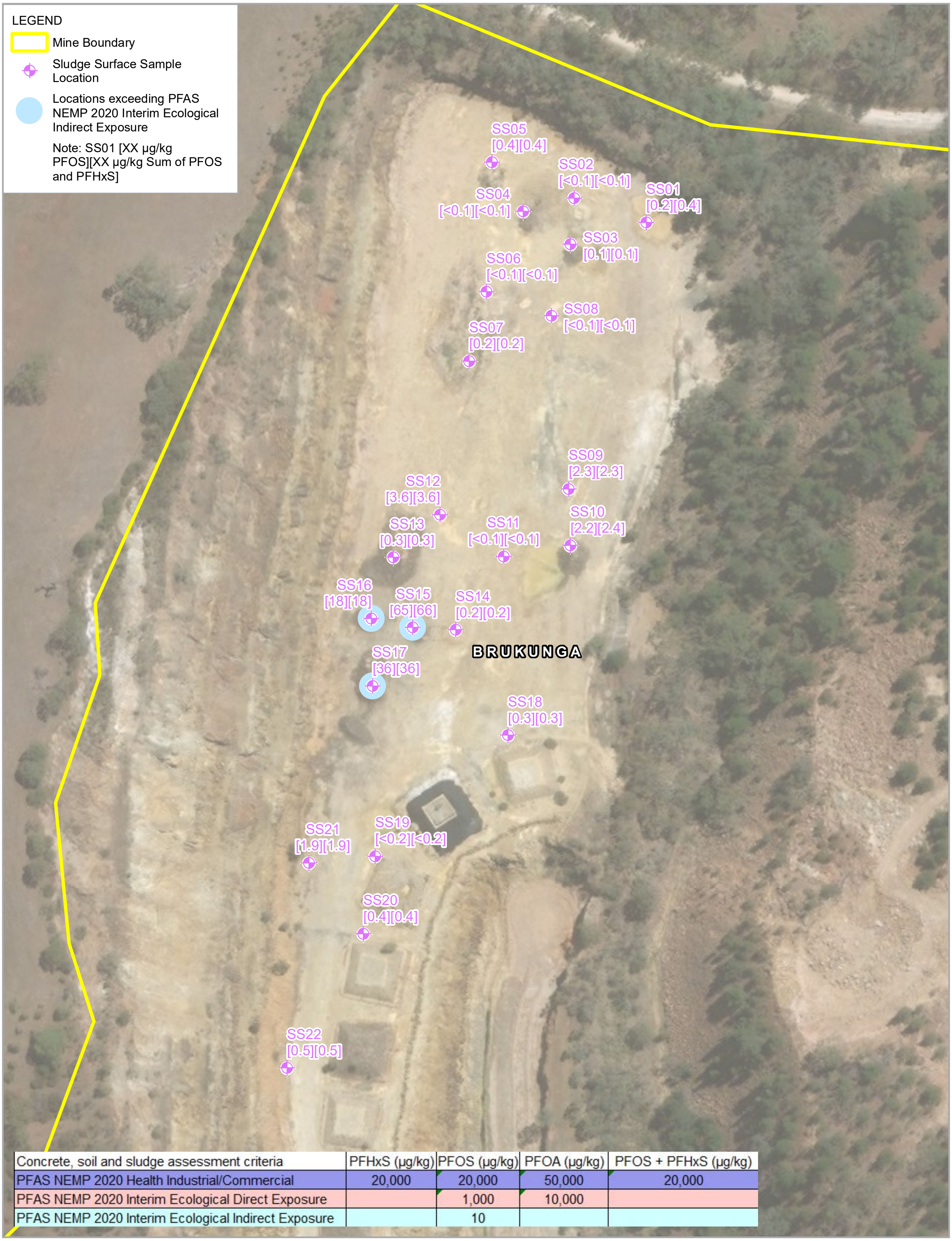
Soil and Concrete PFAS Concentration Plan

Project No. **12516828**
Revision No. **K**
Date **16 Mar 2021**

FIGURE 13

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z026_SoilAndConcreteConcentrationPlan.mxd Data source: Aerial imagery - esri 2019 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: eibbertson



Concrete, soil and sludge assessment criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 25 50

Metres

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

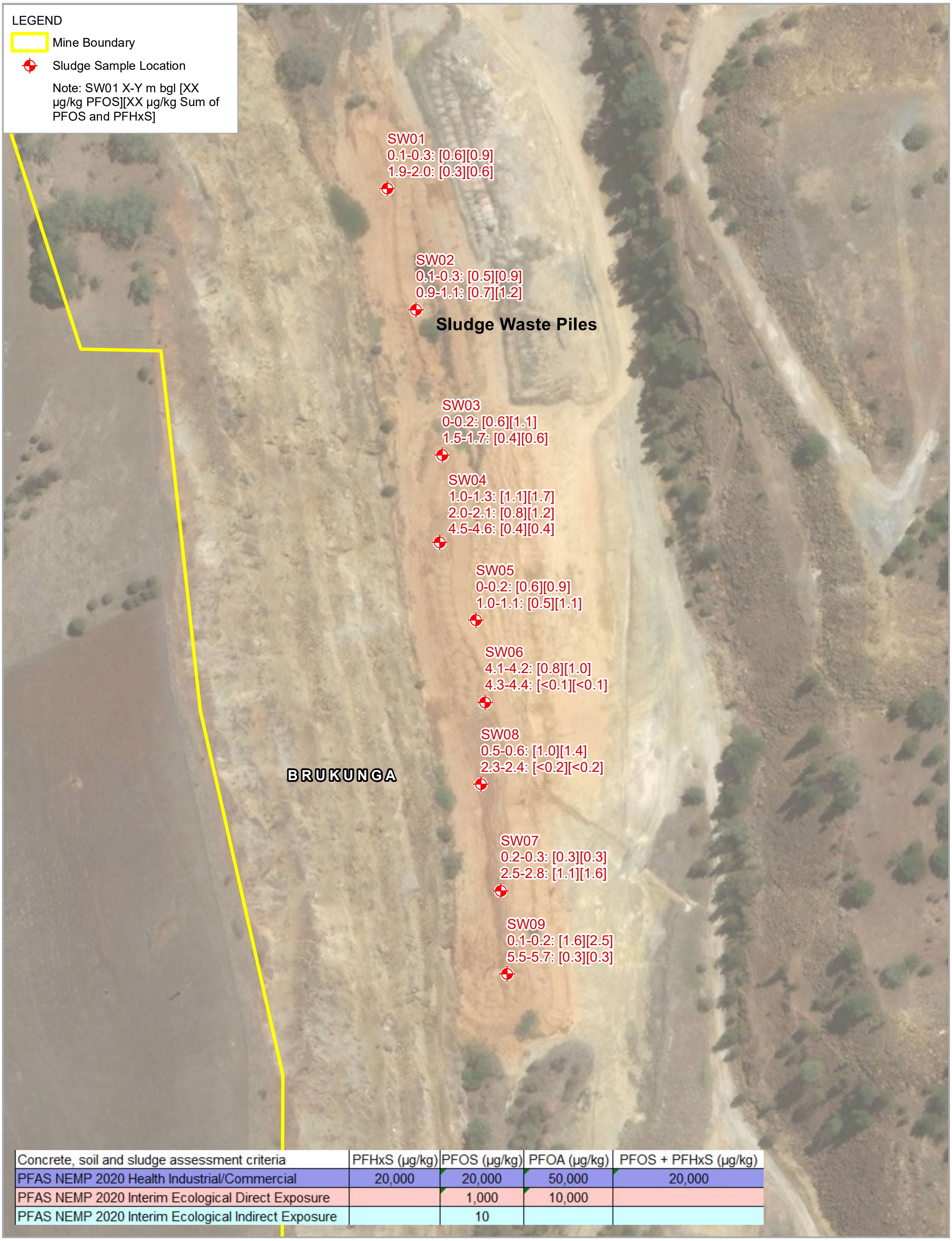
Northern Bench Sludge PFAS Concentrations Plan

Project No. **12516828**
Revision No. **I**
Date **18 Feb 2021**

FIGURE 14a

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z027_SludgeExceedancePlan_Fig12_I.mxd

Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Concrete, soil and sludge assessment criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 25 50

Metres

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
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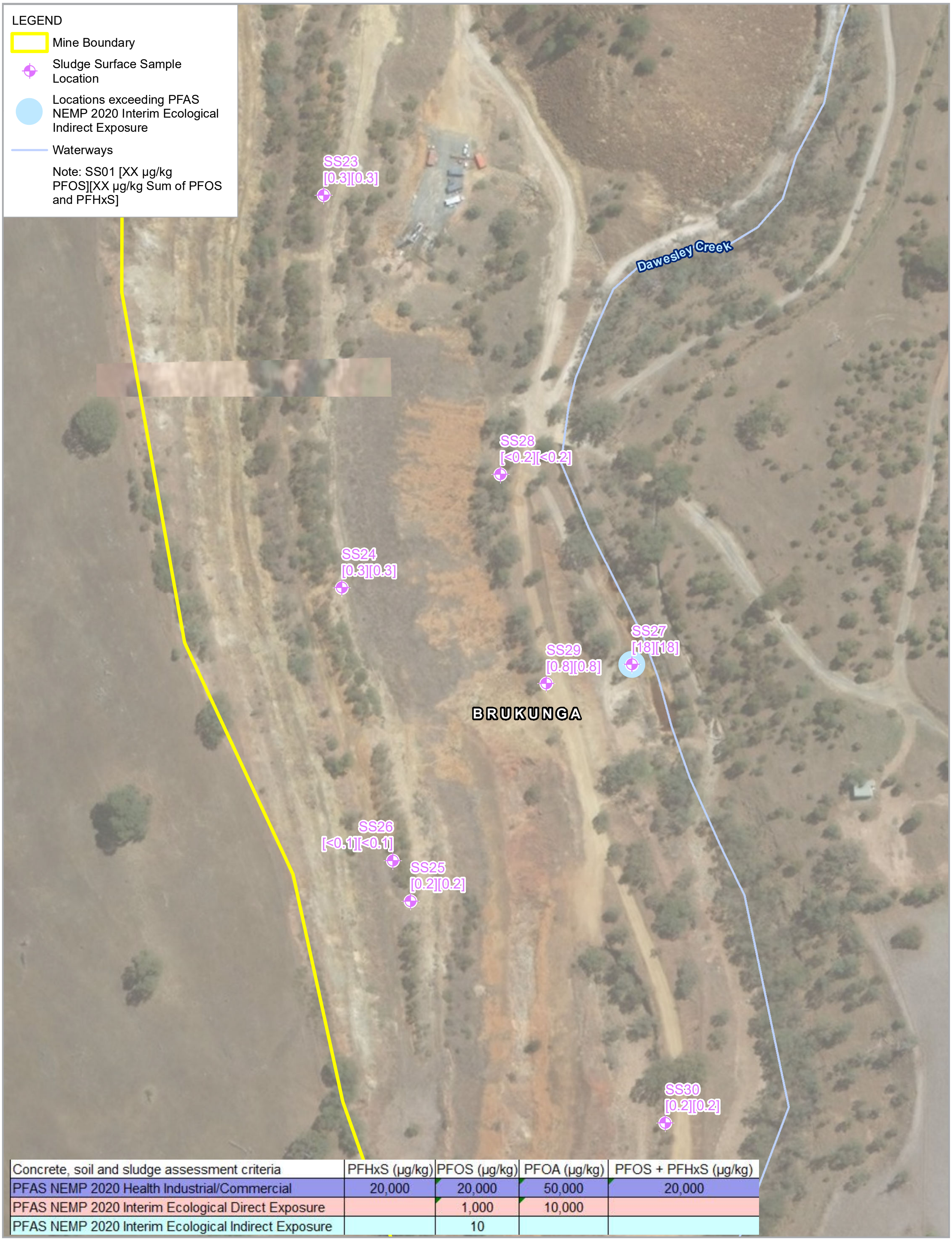
Southern Waste Pile Sludge PFAS Concentrations Plan

Project No. **12516828**
Revision No. **I**
Date **18 Feb 2021**

FIGURE 14b

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z027_SludgeExceedancePlan_Fig12_I.mxd

Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Concrete, soil and sludge assessment criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 25 50

Metres

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

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

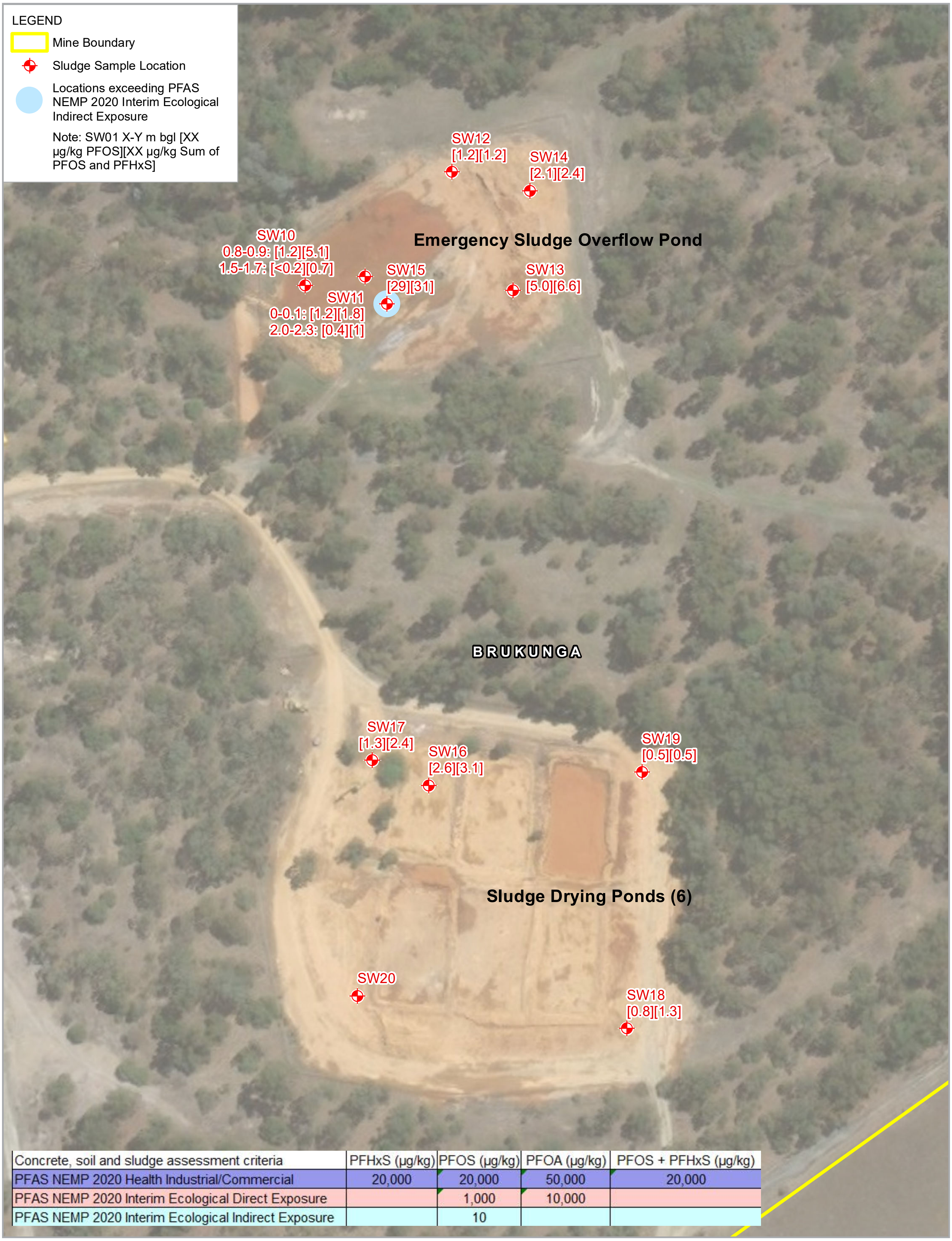
South Extension Sludge PFAS Concentrations Plan

Project No. **12516828**
Revision No. **I**
Date **18 Feb 2021**

FIGURE 14c

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z027_SludgeExceedancePlan_Fig12_I.mxd

Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Concrete, soil and sludge assessment criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 25 50

Metres

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

N

GHD

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

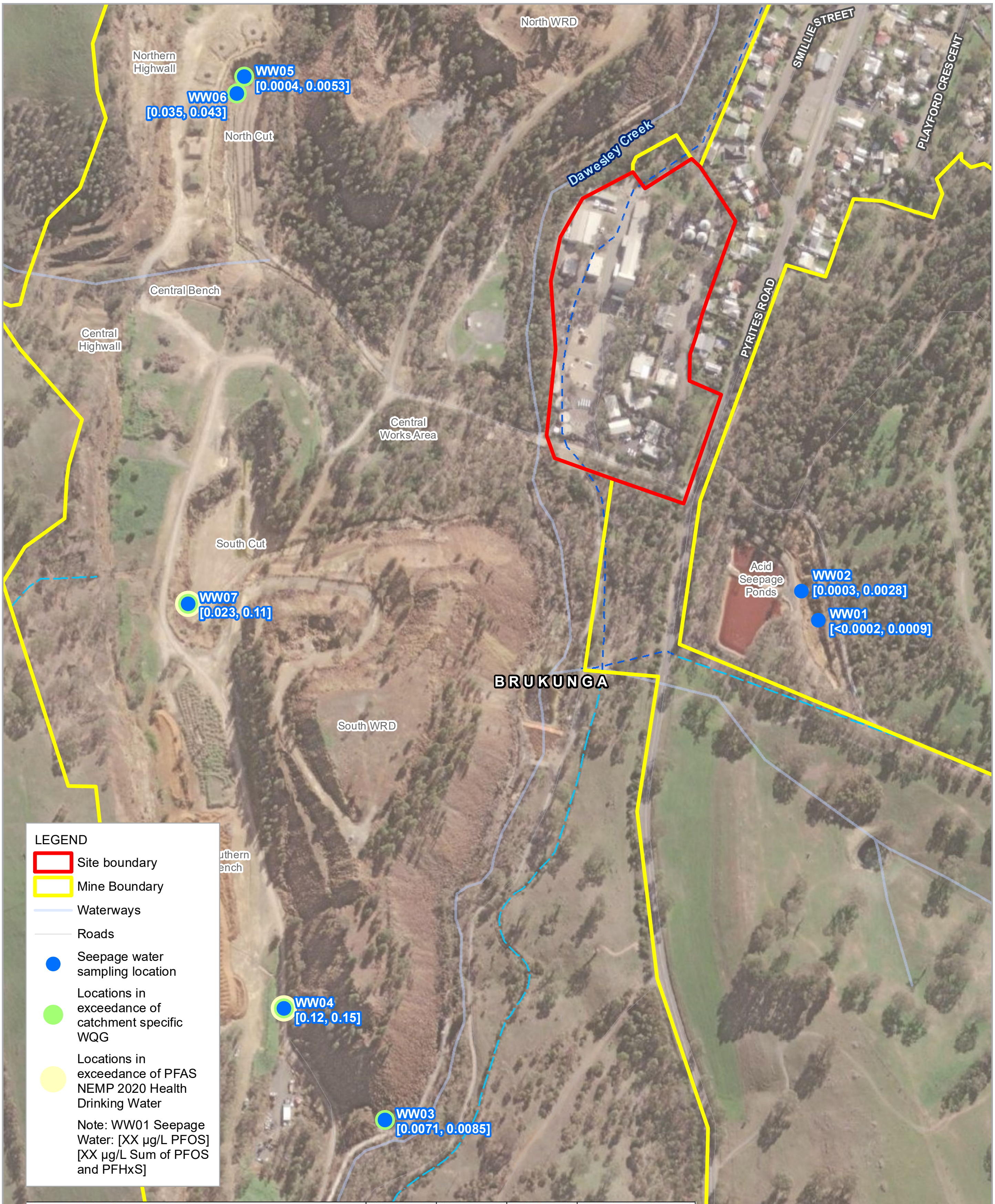
Emergency Overflow Pond & Drying Ponds Sludge PFAS Concentrations Plan

Project No. 12516828
Revision No. I
Date 18 Feb 2021

FIGURE 14d

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z027_SludgeExceedancePlan_Fig12_I.mxd

Data source: Aerial imagery - esri 2021 Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Seepage Water Assessment Criteria	PFHxS (µg/L)	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
NHMRC 2019 Recreational Water PFAS Guidelines	2	2	10	2
PFAS NEMP 2020 Health Drinking Water	0.07	0.07	0.56	0.07
PFAS NEMP 2020 Freshwater - 99% protection level			19	
Catchment specific WQG - highly disturbed systems	0.0046	0.0066		

Paper Size ISO A4

0 50 100 150 200

Meters

N

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

SA Country Fire Service
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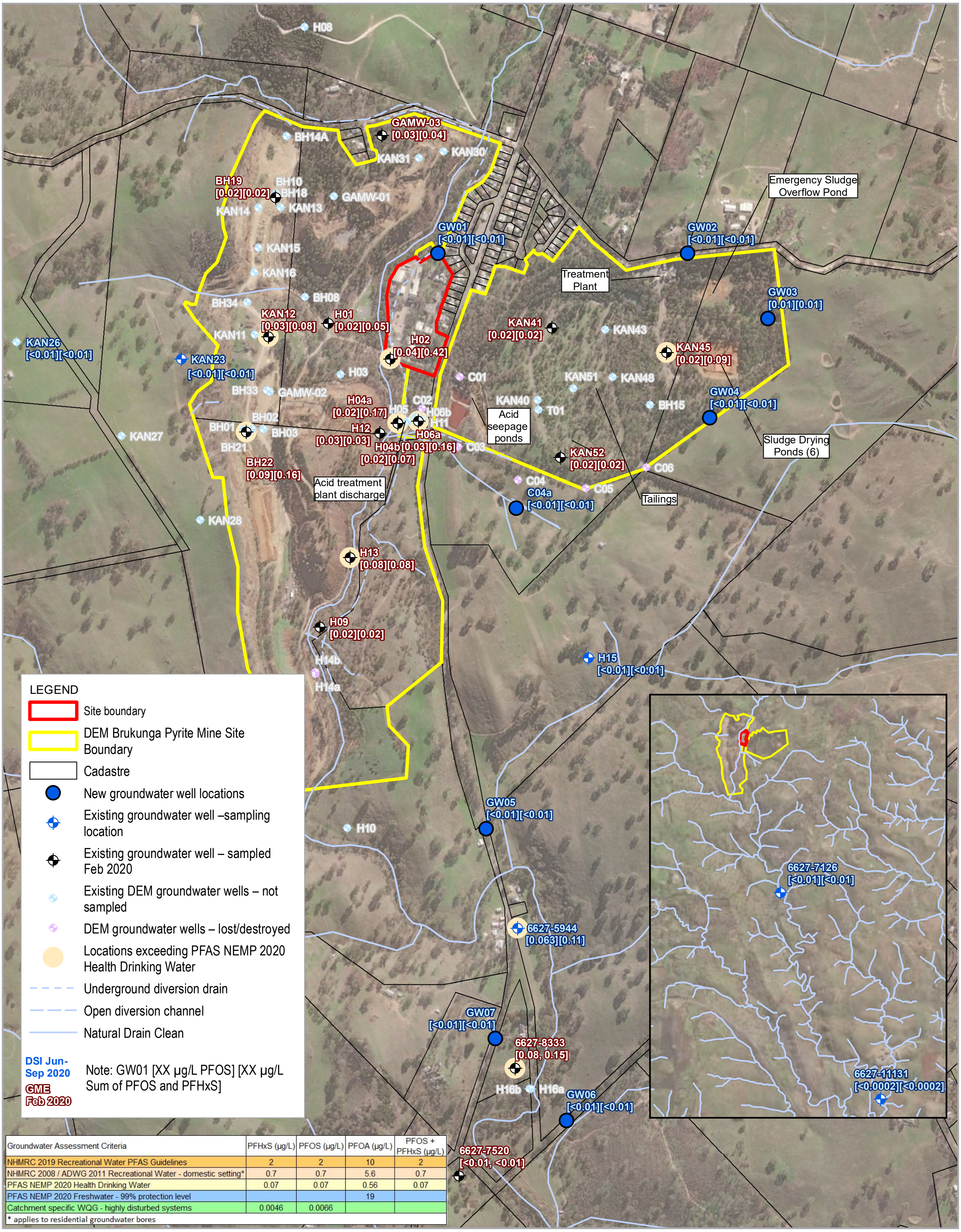
Seepage Water PFAS Concentrations Plan

Project No.	**12516828**
Revision No.	**F**
Date	**16 Mar 2021**

FIGURE 15

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z033_SeepageWaterPFASConcentrationsPlan.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map © OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: eibbertson



Groundwater Assessment Criteria	PFHxS (µg/L)	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
NHMRC 2019 Recreational Water PFAS Guidelines	2	2	10	2
NHMRC 2008 / ADWG 2011 Recreational Water - domestic setting*	0.7	0.7	5.6	0.7
PFAS NEMP 2020 Health Drinking Water	0.07	0.07	0.56	0.07
PFAS NEMP 2020 Freshwater - 99% protection level			19	
Catchment specific WQG - highly disturbed systems	0.0046	0.0066		

* applies to residential groundwater bores

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

SA Country Fire Service
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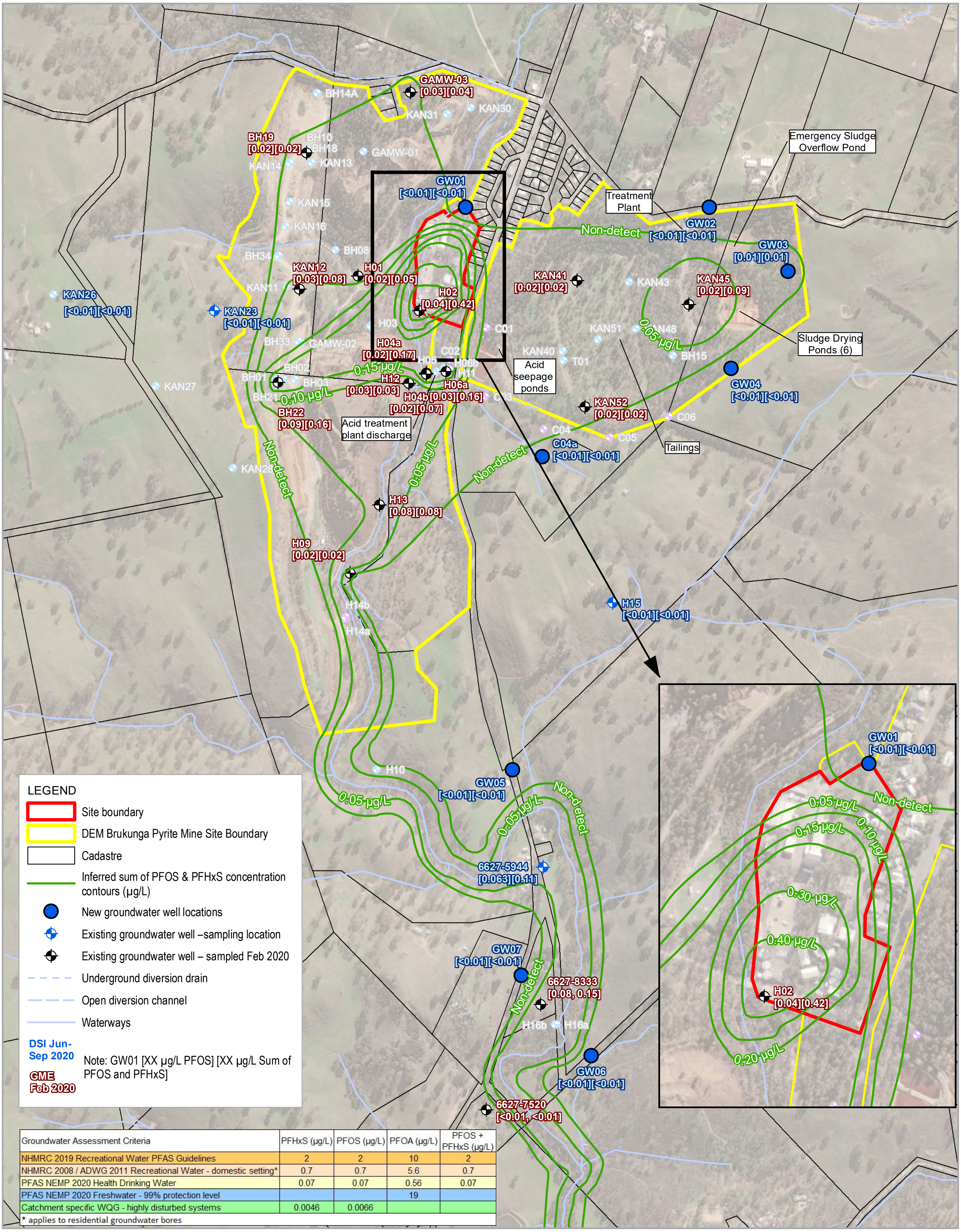
DSI

Project No. 12516828
Revision No. O
Date 01 Mar 2021

Groundwater PFAS Concentrations Plan

FIGURE 16a

\\ghdnet\ghd\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z028_GroundwaterPFASConcentrationsPlan_Fig16a_O.mxd Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Groundwater Assessment Criteria	PFHxS (µg/L)	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
NHMRC 2019 Recreational Water PFAS Guidelines	2	2	10	2
NHMRC 2008 / ADWG 2011 Recreational Water - domestic setting*	0.7	0.7	5.6	0.7
PFAS NEMP 2020 Health Drinking Water	0.07	0.07	0.56	0.07
PFAS NEMP 2020 Freshwater - 99% protection level			19	
Catchment specific WQG - highly disturbed systems	0.0046	0.0066		

* applies to residential groundwater bores

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

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

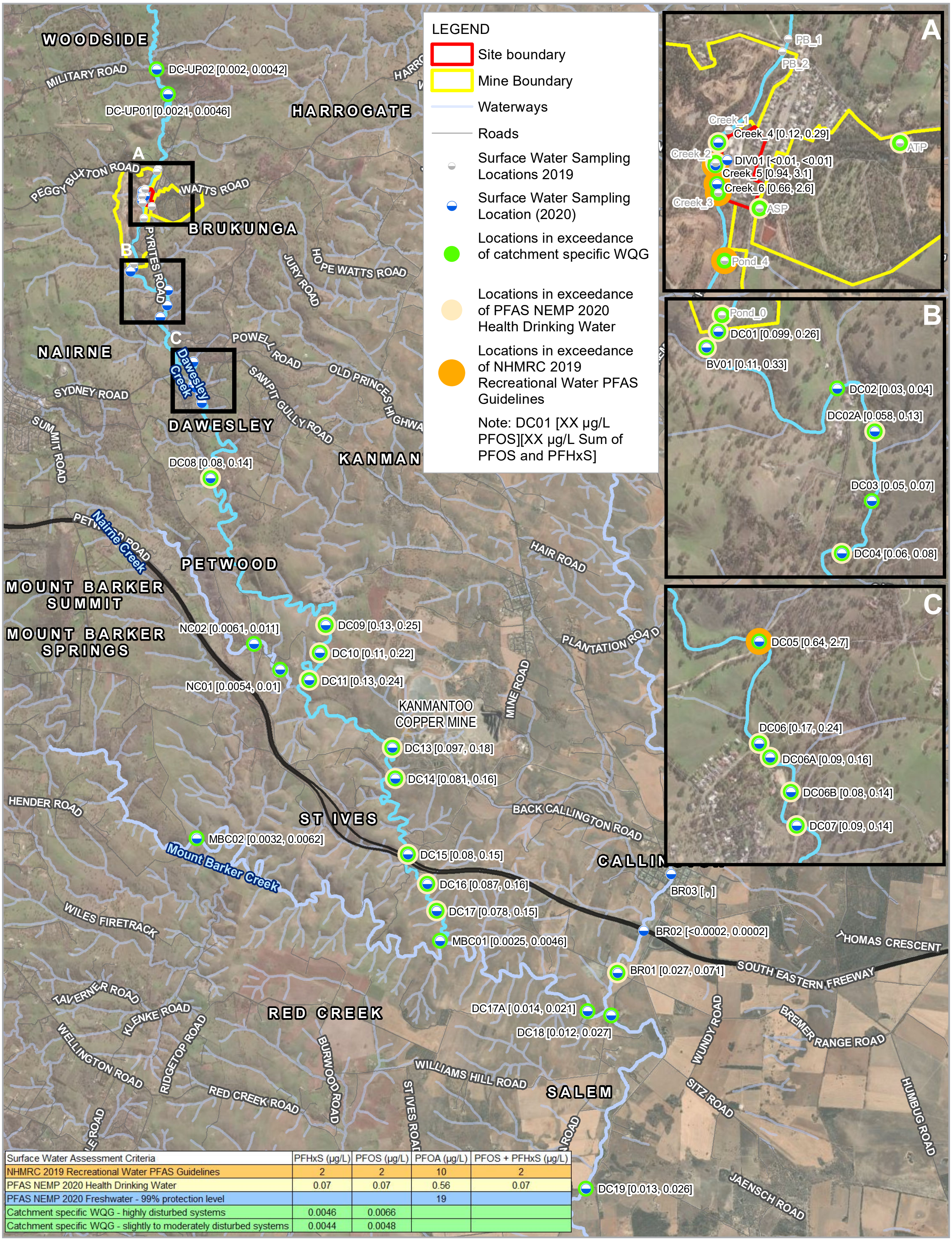
Groundwater PFAS Concentrations Contour Plan

Project No. **12516828**
Revision No. **K**
Date **01 Mar 2021**

FIGURE 16b

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z035_GroundwaterPFASConcentrationsContourPlan_Fig16b_K.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2021 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt



Surface Water Assessment Criteria	PFHxS (µg/L)	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
NHMRC 2019 Recreational Water PFAS Guidelines	2	2	10	2
PFAS NEMP 2020 Health Drinking Water	0.07	0.07	0.56	0.07
PFAS NEMP 2020 Freshwater - 99% protection level			19	
Catchment specific WQG - highly disturbed systems	0.0046	0.0066		
Catchment specific WQG - slightly to moderately disturbed systems	0.0044	0.0048		

Paper Size ISO A4
0 0.5 1 1.5 2
Kilometres

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

N

SA Country Fire Service
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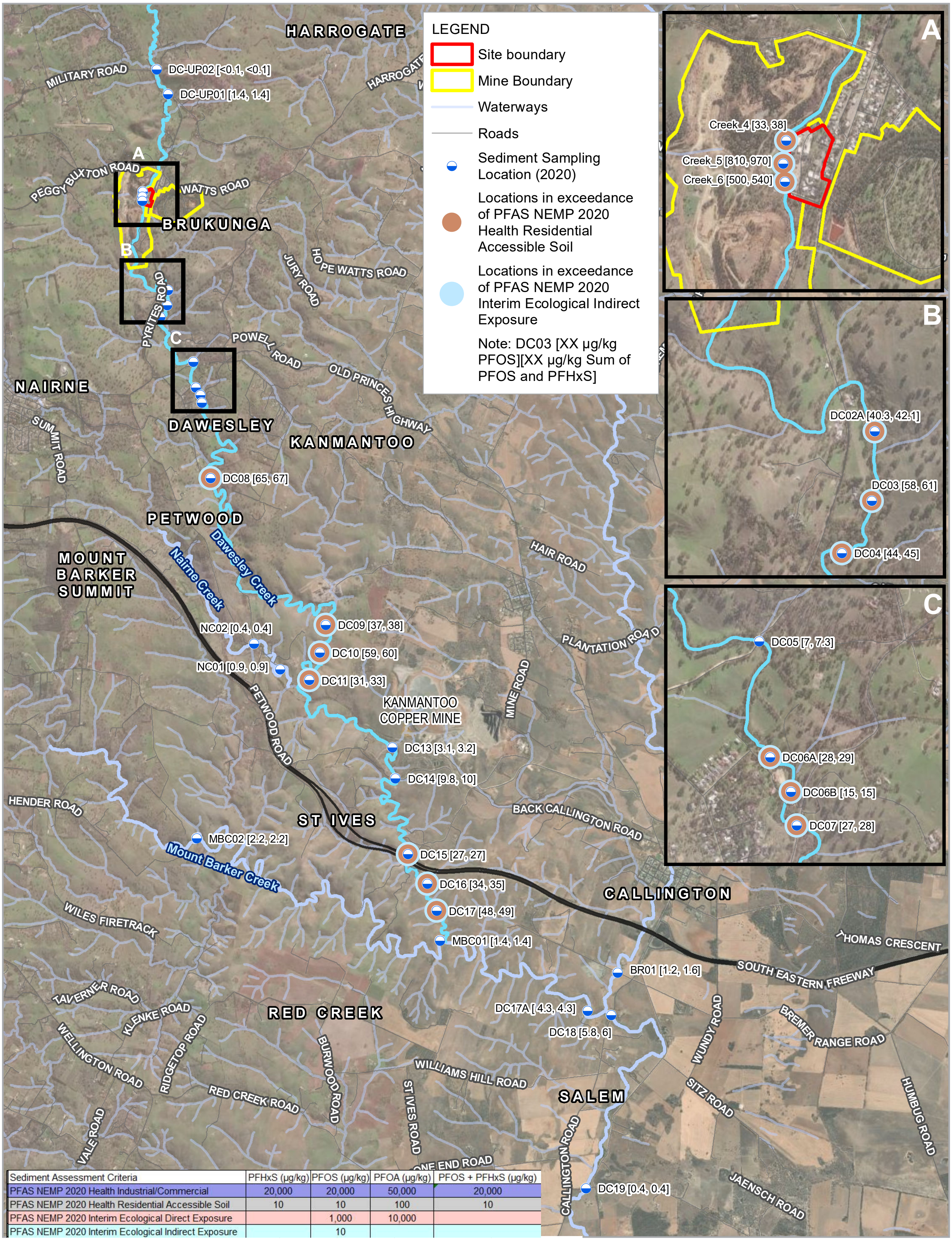
Surface Water PFAS Concentrations Plan

Project No.	**12516828**
Revision No.	**G**
Date	**26 Feb 2021**

FIGURE 17

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z038_SurfaceWaterPFASConcentrationsPlan_Fig17_G.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.
Created by: dschmidt



LEGEND

🟥	Site boundary
🟨	Mine Boundary
—	Waterways
—	Roads
◒	Sediment Sampling Location (2020)
●	Locations in exceedance of PFAS NEMP 2020 Health Residential Accessible Soil
●	Locations in exceedance of PFAS NEMP 2020 Interim Ecological Indirect Exposure

Note: DC03 [XX µg/kg PFOS][XX µg/kg Sum of PFOS and PFHxS]

Sediment Assessment Criteria	PFHxS (µg/kg)	PFOS (µg/kg)	PFOA (µg/kg)	PFOS + PFHxS (µg/kg)
PFAS NEMP 2020 Health Industrial/Commercial	20,000	20,000	50,000	20,000
PFAS NEMP 2020 Health Residential Accessible Soil	10	10	100	10
PFAS NEMP 2020 Interim Ecological Direct Exposure		1,000	10,000	
PFAS NEMP 2020 Interim Ecological Indirect Exposure		10		

Paper Size ISO A4

0 0.5 1 1.5 2

Kilometres

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

N

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

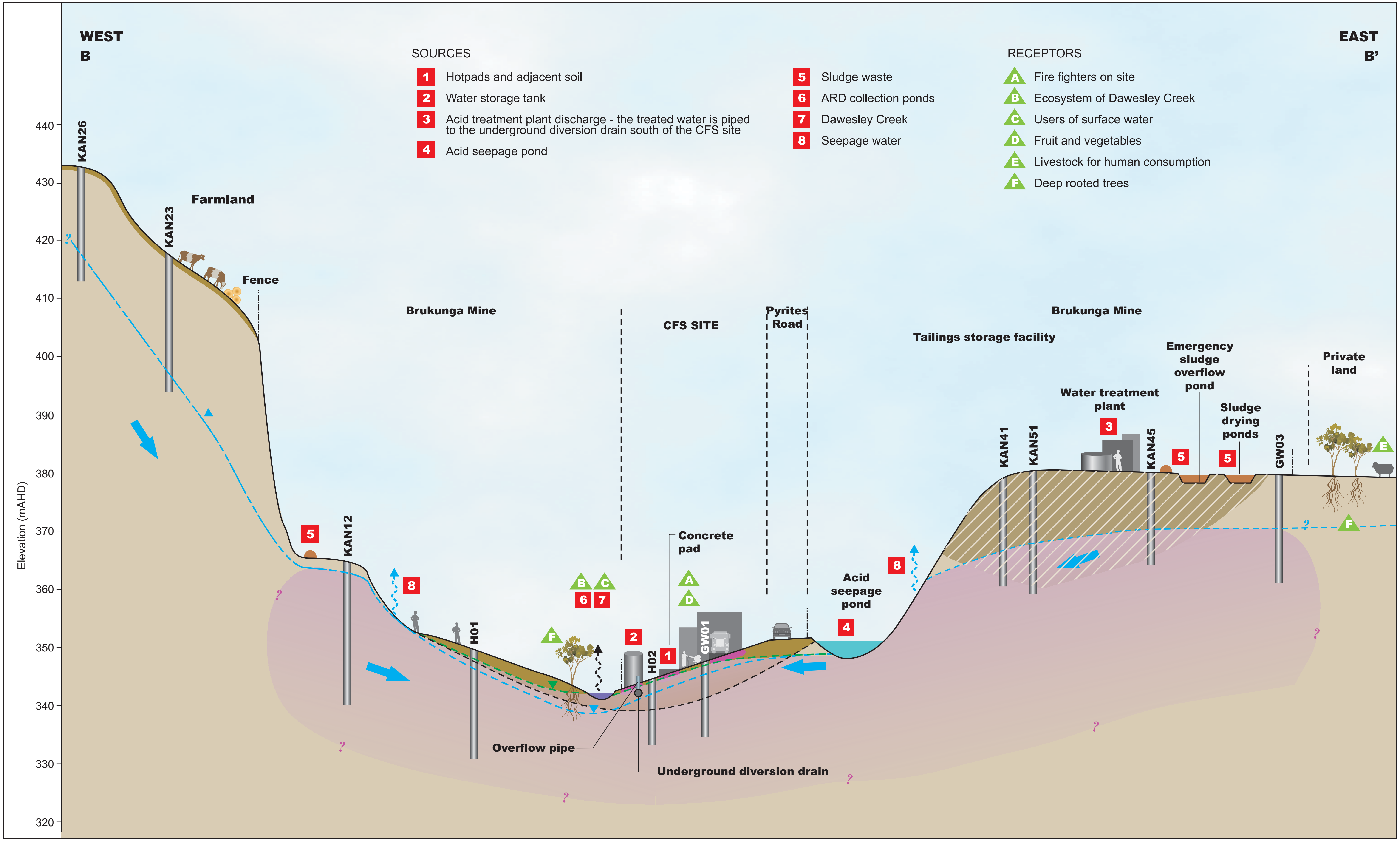
Sediment
PFAS Concentrations Plan

Project No.	12516828
Revision No.	H
Date	26 Feb 2021

FIGURE 18

\\ghdnet\ghd\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z040_SedimentPFASConcentrationsPlan_Fig15b_H.mxd

Data source: Aerial imagery - esri 2019 / Inset map - Open Street Map Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; General topo - DPTI 2015; Waterways - DEWNR 2014.
Created by: dschmidt



Conceptual diagram only.
Vertical scale: Approximate
Horizontal: Not to scale

LEGEND

- ▨ Fill (tailings)
- Regolith (silt/sand/clay)
- Fractured rock (schists)
- PFAS impacted soil
- PFAS impacted groundwater (above LOR)
- Dry season level losing stream
- Wet season level gaining stream
- ● Dawsley Creek diversion drain
- Groundwater flow direction
- Dawsley Creek - PFAS impacted
- Seepage
- Evapotranspiration

SA County Fire Service
CFS Brukunga State Training Centre
DSI

Conceptual Site Model (West-East)

Job Number	12-516828
Revision	0
Date	18 Feb 2021

Figure 19

AU\Launceston\Projects\12\516828\12516828_LST_01.cdr

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

Brukunga Pyrite Mine Site Boundary

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: Features of the Generating Site		
Location: Brukunga Pyrite Mine, SA		
Client: Dept. of State Development (DSD)		Job number: 113077
Drawn by: TRJ	Scale: As shown	Source: See Ref.
Proj Man: AS	Date: 5 Feb. 2018	Figure 3

Appendices

Appendix A – Community Engagement

27 April 2020

GHD ref: 12516828

EJ Shephard
PO Box 32
NAIRNE SA 5252

Dear land owner,

Groundwater sampling of existing monitoring wells on your land at Lot 54 Pyrites Road, Brukunga SA

Investigations are currently being undertaken at the CFS State Training Centre, Brukunga in relation to the historical use of PFAS containing firefighting foam until 2001 and Portable Fire Extinguishers until January 2020.

PFAS stands for ‘per- and poly-fluoro alkyl substances’. PFAS are ingredients in some common domestic products such as paints, dishwasher rinse aids, and textile treatments (water proofing, stain prevention) along with certain types of firefighting foam called AFFF (aqueous film forming foams) that were used previously by firefighting agencies. Large quantities of PFAS have not been used at the CFS State Training Centre since 2001, when their use was restricted to Portable Fire Extinguishers only. South Australia was the first state to ban the use of fluorinated AFFF, with the ban coming into effect on 30 January 2020 after a two-year transition period. The CFS have not used fluorinated AFFF during the transition period.

The CFS have engaged GHD Pty Ltd (GHD), an environmental consulting firm, to investigate any potential PFAS impacts on groundwater at the CFS State Training Centre. The results of the GHD investigations indicated concentrations of PFAS in Dawesley Creek exceed the Australian drinking water guidelines (National Health and Medical Research Council and Natural Resource Management Ministerial Council 2011, Version 3.5, Updated August 2018). Additional investigations are required, which will include targeted groundwater sampling from both public and private land surrounding the CFS State Training Centre and old Brukunga Pyrite Mine.

These additional investigations involve sampling groundwater from existing groundwater monitoring wells installed by the Department for Energy and Mining, some of which are located on your property at Lot 54 Pyrites Road, Brukunga SA. We are writing to request your informed consent to access your property and collect groundwater samples as part of this monitoring program. The work will be completed in accordance with local regulations and guidelines.

At this stage, groundwater sampling is scheduled for the week between the 25 and 29 May 2020 between 9 am and 5 pm. More accurate timing can be confirmed in future communications. If you are prepared to provide us your consent to access your private property to conduct the proposed groundwater investigation, please fill in the enclosed consent form and scan and email it to back to us at Dilara.Valiff@ghd.com. Should you have any questions or concerns please contact the project manager via email (Dilara.Valiff@ghd.com) or phone (08 8111 6572 or 0420 959 236).

On behalf of the CFS, GHD would like to make you aware that should the results of groundwater testing on your property exceed relevant guidelines and site contamination be identified, the South Australian Environment Protection Agency (EPA) will need to be notified (under the Section 83A – Notification of site contamination that affects or threatens underground water of the Environment Protection Act 1993 (EP Act)). The EPA is required to record details of site contamination on the EPA Public Register pursuant to section 109 of the EP Act. Where contamination on third-party sites is identified, the landowners will be informed and an appropriate risk management strategy be implemented in accordance with the "Guidelines for the assessment and remediation of site contamination" (EPA 2019) as soon as reasonably practicable, to ensure the protection of human health and the environment. Once contamination details have been recorded, this information will be made available on the Public Register Index of the EPA website and to interested parties upon written enquiry to the Public Register Administrator of the EPA. The existence of this information in relation to the land will also be identified by the EPA when responding to enquiries under the Land and Business (Sale and Conveyancing) Act 1994 (LBSC Act) and the subordinate Regulations (LSBC Regulations) (via the 'statement of environmental particulars' contained within the statement under section 7). This will typically occur at the time of sale of the property. There are also requirements for vendors in relation to identifying whether environmental assessments of the land have been carried out.

The CFS will share the results of the testing with the relevant Commonwealth and South Australian government agencies to determine if there are any potential concerns and consider the appropriate community advice. If contamination is found in the groundwater, CFS will fulfil its environmental obligations to the South Australian Government and local community. This will include further investigations to determine the extent of the impact and any potential risks. All environmental investigations, remediation and monitoring will be undertaken in accordance with the *Environment Protection Act 1993* and appropriate guidelines.

The project team will make every effort to minimise impacts to your property and household and we thank you for your patience and understanding during these works. If you have any questions or concerns during these works, please contact GHD on 1800 531 899. The GHD Project Manager can be contacted on 0420 959 236. Questions for the CFS can be directed to David Jeffree on 0418 985 359.

Sincerely
GHD

Dilara Valiff
Senior Environmental Consultant
+61 8 8111 6572

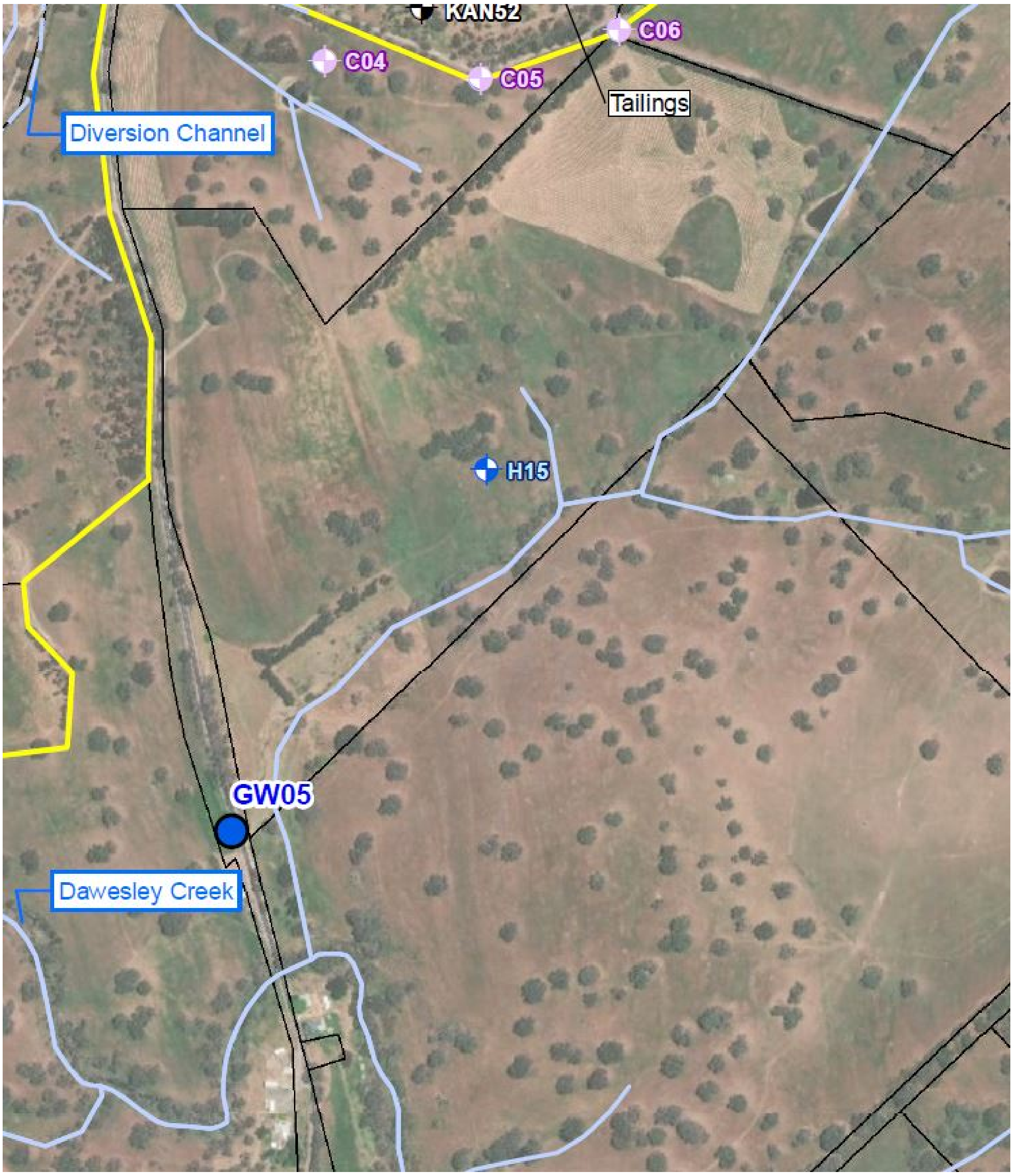


Figure: Map of proposed groundwater sampling location H15 at Lot 54 Pyrites Road, Brukunga SA.

Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.

- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
- The EPA will then produce a separate report, mailed directly to the person making the request (generally a real estate agent or conveyancer).
- It answers "yes" or "no" to 33 questions relating to all areas of environmental interest.
- This information will be incorporated into the property sale contract and Form 1 document at the time of sale and is required to be disclosed to prospective purchasers of this property.
- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
    - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), ____, the owner/s or authorised representatives of the property identified as ____, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative): ___________________________________

Name: ___________________________________

Date: ___________________________

Witness signature (or authorised representative): ___________________________________

Name: ___________________________________

Date: ___________________________

27 April 2020

TA Jackson
361 Mail Road
HARROGATE SA 5244

GHD ref: 12516828

Dear land owner

Access to your property for the installation of a groundwater monitoring well in the future road reserve (public land) adjacent to your property at Lot 294 Pyrites Road

Investigations are currently being undertaken at the CFS State Training Centre in relation to the historical use of PFAS containing firefighting foam.

PFAS stands for ‘per- and poly-fluoro alkyl substances’. PFAS are ingredients in some common domestic products such as paints, dishwasher rinse aids, and textile treatments (water proofing, stain prevention) along with certain types of firefighting foam called AFFF (aqueous film forming foams) that were used previously by firefighting agencies. Large quantities of PFAS have not been used at the CFS State Training Centre since 2001, when their use was restricted to Portable Fire Extinguishers only. South Australia was the first state to ban the use of fluorinated AFFF, with the ban coming into effect on 30 January 2020 after a two-year transition period. The CFS have not used fluorinated AFFF during the transition period.

The CFS have engaged GHD Pty Ltd (GHD), an environmental consulting firm, to investigate any potential impacts on groundwater at the CFS State Training Centre. The results of the GHD investigations indicated concentrations of PFAS in Dawesley Creek exceed the Australian drinking water guidelines (Australian National Health and Medical Research Council and Natural Resource Management Ministerial Council 2011, Version 3.5, Updated August 2018). Additional investigations are required, which will include targeted groundwater sampling from public land surrounding the CFS State Training Centre.

These additional investigations involve the installation of three (3) groundwater monitoring wells nearby to your property. All three groundwater monitoring wells are located on public land and the CFS have sought approval from Council to undertake these works. However, one of the proposed well installation locations is on a future road reserve (public land) that is currently inaccessible via public roads. Your property at Lot 294 Pyrites Road, Brukunga SA is adjacent to this location (see attached map). We seek your consent for a ute-mounted drill rig to access the proposed monitoring well location via your property and would like to discuss access options with you. If there are no other access options we may also need to seek your permission to temporarily remove (and replace) a section of fence, without disturbing livestock.

At this stage, the monitoring well installation is scheduled to occur in the week between the 18 and 22 May 2020 between 9 am and 5 pm. The work will be completed within one day. The groundwater monitoring well will be drilled to a maximum depth of approximately 9.5 m using a ute-mounted rotary drill rig. The well will be completed at the surface with a lockable stand pipe monument. Following the well installation the vehicles would leave again by crossing your property and we would arrange for any fences that were temporarily removed to be reinstated. If you are prepared to grant us access to your private property, please send an informal email to the GHD project manager (Dilara.Valiff@ghd.com) so we can discuss the details and make the necessary arrangements. If you have any questions regarding our request, please contact me via email or phone (0420 959 236).

Access to your private property may be required to complete the Groundwater sampling that needs to be conducted within a week of the well installation.

The CFS will share the results of the testing with the relevant Commonwealth and South Australian government agencies to determine if there are any potential concerns and consider the appropriate community advice. If contamination is found in the groundwater, CFS will fulfil its environmental obligations to the South Australian Government and local community. This will include further investigations to determine the extent of impact and any potential risks. All environmental investigations, remediation and monitoring will be undertaken in accordance with the *Environmental Protection Act 1993* and appropriate guidelines.

The project team will make every effort to minimise impacts on neighbouring landholders and we thank you for your patience and understanding during these works. If you have any questions or concerns regarding these works, please contact GHD on 1800 531 899. The GHD Project Manager can be contacted on 0420 959 236. Questions for the CFS can be directed to David Jeffree on 0418 985 359.

Sincerely
GHD

Dilara Valiff
Senior Environmental Consultant
+61 8 8111 6572

Figure: Map of proposed new groundwater monitoring well location GW06 in future road reserve (public land), Brukunga SA.

27 April 2020

GHD ref: 12516828

Dear resident

Installation of groundwater monitoring wells in public land

Investigations are currently being undertaken at the CFS State Training Centre in relation to the historical use of PFAS containing firefighting foam until 2001 and Portable Fire Extinguishers until January 2020.

PFAS stands for ‘per- and poly-fluoro alkyl substances’. PFAS are ingredients in some common domestic products such as paints, dishwasher rinse aids, and textile treatments (water proofing, stain prevention) along with certain types of firefighting foam called AFFF (aqueous film forming foams) that were used previously by firefighting agencies. Large quantities of PFAS have not been used at the CFS State Training Centre since 2001, when their use was restricted to Portable Fire Extinguishers only. South Australia was the first state to ban the use of fluorinated AFFF, with the ban coming into effect on 30 January 2020 after a two-year transition period. The CFS have not used fluorinated AFFF during the transition period.

The CFS have engaged GHD Pty Ltd (GHD), an environmental consulting firm, to investigate any potential impacts on groundwater at the CFS State Training Centre. The results of the GHD investigations indicated concentrations of PFAS in Dawesley Creek exceed the Australian drinking water guidelines (National Health and Medical Research Council and Natural Resource Management Ministerial Council 2011, Version 3.5, Updated August 2018). Additional investigations are required, which will include targeted groundwater sampling from public land surrounding the CFS State Training Centre.

These additional investigations involve the installation of three (3) groundwater monitoring wells nearby to your property. All three groundwater monitoring wells are located on public land and the CFS have sought approval from Council to undertake these works. No access to private property will be required. The work is being done in accordance with local regulations and approved by Council.

At this stage, the monitoring well installation is scheduled to occur in the week between the 18 and 22 May 2020 between 9 am and 5 pm. This will be followed by groundwater sampling to be conducted within a week after installation.

As an adjacent landholder, we want to advise you of the works and keep you informed of what is happening. The deepest of the groundwater monitoring wells will be drilled to a depth of approximately 9.5 m. During the installation of the groundwater monitoring wells, the only machinery used will be a rotary drill rig. The well will be completed at the surface with a lockable stand piper monument.

The CFS will share the results of the testing with the relevant Commonwealth and South Australian government agencies to determine if there are any potential concerns and consider the appropriate community advice. If contamination is found in the groundwater, CFS will fulfil its environmental obligations to the South Australian Government and local community. This will include further

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Level 4 211 Victoria Square Adelaide SA 5000 GPO Box 2052 Adelaide SA 5001 Australia
T +61 8 8111 6600 **F** +61 8 8111 6699 **E** adlmail@ghd.com **W** www.ghd.com

investigations to determine the extent of impact and any potential risks. All environmental investigations, remediation and monitoring will be undertaken in accordance with the *Environmental Protection Act 1993* and appropriate guidelines.

The project team will make every effort to minimise impacts on neighbouring landholders and we thank you for your patience and understanding during these works. If you have any questions or concerns during these works, please contact GHD on 1800 531 899. The GHD Project Manager can be contacted on 0420 959 236. Questions for the CFS can be directed to David Jeffree on 0418 985 359.

Sincerely
GHD

Dilara Valiff
Senior Environmental Consultant
+61 8 8111 6572

CFS Brukunga DSI - Community Engagement during May – June 2020 prior to access/sampling on private land

Property address	**Well ID & purpose**	**Property owner's name, contacts**	**Mailing Address**	**Actions taken**	**Informed Consent required?**	**Informed Consent received?**	**Comments / Status**
296 Pyrites Rd, Brukunga	Installing new well GW06 on public land	Ray & Tania Jackson bonniedoon361@bigpond.com Ph: 0429 189 089		Letterbox drop 4/5, Doorknock 8/5, Doorknock 4/9	**No**	N/A	Letter informed of well install on public land. Sean and Rob spoke with residents on 8/05/2020 and were told that they were renting the property. Property is owned by Ray and Tania Jackson (see 294 Pyrites Rd, Brukunga for communication with them), property shares access gate with 294 Pyrites Rd, Brukunga. Sean and Vera conducted doorknock on 4/9 at 8 pm, lights were on inside of house but received no answer, left letter, Vera's business card and note requesting residents contact us so we can explain the contents of the letter.
93 Harrogate Rd, Brukunga	Installing new well GW06 on public land	RF & JM McEvoy mcevoyjr@bigpond.com Ph: 08 83880267	PO Box 124, Nairne 5252	Letter posted 27/4, Letterbox drop 4/5, Doorknock 8/5	**No**	N/A	Letter re access to property for installation of a new well on future road reserve. Email response received on 5/5/2020 agreed on doorknocking. Sean and Rob visited on 8/5/2020 – property owner took Rob to show him proposed location and that it would be difficult to access from this property.
113 McIntyre Rd, Brukunga	Installing new well GW06 on public land	RJ & S Shearer	PO Box 1064, Nairne 5252	Letter posted 27/4, Letterbox drop 4/5	**No**	N/A	Letter re access to property for installation of a new well on future road reserve. Visited neighbourhood on 8/5/2020 – did not meet with property owners, as seen from neighbouring property (93 Harrogate Rd) it would be difficult to access proposed location from this property.
294 Pyrites Rd, Brukunga	Installing new well GW06 on public land, sampling of bore and Dawesley Creek on private land	Ray & Tania Jackson bonniedoon361@bigpond.com Ph: 0429 189 089	361 Mail Rd, Harrogate 5244	Letter posted 27/4, Letterbox drop 4/5, Well install 26/5, Sampling of	**Yes**	Yes	Letter re access to property for installation of a new well on public road easement. Could not find address during letterbox drop, owners of conjoined property 296 Pyrites Rd. Ray Jackson (0409 282 703) met Joel Chance on Tuesday 19/5/2020 at 9 am at 296 Pyrites Rd, accompanied to the

Property address	Well ID & purpose	Property owner's name, contacts	Mailing Address	Actions taken	Informed Consent required?	Informed Consent received?	Comments / Status
				GW06 15/6, Report of Lab results emailed 8/07, Sampling of private bore and Dawesley Creek 17/8 Sampling of private bore and soil from disused vegetable garden 17/9			proposed location of well GW06. Four-wheel drive vehicle is required for access to the well area due to undulated hills. Sean and Joel sampled GW06 on 15/06/2020, Joel contact Ray prior to accessing the site. DV received query from Tania re Public Notice in the newspaper re EPA Sec83a Notification on 8/7/20 relating to private bore 6627-833 at 260 Pyrites Rd (owned by Simon Nefiodovas, tested in February 2020), with PFAS > PFAS NEMP 2018 Health Drinking Water of 0.07 ug/L for Sum of PFHxS and PFOS. DV emailed info for new well GW06 (PFAS <LOR) to Tania on 8/07/2020. DV in contact with Tania about sampling the property's private bore and arranged for SS to meet with Ray to collect samples. SS meet with Ray 17/8/20 and collected samples from the pumped bore well and nearby Dawesley Creek that runs through the property. With permission from property owners SS conducted second round of sampling from private bore, as well as soil from the disused vegetable garden on 17/9/20. Ray was at work so SS conducted sampling unaccompanied.
220 Pyrites Rd, Brukunga	Installing new well GW07 on public land			Letterbox drop 4/5	**No**	N/A	Letter informed of well install on public land
260 Pyrites Rd, Brukunga	Installing new well GW07 on public land	Simon Nefiodovas, 0412 955 274		Letterbox drop 4/5, Access to DC03 & DC04 through	**No**	N/A	Letter informed of well install on public land. Sean contacted Simon about accessing the public road easement behind his property to sample DC03. Simon confirmed that the land parcel to his south was a reserve

Property address	**Well ID & purpose**	**Property owner's name, contacts**	**Mailing Address**	**Actions taken**	**Informed Consent required?**	**Informed Consent received?**	**Comments / Status**
				property 8/5			owned by council, Sean accessed the site through 260 Pyrites Rd, Brukunga and sampled DC04.
265 Pyrites Rd, Brukunga	Installing new well GW07 on public land			Letterbox drop 4/5	**No**	N/A	Letter informed of well install on public land
289 Pyrites Rd, Brukunga	Installing new well GW08 and H10 existing well sampling	Lynlee Krek & John Hunt	PO Box 4001, Tranmere North 5073	Letter posted 27/4, Letterbox drop 4/5	**Yes**	**No**	Email received 4/05/2020. Property owners have **refused consent** to access their site to install a new well or monitor the existing well and have requested that the GHD field team do not visit the property during the doorknocking
203 Peggy Buxton Rd, Brukunga	KAN23, KAN26, KAN27, KAN28 Existing wells sampling	Peggy Buxton Road Pty Ltd, Peter Buik, owner, 0408 821 562. Andrew Dunncliff, lawyer, Commercial & Legal, andrew@commercialandlegal.com.au	PO Box 7052, Adelaide 5000	Letter posted 27/4, Letterbox drop 4/5/2020, Report of Lab results emailed to Andrew 8/07	**Yes**	**Yes**	Letter re Groundwater sampling of existing wells on 203 and Lot 100 Peggy Buxton Road. Rob and Sean did doorknocking on 8/05/2020, nobody home. Sean and Vera did doorknocking on 18/5/2020, obtained phone number for property owner Peter Buik from contractor. DV spoke to Peter on 22/05/2020 and to the lawyer Andrew Duncliff, Commercial and Legal on 25/05/2020. Andrew emailed on 27/05/2020 confirming owner's consent, subject to providing lab results including pH, TDS & PFAS. Signed consent Form was received on 2/6/2020. Property is leased to residents who farm the property. Sean called Peter and confirmed access for environmental monitoring team to visit property on 13/06/2020. Sean and Joel visited site on 15/06/2020 to locate and sample existing wells, only KAN23 was able to be located with the use of a metal detector, while searching for KAN26, Sean and Joel met with the daughter of the tenants, who wanted to confirm GHD had acquired permission from Peter to be on the property and was not aware of the existence of the wells. Peter provided contact details of previous property owner Jill Shephard (0488

Property address	Well ID & purpose	Property owner's name, contacts	Mailing Address	Actions taken	Informed Consent required?	Informed Consent received?	Comments / Status
							588 007) to try and provide more background information to be able to locate other well locations. Sean called Jill on 17/06/2020 confirmed that all of the existing wells were installed with gatics and gave descriptions of the wells locations. Sean called Peter to organise another site visit on 17/06/2020. Sean returned to property on 19/06/2020 to search for remaining wells, using a metal detector and handheld GPS device was only able to locate KAN26. Lincoln Jeffery from LinkUp surveyed KAN23 and KAN26 on 26/06/2020 and attempted to locate KAN27 and KAN28 but was unable to locate them. Lincoln reported that when accessing the site he met with one of the tenants who was strongly opposed to having groundwater wells installed on the property, however relaxed when informed that the work involved surveying existing wells. DV emailed lab results for KAN23 and KAN26 (PFAS <LOR) to A Duncliff on 8/07/2020.
Lot 54 Pyrites Rd, Brukunga	H15 Existing well sampling and new well C04a installation	Elizabeth Jean Shephard lizshephard@hotmail.com Mob 0438 952 654	PO Box 32 Nairne 5252	Letter posted 27/4, Letterbox drop 4/5, Report of Lab results emailed / sent 10/07	**Yes**	**Yes**	Letter re Groundwater sampling of existing well H15. Liz leases Lot 54 to farmer Dale Mills (0418 892 454). Rob and Sean visited on 8/05/2020 and discussed installing a new well bordering the DEM tailings dam, Liz is certain that H15 does not exist. DV received verbal consent to sample existing & install the new well. DV spoke to Liz on 12 and 13 May 2020 re informed consent form clarification. Liz posted signed Informed consent form to DV dated 13/5/2020. Liz requested the lab results of metals, iron, TDS and pH to be provided to her. DV responded to Liz's email received on 9/6/2020, informing of well install to 14 m bgl on 28/5/2020.

Property address	**Well ID & purpose**	**Property owner's name, contacts**	**Mailing Address**	**Actions taken**	**Informed Consent required?**	**Informed Consent received?**	**Comments / Status**
							Sean called and met Liz on 16/06/2020, sampled H15 and C04a. Note could not drive to H15 due to lambing season and slippery steep track. Lincoln Jeffery from LinkUp surveyed H15 and C04a on 26/06/2020. DV emailed and posted lab results and map to Liz for wells H15 and C04a (PFAS <LOR) on 10/07/2020.
Lot 31 Smyth Road, Dawesley	Dawesley Creek water sampling around DC06/07	Luke Angel M: 0414 834 797	Lot 31 Smyth Road, Dawesley	Phone call DV on 15/5/2020	**Yes**	No	DV spoke to Luke on 22/5/2020. Luke did not consent to creek water sampling on his property, but can sample the creek water at the weir located to the north of Luke's property, regularly sampled by DEM (Brukunga mine).
16 Hawthorn Street, Dawesley, "The Brae"	Additional private bore identified at the property And require informed consent for testing creek samples DC06A and DC06B	Milos J Castelli & M Sepe 0402 143 516 Wedding venue and cottage accommodation		Doorknock 18/05, Report of Lab results emailed 15/07	**No**	yes	SS and VB did door knocking on 18/05/2020 and spoke to owner. Milos informed that gate blocking access to DC06 belonged to his neighbour Ken Sourby, who he called and requested access to the road reserve on behalf of GHD, to which Ken agreed. Milos suggested to take samples from 2 additional fords in the creek on his property marked DC06A and DC06B (which GHD took on the day and put on hold for informed consent). After the consent was received, samples were requested for PFAS analysis. Milos asked if GHD would test his bore water (used mostly for irrigation). SS left an informed consent form and an information letter, saying that if we were provided the informed consent we could arrange a day to come sample the bore during the next round. DV spoke to Milos and emailed consent form on 2/6/2020. Milos sent signed consent form on 9 May 2020.

Property address	Well ID & purpose	Property owner's name, contacts	Mailing Address	Actions taken	Informed Consent required?	Informed Consent received?	Comments / Status
							Sean called Milos prior accessing / sampling private bore on 16/6 (pump wasn't working properly and Milos said he'd try to fix it by the time Sean came back later in the week) and on 19/06/2020. DV emailed lab results to Milos for private bore Hawthorn1 (PFAS <LOR) at the property and creek samples DC06A and DC06B on 15/07/2020.
95 Smyth Road, Dawesley "Carlisle Lodge"	Require access to creek location DC08 on public land	Bernard and Sue 0422 827 602 Airbnb accommodation, also run safety training company in Mt Barker		Doorknock 18/05	**No**	N/A	The last property door knocked, Sean and Vera spoke to the neighbours who said the property owners did some conservation work in the creek. After checking the house to see if the property owners were home Sean and Vera met daughter down the road, gave her the information letter to pass onto her parents and she gave us her step-father's (property owner) mobile number. DV called Bernard on 3/6/2020, getting access via private property to the creek. Sean called Bernard prior accessing and sampling creek on 9/6/2020.
8 July 2020 Community Engagement during Dawesley Creek sampling							
483 Ironstone Range Rd, Petwood	6627-11131 (private bore)	Brianna (0438 838 972) and Brad McAvanney briannamcavaney@hotmail.com		Doorknock 8/07 GW sampling from private bore 24/07	**Yes**	Yes	Sean and Vera doorknocked and spoke to a group who were housesitting for the residents and they it should be fine for the environmental monitoring team to access to the creek locations for collecting creek samples DC09, DC10 and DC11 within the road easement that runs through the property. Brianna contacted GHD to request sampling of private bore, Taylah arranged for Sean to visit the property on 24/9/20. Sean meet with Brianna and Brad on 24/9/20, Brianna had to leave to take the children to school, but Brad accompanied Sean down to the bore.
Lot 13 Ironstone		Craig Daykin 0419 828 825	PO Box 387 Littleham		**No**	N/A	Sean called property owner, access to road easement requested and gained for sampling Nairne Creek. Craig mentioned that the Dawesley Creek was the only accessible

Property address	**Well ID & purpose**	**Property owner's name, contacts**	**Mailing Address**	**Actions taken**	**Informed Consent required?**	**Informed Consent received?**	**Comments / Status**
Range Rd, Petwood		cadaykin@hotmail.com.au enquires@bluestonesupplies.com.au Adelaide Hills Bluestone Supplies (08 8391 1625)	pton SA 5250				water source and was being used for livestock watering for cattle on his property. Sean to contact Craig prior to arriving to site to ensure he has time to notify work crew of GHD works being completed. Sean called Craig to arrange a time to sample private bore on 483 Ironstone Range Rd, however Craig informed that the property belongs to his neighbours but didn't have any problem with driving through property to access neighbour's property. As these properties are separate this property will not have been included in the doorknock informing residents of the contamination in Dawesley Creek, will need to email to him separately. Sean emailed Craig letter to residents and water use survey from the doorknock to Craig on 2/10/20.
573 Back Callington Rd, Petwood				Doorknock 8/07	**No**	N/A	Sean and Vera doorknocked, there was no one at home. Printed information letter to residents was left in door nearest the driveway.
649 Back Callington Rd, Petwood				Doorknock 8/07	**No**	N/A	Sean and Vera doorknocked and met with the residents who appeared to run a nursery business. The man was reluctant to allow access due to previous dealings with the EPA on his property and who in his opinion hadn't managed to do anything to improve the situation with the neighbouring Kanmantoo mine. However he agreed to allow access to the public land to conduct the sampling and accompanied Sean down to the creek (DC13), at which point due to the time Vera had to leave to get back home in time to look after her kids. The man pointed out the Kanmantoo mine's discharge point and so DC13 was positioned upstream of it and DC14 which was a few hundred meters downstream would detect any spike in analyte.

Property address	Well ID & purpose	Property owner's name, contacts	Mailing Address	Actions taken	Informed Consent required?	Informed Consent received?	Comments / Status
							DC14 and DC15 (which were roadside) were sampled after Sean visited Brukunga as the DEM WTP crew would want to close the gates to the mine mid-afternoon (3:30 pm).
Lots 14 & 15 Éclair Mine Rd, St Ives		Kristina Van Meeter 0409278123 jakemfarm@gmail.com JAKEM Farm			**N/A**	N/A	Sean called property owner on 21/07/2020 and was informed that the road easement runs through adjacent properties. Sean emailed Kristina a map of sampling locations and she will be able to provide contact details of her neighbours for us to contact the property owners prior to accessing Dawesley Creek and Mt Barker Creek. Kristina provided the names and mobile numbers of her neighbouring property owners we would need to contact to access the public road reserve at the bottom of Dawesley Creek. Sean and Vera, accompanied by EPA Hannah Custance met with Kristina while setting up for sampling from DC16.
106 Blue Wren Lane, Wistow					**No**	N/A	Sean and Vera doorknocked on 17/08/2020 to request permission to access public road reserve via private property. Permission was received, left information letter on way out. Sean doorknocked on 11/09/2020 to request permission a second time, however resident was not home. So during field work 4WD was parked outside of property and walked to sampling location via public road easement that was on neighbouring property to the north. Sean doorknocked on 17/09/2020 to request permission to access road easement, however resident was not home. So during field work 4WD was parked outside of property and walked to sampling location via public road easement that was on neighbouring property to the north.
Bremer Range Rd, St Ives		Mick Chapman 0424569317 Holly Chapman			**No**	N/A	Sean called Holly on 22/07/2020 and received permission to access public road and sample DC16. Holly has informed us that she co-owns the property and that the co-owner had put

Property address	Well ID & purpose	Property owner's name, contacts	Mailing Address	Actions taken	Informed Consent required?	Informed Consent received?	Comments / Status
(unnumbered, east of 14 & 15 Éclair Mine Rd, St Ives)		0422737898					up fences and padlocked the gate across the public road easement and gave permission for environmental monitoring team to cut the padlock to gain access. Holly also mentioned that there were groundwater monitoring wells and there used to be a smelter south-west of the Dawesley Creek (field work show that these were on the adjacent property owned by Robert Mach). Sean and Vera, accompanied by EPA Hannah Custance accessed the public land by crossing the property, the padlock previously mentioned was too heavy to be cut with bolt cutters but the fence was short enough to be easily jumped, while navigating to DC17 (Samuels Rd), it was observed that the site would be easily accessible from the other side which had a non-padlocked gate. Sean attempted to contact Holly to request access to property to reach neighbouring property for sampling on 11/9/20 and 17/9/20, but was unable to make contact. So during field work on 11/9/20 the 4WD was parked outside of the property boundary and walked through property via the public road reserve which was accessible from edge of property. SS was still unable to make contact with Holly, during field work on 17/9/20, the 4WD was parked outside of the property boundary and walked through property via the public road reserve which was accessible from edge of property.
Lot 50 Éclair Mine Rd, St Ives		Robert Mach 0429944213			**No**	N/A	Sean called the property owner while in the field on 23/07/2020, Robert did not give permission to access the road easement to sample from Dawesley Creek as to access the road easement would still require traversing into his neighbours property and suggested that we access the easement only through that property.

Property address	**Well ID & purpose**	**Property owner's name, contacts**	**Mailing Address**	**Actions taken**	**Informed Consent required?**	**Informed Consent received?**	**Comments / Status**
Lot 70 Samuels Rd, Callington		Jose 0414490301			**No**	N/A	Sean called Jose on 22/07/2020 but no response, left message with details. Sean called Jose again while in the field on 23/07/2020, Jose gave permission to access the road easement and advised that it would be easiest to access the property by driving in through a gate in the north-western corner of his property (through Bremer Range Rd, for which we already had permission to access from Holly), but that even with a 4WD it would only make it half the distance. Sean called Jose to request permission and was received to access public land via private property for concurrent sampling first to be 11/09/2020 and second to be 17/09/2020, access to be the same as previously discussed.
BR01		Brad Crook 430C Callington Rd, Salem					While sampling BR01, Sean spoke with one of the local residents (Brad Crook) who commented that it was very unusual for the Bremer River to have run dry. During the door knocking on 10/8/20, Sean and Vera spoke with Brad again and completed the water use survey indicating that he is pumping water from the Mt Barker Creek to irrigate plants and water livestock.
430D Callington Road, Salem		Paul and Rose Johnston		Door knocking and sampling of Mt Barker Creek 10/8	**Yes**	Yes	While doorknocking on 10/8 Sean and Vera spoke with the property owners who use the property for environmental conservation, they agreed to sign the informed consent and allow access to the Mt Barker Creek for sampling the same day. The sampling point is immediately adjacent to the SA EPA water quality monitoring station located on the property.

Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.
- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
- The EPA will then produce a separate report, mailed directly to the person making the request (generally a real estate agent or conveyancer).
- It answers "yes" or "no" to 33 questions relating to all areas of environmental interest.
- This information will be incorporated into the property sale contract and Form 1 document at the time of sale and is required to be disclosed to prospective purchasers of this property.
- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
    - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), Brad McAvaney, the owner/s or authorised representatives of the property identified as 848 Ironstone Range Rd Petwood, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative): ______________________

Name: Brad McAvaney

Date: 23/9/2020

Witness signature (or authorised representative): ______________________

Name: Sean Sparrow

Date: 23/9/2020

Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.
- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
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- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
    - ○ (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), TANIA JACKSON, the owner/s or authorised representatives of the property identified as 296 PYRITES RD BRUKUNGA, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative):

Name: TANIA JACKSON

Date: 16/8/2020.

Witness signature (or authorised representative):

Name: Ray Jackson

Date: 16/8/2020.

Property owner informed consent

I understand:

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- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993.*
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
- The EPA will then produce a separate report, mailed directly to the person making the request (generally a real estate agent or conveyancer).
- It answers "yes" or "no" to 33 questions relating to all areas of environmental interest.
- This information will be incorporated into the property sale contract and Form 1 document at the time of sale and is required to be disclosed to prospective purchasers of this property.
- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
    - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), Peter Andrew Buik, the owner/s or authorised representatives of the property identified as 203 and Lot 100 Peggy Buxton Rd, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative):

Name: Peter Andrew Buik

Date: 2nd June 2020.

Witness signature (or authorised representative):

Name: ANDREW. DUNNCLIFFE

Date: 2/6/2020

Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.

- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
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- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
    - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), PAUL Y. JOHNSTON, the owner/s or authorised representatives of the property identified as 430D Callington Rd Salem, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative):

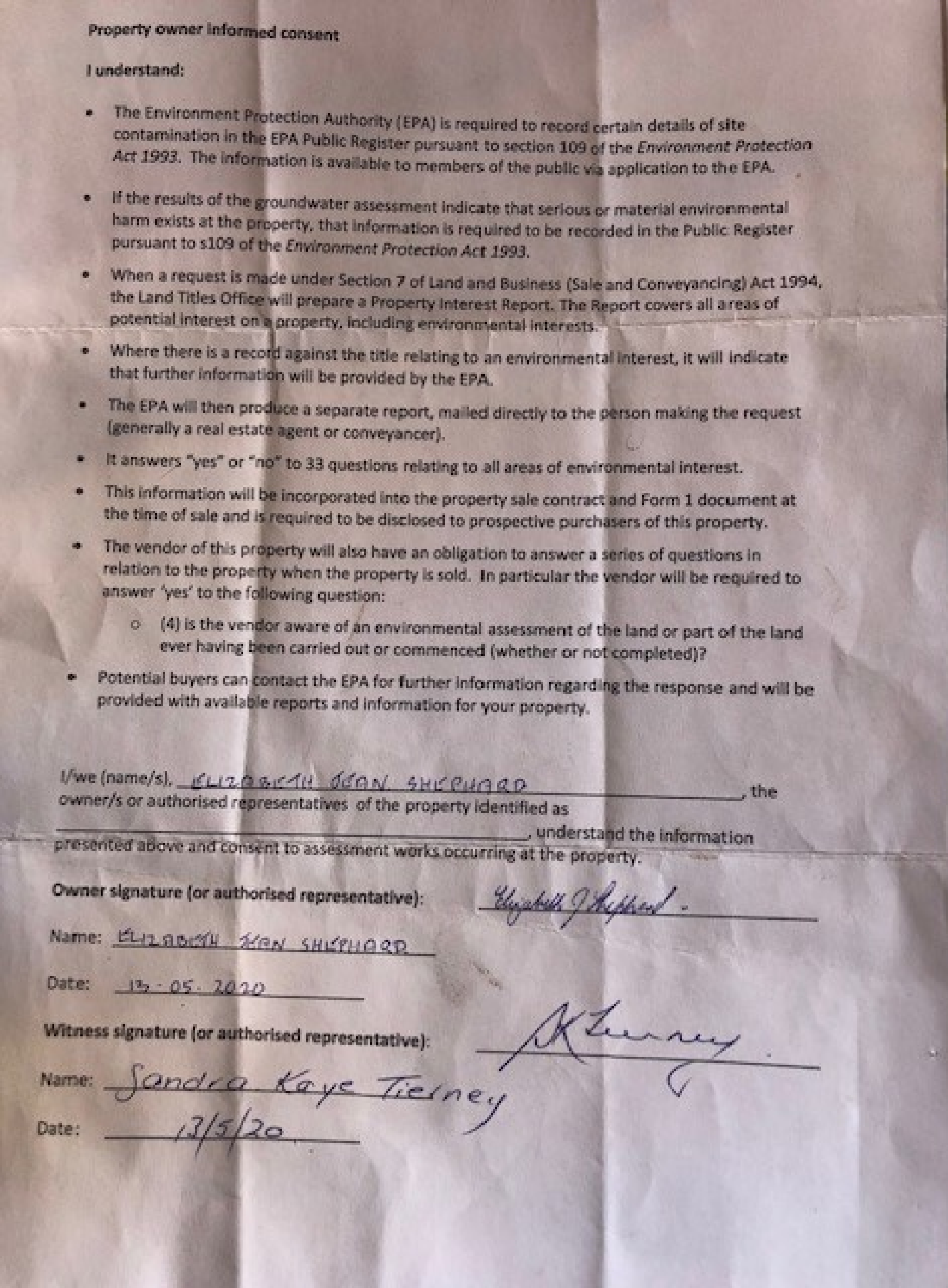
Name: PAUL JOHNSTON

Date: 10/8/20

Witness signature (or authorised representative):

Name: Sean Sparrow

Date: 10/8/2020



Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.
- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
- The EPA will then produce a separate report, mailed directly to the person making the request (generally a real estate agent or conveyancer).
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- The vendor of this property will also have an obligation to answer a series of questions in relation to the property when the property is sold. In particular the vendor will be required to answer 'yes' to the following question:
  - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), ELIZABETH JEAN SHEPHARD, the owner/s or authorised representatives of the property identified as ______, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative): Elizabeth J Shephard

Name: ELIZABETH JEAN SHEPHARD

Date: 13-05-2020

Witness signature (or authorised representative):

Name: Sandra Kaye Tierney

Date: 13/5/20

Property owner informed consent

I understand:

- The Environment Protection Authority (EPA) is required to record certain details of site contamination in the EPA Public Register pursuant to section 109 of the *Environment Protection Act 1993*. The information is available to members of the public via application to the EPA.
- If the results of the groundwater assessment indicate that serious or material environmental harm exists at the property, that information is required to be recorded in the Public Register pursuant to s109 of the *Environment Protection Act 1993*.
- When a request is made under Section 7 of Land and Business (Sale and Conveyancing) Act 1994, the Land Titles Office will prepare a Property Interest Report. The Report covers all areas of potential interest on a property, including environmental interests.
- Where there is a record against the title relating to an environmental interest, it will indicate that further information will be provided by the EPA.
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  - (4) is the vendor aware of an environmental assessment of the land or part of the land ever having been carried out or commenced (whether or not completed)?
- Potential buyers can contact the EPA for further information regarding the response and will be provided with available reports and information for your property.

I/we (name/s), MILOS JOSEPH CASTELLI, the owner/s or authorised representatives of the property identified as THE BRAE 16 HAWTHORN ST DAWESLEY, understand the information presented above and consent to assessment works occurring at the property.

Owner signature (or authorised representative):

Name: MILOS JOSEPH CASTELLI

Date: 09/06/2020

Witness signature (or authorised representative):

Name: Maddalena Joseph Castelli (Sepe)

Date: 9/6/2020

Appendix B – Borehole Logs

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. C04A

SHEET 1 OF 2

Position : 312286.1 E 6123984.8 N MGA94 54	**Surface RL:** 363.18m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 28/5/2020	**Date Completed :** 28/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
0	Air Hammer	Nil			0.05 (363.13)			Natural topsoil, schist.	M	S	Trace organic matter observed.		
								QUARTZITE, dark grey with silver mica.		H			
1													
2													
3													
4													
5			▼										
6													
7													
8													

See standard sheets for details of abbreviations & basis of descriptions

Job No. 12516828

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. C04A

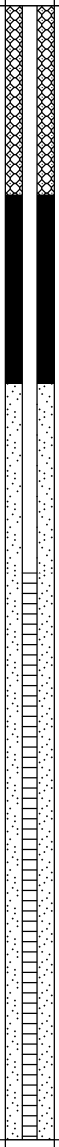
SHEET 2 OF 2

Position : 312286.1 E 6123984.8 N MGA94 54	**Surface RL:** 363.18m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 28/5/2020	**Date Completed :** 28/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING				MATERIAL					
Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
Air Hammer	Nil							H	
				8.50 (354.68)	SP	SAND, pale brown.	SM	S	Alluvial material observed. Perched aquifer.
				9.20 (353.98)		QUARTZITE, yellowish brown.	D	Fb	
		∇		11.50 (351.68)		QUARTZITE, yellowish brown.	W	Fb	
				14.00 (349.18)		End of borehole at 14.00 metres. Target Depth			

Bore Construction



See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 12516828

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW01

SHEET 1 OF 2

Position : 312077.5 E -6124665.7 N MGA94 54	**Surface RL:** 349.86m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 26/5/2020	**Date Completed :** 26/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	USC Symbol	Description	Moisture Condition	Consistency / Density Index	Comments/ Observations
0	Air Hammer (0–8)	Nil (0–8)		GW01_0-0.2	0.00	(SP-SC)	FILL; Clayey SAND, pale brown, medium to fine grained, poorly sorted, low plasticity fines.	M	S	Organic matter observed.
				GW01_0.2-0.4	0.30 (349.56)		SCHIST, pale brown, well sorted, weathered.	D	Fb	
1				GW01_0.9-1.1						
					1.20 (348.66)		SCHIST, pale brown, well sorted.	D	Fb	
					1.90 (347.96)		SCHIST, pale brown, well sorted, with trace pyrite fragments and silver mica.	D	H	
2										
			▼							
3										
					3.40 (346.46)		SCHIST, light grey to silver, well sorted, with trace pyrite fragments and silver mica.	D	H	
4										
5										
6										
7										
8										

Description: [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects

Bore Construction — Bore Construction Log | Components

See standard sheets for details of abbreviations & basis of descriptions

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12516828

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

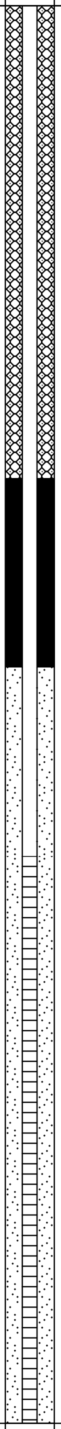
HOLE No. GW01

SHEET 2 OF 2

Position : 312077.5 E -6124665.7 N MGA94 54	**Surface RL:** 349.86m AHD		**Angle from Horiz. :** 90°		**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW		**Checked :** RW
Date Started : 26/5/2020	**Date Completed :** 26/5/2020		**Logged by :** JC		**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
9 10 11 12 13	Air Hammer	Nil							D	H			
14 15			▽		13.50 (336.36)			SCHIST, light grey to silver, well sorted, with trace pyrite fragments and silver mica.	W	H			
16					15.50 (334.36)			End of borehole at 15.50 metres. Target Depth					



See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.
12516828

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW02

SHEET 1 OF 3

Position : 312742.6 E -6124665.0 N MGA94 54
Surface RL: 386.66m AHD
Angle from Horiz. : 90°
Processed : MH
Rig Type : DH400 Air Hammer
Mounting: Land Rover
Contractor : WDS
Driller : MW
Checked : RW
Date Started : 27/5/2020
Date Completed : 27/5/2020
Logged by : JC
Date: 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
	Air Hammer	Nil			0.05 (386.61)		(SP-SC)	FILL; Clayey SAND, pale brown, medium to fine grained, poorly sorted with gravels.	M	S	Trace organic matter observed.		
					0.25 (386.41)			SCHIST, pale brown, weathered.	SM	Fb			
								SCHIST, yellowish brown, weathered.	D	Fb			
1													
2													
3													
4													
5													
6													
7													
8													

See standard sheets for details of abbreviations & basis of descriptions

Job No.
12516828

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW02

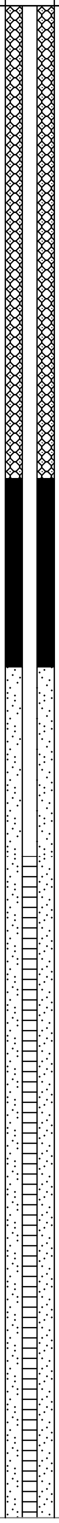
SHEET 2 OF 3

Position : 312742.6 E -6124665.0 N MGA94 54	**Surface RL:** 386.66m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 27/5/2020	**Date Completed :** 27/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Components
9, 10, 11	Air Hammer	Nil							D	Fb		
12, 13					12.00 (374.66)			SCHIST, yellowish brown, weathered.	SM	Fb		
14, 15, 16			▼		14.00 (372.66)			SCHIST, brown-grey, weathered.	SM	Fb		

Bore Construction Log



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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.
12516828

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

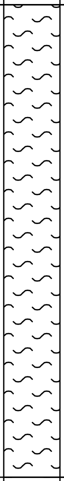
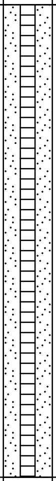
BOREHOLE LOG SHEET

HOLE No. GW02

SHEET 3 OF 3

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA
Position : 312742.6 E -6124665.0 N MGA94 54 **Surface RL:** 386.66m AHD **Angle from Horiz. :** 90° **Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover **Contractor :** WDS **Driller :** MW **Checked :** RW
Date Started : 27/5/2020 **Date Completed :** 27/5/2020 **Logged by :** JC **Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
17 18	Air Hammer	Nil			18.50 (368.16)				SM	Fb			
19 20 21 22 23 24								End of borehole at 18.50 metres. Target Depth. Groundwater not encountered during drilling. Groundwater recharged and recorded on 9/06/20 prior to well install.					

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GEO BOREHOLE AS1726 2017 12516828 BRUKUNGA LOGS VER2.GPJ GHD GEO TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW03

SHEET 1 OF 3

Position : 312957.4 E -6124490.9 N MGA94 54	**Surface RL:** 380.35m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 28/5/2020	**Date Completed :** 28/5/2020	**Logged by :** JC	**Date:** 14/2/2021

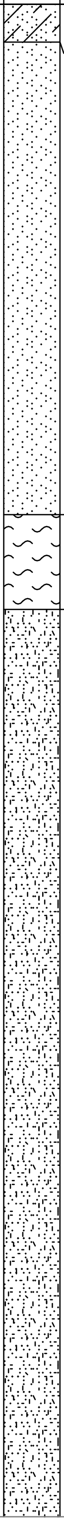
Note: * indicates signatures on original issue of log or last revision of log

DRILLING: SCALE (m) 0–8; Drilling Method: Air Hammer (0–8 m); Hole Support \ Casing: Nil (0–8 m); Water; Samples & Tests

MATERIAL

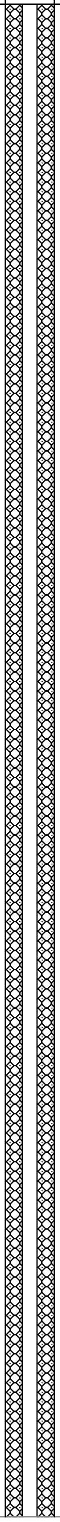
Depth/(RL) metres	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
	(SP-SC)	FILL; Clayey SAND, poorly sorted, low plasticity fines.	S	M	Organic matter observed.
0.20 (380.15)	SP	FILL; Sand, quartzite, silt stone, schist mix, pale brown to yellow brown, poorly sorted.	D	Fb	
2.70 (377.65)		SCHIST, yellowish brown, weathered.	D	Fb	
3.20 (377.15)		QUARTZITE, medium to dark grey with silver mica.	D	H	

Graphic Log



Bore Construction

Bore Construction Log



Components

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GEO_BOREHOLE_AS1726 2017 12516828 BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

HOLE No. GW03

SHEET 2 OF 3

Client : CFS					
Project : CFS Brukunga					
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA					
Position : 312957.4 E -6124490.9 N MGA94 54	**Surface RL:** 380.35m AHD		**Angle from Horiz. :** 90°		**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW		**Checked :** RW
Date Started : 28/5/2020		**Date Completed :** 28/5/2020	**Logged by :** JC		**Date:** 14/2/2021

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DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
	Air Hammer	Nil							D	H			
9													
10													
11													
12													
					12.80 (367.55)			SCHIST, pale brown with silver mica.	D	Fb			
13													
14													
15													
16													

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW03

SHEET 3 OF 3

Position : 312957.4 E -6124490.9 N MGA94 54	**Surface RL:** 380.35m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 28/5/2020	**Date Completed :** 28/5/2020	**Logged by :** JC	**Date:** 14/2/2021

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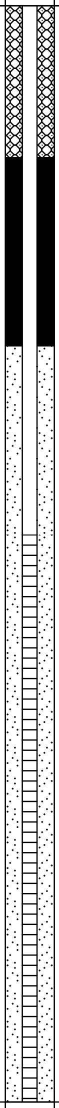
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
	Air Hammer	Nil					D	Fb	
17			▼		17.00 (363.35)	SCHIST, pale brown with silver mica.	SM	Fb	
18									
19			▽		19.50 (360.85)	SCHIST, pale brown with silver mica.	M	Fb	
20									
21									
22					21.80 (358.55)	End of borehole at 21.80 metres. Target Depth			
23									
24									

Bore Construction

Bore Construction Log | Components



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BOREHOLE LOG SHEET

HOLE No. GW04

SHEET 1 OF 3

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

Position : 312802.1 E -6124225.8 N MGA94 54		**Surface RL:** 385.28m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 27/5/2020		**Date Completed :** 27/5/2020	**Logged by :** JC	**Date:** 14/2/2021

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DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
	Air Hammer	Nil			0.15 (385.13)		(SP-SM)	FILL; Silty SAND, poorly sorted.	M	S	Organic matter observed.		
								SCHIST, light to medium grey, well sorted, weathered with silver mica.	D	Fb			
1													
2					2.30 (382.98)			SCHIST, pale brown, well sorted with silver to gold mica.	D	H			
					2.70 (382.58)			SCHIST, light grey, well sorted with silver mica.	D	H			
3													
4													
5													
6													
7					7.60 (377.68)			SCHIST, brown-grey, well sorted with silver mica.	D	H			
8													

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW04

SHEET 2 OF 3

Position : 312802.1 E -6124225.8 N MGA94 54	**Surface RL:** 385.28m AHD	**Angle from Horiz. :** 90°		**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 27/5/2020	**Date Completed :** 27/5/2020		**Logged by :** JC	**Date:** 14/2/2021

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DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
	Air Hammer	Nil							D	H			
9													
10													
11													
12													
13													
14													
15													
16													

See standard sheets for details of abbreviations & basis of descriptions

Job No. 12516828

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

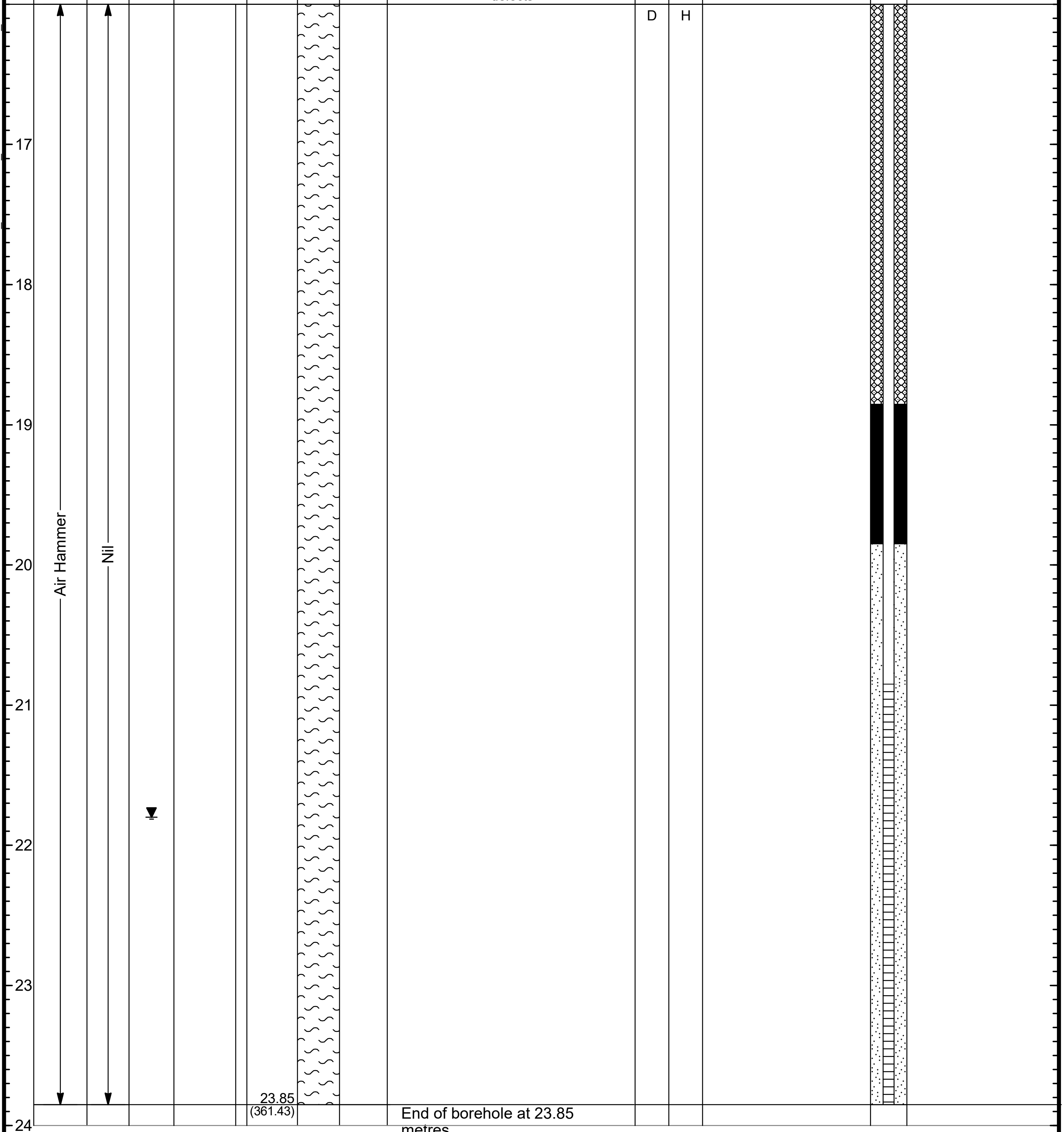
HOLE No. GW04

SHEET 3 OF 3

Position : 312802.1 E -6124225.8 N MGA94 54	**Surface RL:** 385.28m AHD		**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 27/5/2020	**Date Completed :** 27/5/2020		**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
									D	H			
24					23.85 (361.43)			End of borehole at 23.85 metres. Target Depth					



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BOREHOLE LOG SHEET

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

Client : CFS

Project : CFS Brukunga

Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW05

SHEET 1 OF 1

Position : 312205.7 E -6123129.1 N MGA94 54	**Surface RL:** 307.01m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 29/5/2020	**Date Completed :** 29/5/2020	**Logged by :** JC	**Date:** 14/2/2021

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DRILLING — **MATERIAL** — **Bore Construction**

Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
Air Hammer (0.00–8.00)	Nil (0.00–8.00)			0.00	(sp-sc)	FILL; Clayey SAND, poorly sorted with gravels.	M	S	Road base and alluvial material observed.
				0.80 (306.21)		SCHIST, pale brown, weathered.	D	Fb	
				3.00 (304.01)	SP	SAND, pale brown, poorly sorted.	M	Fb	Alluvial material observed.
				3.50 (303.51)		SCHIST, medium grey, weathered, with silver mica.	M	Fb	
		▼ (approx. 5.4)		4.00 (303.01)		SCHIST, pale brown.	SM	Fb	
		▽ (approx. 6.0)		5.80 (301.21)		SCHIST, light grey/silver.	D	Fb	
				6.00 (301.01)		SCHIST, pale brown.	W	Fb	
				7.50 (299.51)		SCHIST, medium grey, with silver mica.	D	H	
				8.00 (299.01)		End of borehole at 8.00 metres. Target Depth			

SCALE (m): 0 – 8

Bore Construction Log — Components

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BOREHOLE LOG SHEET

GEO BOREHOLE AS1726 2017 12516828 BRUKUNGA LOGS VER2.GPJ GHD GEO TEMPLATE 2.00.GDT 16/3/21

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW06

SHEET 1 OF 2

Position : 312419.7 E -6122349.1 N MGA94 54	**Surface RL:** 297.67m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 26/5/2020	**Date Completed :** 26/5/2020	**Logged by :** JC	**Date:** 14/2/2021

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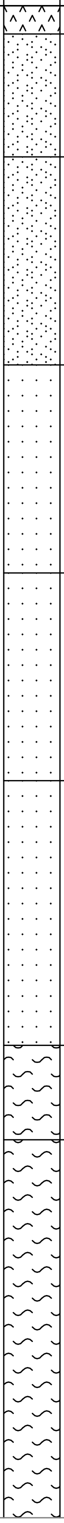
DRILLING — Drilling Method: Air Hammer (0–8 m); Hole Support \ Casing: Nil (0–8 m); Water: ▼ at approx. 6.25 m, ▽ at 8 m; Samples & Tests: —

MATERIAL

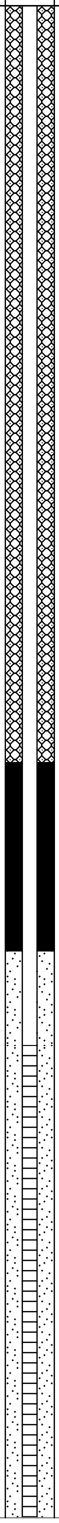
Description: [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects



Depth/(RL) metres	USC Symbol	Description	Moisture Condition	Consistency / Density Index	Comments/ Observations
0.00–0.15 (297.52)		Natural top soil, pale brown, low plasticity, poorly sorted.	M	S	
0.15–0.80 (296.87)	SP	SAND, pale brown, fine grained, well sorted.	SM	S	
0.80–1.90 (295.77)	SP	SAND, pale brown.	D	Fb	
1.90–3.00 (294.67)	SP	SANDSTONE, white to yellow, weathered.	D	Fb	
3.00–4.10 (293.57)	SP	SANDSTONE, white to yellow.	SM	H	
4.10–5.50 (292.17)	SP	SANDSTONE, orange.	D	Fb	
5.50–6.00 (291.67)		SCHIST, light to medium grey.	SM	Fb	
6.00–		SCHIST, light to medium grey, fractured.	W	Fb	

Bore Construction

Bore Construction Log | Components



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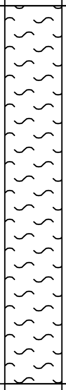
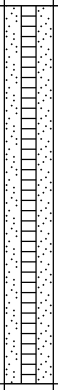
BOREHOLE LOG SHEET

HOLE No. GW06

SHEET 2 OF 2

Client : CFS					
Project : CFS Brukunga					
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA					
Position : 312419.7 E -6122349.1 N MGA94 54	**Surface RL:** 297.67m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 26/5/2020	**Date Completed :** 26/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
9	Air Hammer	Nil							W	Fb			
10					10.00 (287.67)			End of borehole at 10.00 metres. Target Depth					
11													
12													
13													
14													
15													
16													

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BOREHOLE LOG SHEET

Client : CFS		**HOLE No. GW07**	
Project : CFS Brukunga			
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA		**SHEET 1 OF 3**	
Position : 312229.9 E -6122568.2 N MGA94 54	**Surface RL:** 303.33m AHD	**Angle from Horiz. :** 90°	**Processed :** MH
Rig Type : DH400 Air Hammer **Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW	**Checked :** RW
Date Started : 29/5/2020	**Date Completed :** 29/5/2020	**Logged by :** JC	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
	Air Hammer	Nil					(SP-SC)	FILL; Clayey SAND, pale brown, poorly sorted with gravels.	M	Fb	Road base and trace organic matter observed.		
1					1.20 (302.13)			SCHIST, pale brown, weathered, with silver mica.	SM	Fb			
					1.50 (301.83)			SCHIST, pale brown, weathered, with silver mica.	D	Fb			
2													
3													
4													
5													
					5.80 (297.53)			SCHIST, light grey/silver with silver mica.	D	Fb			
6					6.20 (297.13)			SCHIST, pale brown, with silver mica.	D	Fb			
					6.50 (296.83)			SCHIST, light grey/silver with silver mica.	D	Fb			
7													
8													

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GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. GW07

SHEET 2 OF 3

Position : 312229.9 E -6122568.2 N MGA94 54	**Surface RL:** 303.33m AHD		**Angle from Horiz. :** 90°		**Processed :** MH
Rig Type : DH400 Air Hammer	**Mounting:** Land Rover	**Contractor :** WDS	**Driller :** MW		**Checked :** RW
Date Started : 29/5/2020	**Date Completed :** 29/5/2020		**Logged by :** JC		**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**	Bore Construction Log	**Components**
									D	Fb			
9													
10													
11													
12	Air Hammer	Nil											
13													
14													
15													
16			▼										

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BOREHOLE LOG SHEET

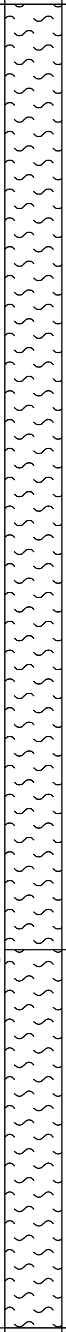
HOLE No. GW07

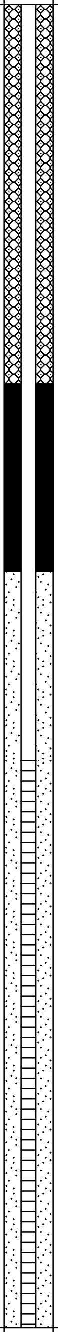
SHEET 3 OF 3

Client :	CFS
Project :	CFS Brukunga
Location :	CFS State Training Centre, Brukunga and surrounding investigation area., SA
Position :	312229.9 E -6122568.2 N MGA94 54
Surface RL:	303.33m AHD
Angle from Horiz. :	90°
Processed :	MH
Rig Type :	DH400 Air Hammer
Mounting:	Land Rover
Contractor :	WDS
Driller :	MW
Checked :	RW
Date Started :	29/5/2020
Date Completed :	29/5/2020
Logged by :	JC
Date:	14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL							Bore Construction	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	Bore Construction Log	Components
17	Air Hammer	Nil							D	Fb			
18													
19													
20													
21			⊻		21.00 (282.33)			SCHIST, light grey/silver with silver mica.	W	Fb			
22													
23					23.00 (280.33)			End of borehole at 23.00 metres. Target Depth					
24													





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BOREHOLE LOG SHEET

Client : CFS		**HOLE No. SB01**	
Project : CFS Brukunga			
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA		**SHEET 1 OF 1**	
Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe **Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020	**Date Completed :** 7/5/2020	**Logged by :** SS	**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Hand Auger	Nil		SB01_0-0.2 SB01_0.2-0.4	0.40	░	SW	SAND, fine to coarse grained, brown, some organics	SM	VL	
					0.70	▨	SC	Clayey SAND, fine to coarse grained, pale brown, some organics	M	L	
1				SB01_0.9-1.1	1.10	▨	CL	Sandy CLAY, low plasticity, dark brown, fine to coarse grained sand	VM	S	
								End of borehole at 1.10 metres. Refusal. Groundwater not encountered.			
2											
3											
4											
5											

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB02

SHEET 1 OF 1

Position : See location plan MGA94 54
Surface RL: Nil AHD
Angle from Horiz. : 90°
Processed : RW
Rig Type : EziProbe
Mounting: Land Rover
Contractor : WB Drilling
Driller : IW
Checked : RW
Date Started : 7/5/2020
Date Completed : 7/5/2020
Logged by : SS
Date: 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Concrete Core	Nil			0.10			CONCRETE			
	Pushtube			SB02_0.1-0.3	0.50			FILL; Gravelly sand, fine to medium grained, poorly graded, brown to grey, fine grained subrounded gravel	SM	L	
					0.60			FILL; Gravel, coarse grained, well graded, subangular to subrounded, white	D	H	
				SB02_0.6-0.8	0.80		CL-CI	Sandy CLAY, low to medium plasticity, pale brown, fine to medium grained sand	SM	S	
				SB02_0.8-0.95	0.95		GP	Sandy GRAVEL, coarse grained, poorly graded, grey, angular to subangular, fine to coarse grained sand	D	L	
1								End of borehole at 0.95 metres. Refusal. Groundwater not encountered.			
2											
3											
4											
5											

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BOREHOLE LOG SHEET

Client : CFS

Project : CFS Brukunga

Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB03

SHEET 1 OF 1

Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe **Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020	**Date Completed :** 7/5/2020	**Logged by :** SS	**Date:** 14/2/2021

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SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
	Pushtube	Nil		SB03_0-0.2	0.20		FILL; Gravelly sand, fine to coarse grained, poorly graded, pale brown-grey, fine to medium grained, subangular to subrounded gravels	D	VL	
					0.40	SC	Clayey SAND, fine to coarse grained, poorly graded, pale red brown, some fine to medium grained, subangular to subrounded gravel	D	F	
				SB03_0.4-0.6	0.60	SC	Clayey SAND, fine to coarse grained, poorly graded, yellow brown to red brown	D	L	
					0.80	GP	Sandy GRAVEL fine to coarse, poorly graded, angular to subangular, white-grey with dark red, fine to coarse, poorly graded sand.	D	L	
					0.90	SP-SC	Clayey SAND fine to coarse, poorly graded, dark brown, and gravel, angular to subangular, fine to coarse, poorly graded gravel.	D	L	
1				SB03_0.9-1.1	1.30	SP-SC	Clayey SAND, fine to coarse, poorly graded, brown, with gravel, subangular to subrounded, fine to medium, poorly graded gravel.	D	L	
					1.50	CL	Sandy CLAY, low plasticity, dark brown - red, trace gravel, fine to coarse, poorly graded sand, angular to subangular, fine to medium, poorly graded gravel.	D	L	
					1.70	SP-SM	Silty SAND, find to medium, well graded, grey-brown, some gravel, subangular to subrounded, fine to medium, poorly graded gravel.	SM	VL	
				SB03_1.7-1.9	2.00	SP	Gravelly SAND, fine to coarse grained, poorly graded, red-brown, angular to subangular, fine to coarse, poorly graded gravel.	D	L	
2				SB03_2.3-2.8	2.90	SP	Gravelly SAND, fine to coarse grained, poorly graded, red-brown and white, angular to subangular, medium to coarse grained, poorly graded gravel.	D	L	
3				SB03_3-3.2	3.20	CL	Sandy CLAY, low plasticity, brown with gravel, fine to coarse grained well graded sand, subangular to subrounded, find to coarse grained well graded gravel.	SM	S	
					3.80	CL-CI	Sandy CLAY, low to medium plasticity, grey with silt, fine to coarse grained, well graded sand.	SM	S	
4							End of borehole at 3.80 metres. Refusal. Groundwater not encountered.			
5										

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB04

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°		**Processed :** RW	
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW		**Checked :** RW	
Date Started : 7/5/2020		**Date Completed :** 7/5/2020		**Logged by :** SS		**Date:** 14/2/2021	

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Hand Auger	Nil		SB04_0-0.2	0.30	▨	SC	Clayey SAND, fine to coarse grained, well graded, orange brown mottle, some organics	SM	L	
								End of borehole at 0.30 metres. Refusal. Groundwater not encountered.			
1											
2											
3											
4											
5											

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BOREHOLE LOG SHEET

Client : CFS

Project : CFS Brukunga

Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB05

SHEET 1 OF 1

Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°			**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW		**Checked :** RW
Date Started : 7/5/2020	**Date Completed :** 7/5/2020	**Logged by :** SS			**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	USC Symbol	Description	Moisture Condition	Consistency / Density Index	Comments/ Observations
Concrete core	Nil			0.10		CONCRETE			
Pushtube			SB05_0.1-0.2	0.30	SC	Clayey SAND, fine to coarse grained, poorly graded, pale brown	D	L	
			SB05_0.3-0.4	0.40		PEAT, black, faint organic smell			
			SB05_0.8-1.0	1.50	SC	Clayey SAND, fine to coarse grained, poorly graded, pale red, with fine to coarse grained, subangular to subrounded gravel	SM	L	
				1.70	GP	Sandy GRAVEL, fine to coarse grained, poorly graded, blue to grey, fine to coarse grained sand	D	L	
			SB05_1.7-1.9	3.00	SC	Clayey SAND, fine to coarse grained, poorly graded, brown, some fine to coarse grained subangular to subrounded gravel	D	L	
				3.10	GP	Sandy GRAVEL, fine to coarse grained, poorly graded, grey, fine to coarse grained sand	D	L	
			SB05_3.1-3.3	3.60	SP	SAND, fine to coarse grained, well graded, yellow to brown, with silt	D	VL	
						End of borehole at 3.60 metres. Refusal. Groundwater not encountered.			

SCALE (m): 1 2 3 4 5

Description: [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects

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BOREHOLE LOG SHEET

Client : CFS

Project : CFS Brukunga

Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB06

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020		**Date Completed :** 7/5/2020	**Logged by :** SS	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Concrete Core	Nil			0.23			CONCRETE			
	Pushtube			SB06_0.2-0.4	0.40		SC	Clayey SAND, fine to medium grained, poorly graded, grey brown, with fine to coarse grained angular to subangular gravel	SM	L	
				SB06_0.4-0.6	0.60		GP	GRAVEL, very coarse grained, angular, grey	D	H	
					0.70		SP	Gravelly SAND, medium to coarse grained, poorly graded, orange with fine to medium grained, subangular to subrounded white gravel	D	MD	
					0.80		SC	Sandy CLAY, low plasticity, red brown with medium to coarse grained, angular to subangular white gravel	D	S	
					0.95		GP	Sandy GRAVEL, coarse grained, angular to subangular, well graded, grey orange, medium to coarse grained sand	D	H	
					1.00		SC	Sandy CLAY, low plasticity, red brown with medium to coarse grained, angular to subangular white gravel	D	S	
1				SB06_1.0-1.2	1.20		GP	Sandy GRAVEL, medium to coarse grained, angular to subangular, well graded, grey to red brown, fine to coarse grained sand	D	L	
					1.70		SC	Sandy CLAY, low plasticity, red brown to pale orange with medium to coarse grained, subangular to subrounded gravel	SM	S	
					1.90		GP	Gravelly SAND, fine to coarse grained, poorly graded, pale red brown with pale yellow, medium to coarse grained angular to subangular sand	SM	L	
2				SB06_1.9-2.1	2.40		SC	Sandy CLAY, low plasticity, red to pale yellow, fine to coarse grained sand	SM	F	
3 4 5								End of borehole at 2.40 metres. Refusal. Groundwater not encountered.			

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB07

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020		**Date Completed :** 7/5/2020		**Logged by :** SS	**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Hand Auger	Nil		SB07_0-0.2	0.30		SW	SAND, fine to medium grained, well graded, brown with organics	SM	VL	
				SB07_0.4-0.6	0.60		SW	SAND, fine to medium grained, well graded, brown, trace fine grained rounded gravel	D	VL	
								End of borehole at 0.60 metres. Refusal. Groundwater not encountered.			
1											
2											
3											
4											
5											

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SB08

SHEET 1 OF 1

Position : See location plan MGA94 54
Surface RL: Nil AHD
Angle from Horiz. : 90°
Processed : RW
Rig Type : EziProbe
Mounting: Land Rover
Contractor : WB Drilling
Driller : IW
Checked : RW
Date Started : 7/5/2020
Date Completed : 7/5/2020
Logged by : SS
Date: 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Concrete Core	Nil			0.10			CONCRETE			
	Push tube			SB08_0.1-0.3	0.30		SC	Clayey SAND, fine to coarse grained, poorly graded, dark grey to orange.	SM	L	
				SB08_0.3-0.5	0.50		GP	Gravelly SAND, fine to coarse grained, poorly graded, pale brown, fine to coarse grained, subangular to subrounded gravel	D	L	
								End of borehole at 0.50 metres. Refusal. Groundwater not encountered.			
1											
2											
3											
4											
5											

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW01

SHEET 1 OF 1

Position : See location plan MGA94 54 **Surface RL:** Nil AHD **Angle from Horiz. :** 90° **Processed :** RW
Rig Type : EziProbe **Mounting:** Land Rover **Contractor :** WB Drilling **Driller :** IW **Checked :** RW
Date Started : 8/5/2020 **Date Completed :** 7/5/2020 **Logged by :** RW **Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
0–3.30	Pushtube	Nil		SW01_0.1-0.3 SW01_1.9-2.0		▨		FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M	L	AMD Sludge
3.30–3.80	Pushtube	Nil		SW01_3.3-3.6	3.30		SC	Clayey gravelly SAND, fine to coarse grained, orange brown, fine to medum grained gravel, low plasticity fines.	M	H	
3.80–5					3.80			End of borehole at 3.80 metres. Refusal. Groundwater not encountered.			

See standard sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW02

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW	**Checked :** RW
Date Started : 8/5/2020		**Date Completed :** 7/5/2020		**Logged by :** RW	**Date:** 14/2/2021

Note: * indicates signatures on original issue of log or last revision of log

DRILLING				MATERIAL						
Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
Pushtube	Nil		SW02_0.1-0.3 SW02_0.9-1.1	1.20	▨		FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand	M	L	AMD Sludge
				1.50		SC	Clayey gravelly SAND, fine to coarse grained, orange brown, fine to medum grained gravel, low plasticity fines.	M	H	
			SW02_1.4-1.5				End of borehole at 1.50 metres. Refusal. Groundwater not encountered.			

SCALE (m): 1, 2, 3, 4, 5

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BOREHOLE LOG SHEET

Client : CFS		**HOLE No. SW03**
Project : CFS Brukunga		
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA		**SHEET 1 OF 1**

Position : See location plan	MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020		**Date Completed :** 7/5/2020	**Logged by :** RW	**Date:** 14/2/2021

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DRILLING					**MATERIAL**						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW03_0-0.2				FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M	L	AMD Sludge
				SW03_0.5-0.7							
1											
				SW03_1.5-1.7							
2											
3											
4											
									W		
5				SW03_4.8-4.9	5.00						

End of borehole at 5.00 metres.
Refusal. Groundwater not encountered.

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BOREHOLE LOG SHEET

GEO_BOREHOLE_AS1726 2017 12516828_BRUKUNGA LOGS VER2.GPJ GHD_GEO_TEMPLATE 2.00.GDT 16/3/21

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW04

SHEET 1 OF 1

Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°			**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW		**Checked :** RW
Date Started : 7/5/2020	**Date Completed :** 7/5/2020	**Logged by :** RW			**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW04_0-0.2				FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M	L	AMD Sludge
1				SW04_1.0-1.3							
2				SW04_2.0-2.1							
3											
					3.85			FILL; SILT, no plasticity, grey white.	M		
4				SW04_3.85-3.9	3.90			FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M W	L	
				SW04_4.5-4.6	4.60			End of borehole at 4.60 metres. Refusal. Groundwater not encountered.			
5											

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW05

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW	**Checked :** RW
Date Started : 7/5/2020		**Date Completed :** 7/5/2020		**Logged by :** RW	**Date:** 14/2/2021

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DRILLING					**MATERIAL**						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
0	Pushtube	Nil		SW05_0-0.2		▨		FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M	L	AMD Sludge
1				SW05_1.0-1.1		▨					
2				SW05_2.0-2.2		▨					
3				SW05_3.4-3.6		▨					
4					4.90	▨					
5								End of borehole at 4.90 metres. Refusal. Groundwater not encountered.			

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW06

SHEET 1 OF 1

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°		**Processed :** RW	
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW		**Checked :** RW	
Date Started : 7/5/2020	**Date Completed :** 7/5/2020			**Logged by :** RW		**Date:** 14/2/2021	

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
0–4	Pushtube	Nil		SW06_0.5-0.7 SW06_4.1-4.2	4.30			FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand.	M	L	AMD Sludge
				SW06_4.3-4.4	4.40		SC	Clayey gravelly SAND, fine to coarse grained, orange brown, fine to medum grained gravel, low plasticity fines.	M	H	
5								End of borehole at 4.40 metres. Refusal. Groundwater not encountered.			

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BOREHOLE LOG SHEET

Client : CFS		
Project : CFS Brukunga		**HOLE No. SW07**
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA		**SHEET 1 OF 1**

Position : See location plan	MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 8/5/2020		**Date Completed :** 8/5/2020	**Logged by :** RW	**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW07_0.2-0.3 SW07_1.0-1.2 SW07_2.5-2.8		▨		FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand	M	L	AMD Sludge
1											
2											
3											
4					4.20						
				SW07_4.2-4.3	4.30				W	L	
					4.50				M	L	
								End of borehole at 4.50 metres. Refusal. Groundwater not encountered.			
5											

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW08

SHEET 1 OF 1

Position : See location plan MGA94 54 **Surface RL:** Nil AHD **Angle from Horiz. :** 90° **Processed :** RW
Rig Type : EziProbe **Mounting:** Land Rover **Contractor :** WB Drilling **Driller :** IW **Checked :** RW
Date Started : 8/5/2020 **Date Completed :** 8/5/2020 **Logged by :** RW **Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
0 – 5	Pushtube	Nil		SW08_0.5-0.6 SW08_2.3-2.4 SW08_4.0-4.1 SW08_4.95-5				FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand	M	L	AMD Sludge
					2.30				W	L	
					2.40				M	L	
					5.00			End of borehole at 5.00 metres. Refusal. Groundwater not encountered.			

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BOREHOLE LOG SHEET

Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW09

SHEET 1 OF 2

Position : See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°		**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW		**Checked :** RW
Date Started : 8/5/2020		**Date Completed :** 8/5/2020		**Logged by :** RW		**Date:** 14/2/2021

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DRILLING					MATERIAL							
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW09_0.1-0.2 SW09_1.6-1.8		▨		FILL; Sandy SILT, no plasticity, orange brown, coarse grained sand	M	L	AMD Sludge
1											
2					2.00	▨			W	L	
				SW09_2.0-2.2	2.10	▨			M	L	
3											
4				SW09_4.0-4.2							
5											

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BOREHOLE LOG SHEET

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Client : CFS
Project : CFS Brukunga
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW09

SHEET 2 OF 2

Position :	See location plan	MGA94 54	**Surface RL:** Nil	AHD	**Angle from Horiz. :** 90°		**Processed :** RW
Rig Type :	EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling		**Driller :** IW		**Checked :** RW
Date Started :	8/5/2020	**Date Completed :** 8/5/2020			**Logged by :** RW		**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW09_5.5-5.7	5.70	▨			M	L	
6 7 8 9 10								End of borehole at 5.70 metres. Refusal. Groundwater not encountered.			

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Job No.
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BOREHOLE LOG SHEET

Client : CFS			**HOLE No. SW10**
Project : CFS Brukunga			
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA			**SHEET 1 OF 1**
Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°	**Processed :** RW
Rig Type : EziProbe **Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 8/5/2020	**Date Completed :** 8/5/2020	**Logged by :** RW	**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Pushtube	Nil		SW10_0-0.2	0.80	▨		FILL; Clayey SAND with gravel, fine to medium grained, brown, low plasticity clay	SM	S	
1				SW10_0.8-0.9	1.40	▨		FILL; SAND, fine to meduim grained, pale yellow	SM	S	
				SW10_1.5-1.7	2.00	▨		FILL; Sandy CLAY, low plasticity, brown, fine to meduim grained sand	W	S	
2					2.70	▨		FILL; As above, mottled dark brown and green	W	S	
				SW10_2.7-2.8	3.00	▨		FILL; As above, mottled pale brown and black, organic odour	W	S	
3								End of borehole at 3.00 metres. Refusal. Groundwater not encountered.			
4											
5											

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BOREHOLE LOG SHEET

Client : CFS

Project : CFS Brukunga

Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA

HOLE No. SW11

SHEET 1 OF 1

Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°		**Processed :** RW
Rig Type : EziProbe	**Mounting:** Land Rover	**Contractor :** WB Drilling	**Driller :** IW	**Checked :** RW
Date Started : 8/5/2020	**Date Completed :** 8/5/2020	**Logged by :** RW		**Date:** 14/2/2021

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DRILLING				MATERIAL						
Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	Description [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations
Pushtube	Nil		SW11_0-0.1 SW11_0.4-0.5	1.10			FILL; Clayey SAND with gravel, fine to medium grained, brown, low plasticity clay	SM	S	
			SW11_1.3-1.5	1.90			FILL; Sandy CLAY, low plasticity, brown, fine to meduim grained sand	W	S	
			SW11_2.0-2.3	3.00			FILL; As above, mottled pale brown and black, organic odour	W	S	
			SW11_3.0-3.2	3.80			FILL; CLAY, low plasticity, orange	SM	S	
							End of borehole at 3.80 metres. Refusal. Groundwater not encountered.			

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BOREHOLE LOG SHEET

Client : CFS		**HOLE No. SW15**
Project : CFS Brukunga		
Location : CFS State Training Centre, Brukunga and surrounding investigation area., SA		**SHEET 1 OF 1**

Position : See location plan MGA94 54	**Surface RL:** Nil AHD	**Angle from Horiz. :** 90°		**Processed :** RW
Rig Type : Hand auger	**Mounting:** Nil	**Contractor :** Nil	**Driller :** SS	**Checked :** RW
Date Started : 8/5/2020	**Date Completed :** 8/5/2020	**Logged by :** SS		**Date:** 14/2/2021

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth metres	Graphic Log	USC Symbol	**Description** [COBBLES/BOULDERS/FILL/TOPSOIL] then SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	**Comments/ Observations**
	Hand Auger	Nil		SW15_0-0.1		▨		FILL; Sandy CLAY, low to meduiim plasticity, orange, fine to coarse grained sand, some gravel	SM	S	
					0.20	▨		FILL; As above, dark orange	SM	S	
					0.45			End of borehole at 0.45 metres. Refusal. Groundwater not encountered.			
1											

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SOIL DESCRIPTION AND CLASSIFICATION

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Soil is described in general accordance with Australian Standard AS 1726-2017 (Geotechnical Site Investigations) in terms of visual and tactile properties, with potential refinement by laboratory testing. AS 1726 defines soil as particulate materials that occur in the ground and can be disaggregated or remoulded by hand in air or water without prior soaking. Classification of the soil is undertaken following description.

SOIL DESCRIPTION

The soil description includes a) Composition, b) Condition, c) Structure, d) Origin and e) Additional observations. 'FILL', 'TOPSOIL' or a 'MIXTURE OF SOIL AND COBBLES / BOULDERS' (with dominant fraction first) is denoted at the start of a soil description where applicable.

a) Soil Composition (soil name, colour, plasticity or particle characteristics, secondary and then minor components)

Soil Name: A soil is termed a *coarse grained soil* where the dry mass of sand and gravel particles exceeds 65% of the total. Soils with more than 35% fines (silt or clay particles) are termed *fine grained soils*. The soil name is made up of the primary soil component (in BLOCK letters), prefixed by applicable secondary component qualifiers. Minor components are applied as a qualifiers to the soil name (using the words 'with' or 'trace').

Particles are differentiated on the basis of size. 'Boulders' and 'cobbles' are outside the soil particle range, though their presence (and proportions) is noted. While individual particles may be designated as silt or clay based on grain size, fine grained soils are characterised as silt or clay based on tactile behaviour or Atterberg Limits, and not the relative composition of silt or clay sized particles.

Colour: The prominent colour is noted, followed by (spotted, mottled, streaked etc.) then secondary colours as applicable. Roughly equally proportioned colours are prefixed by (spotted, mottled, streaked etc.). Colour is described in its moist condition, though both wet and dry colours may also be provided if appropriate.

Plasticity: Fine grained soils are designated within standard ranges of plasticity based on tactile assessment or laboratory assessment of the Liquid Limit.

Particle Characteristics: The particle shape, particle distribution and particle size range within a coarse grained soil is described using standard terms. Particle composition may be described using rock or mineral names, with specific terms for carbonate soils.

Secondary and Minor Components: The primary soil is described and modified by secondary and minor components, with assessed ranges as tabulated.

Carbonate Soils: Carbonate content can be assessed by use of dilute '10%' HCl solution. Resulting clear sustained effervescence is interpreted as a *Carbonate soil* (approximately >50% carbonate), while weak or sporadic effervescence indicates *Calcareous soil* (< 50% carbonate). No effervescence is interpreted as a non-calcareous soil.

Organic and Peat Soils: Where identified, organic content is noted. *Organic soil* (2% to 25% organic matter) is usually identified by colour (usually dark grey/black) and odour (i.e. 'mouldy' or hydrogen sulphide odour). *Peat* (>25% organic matter) is identified by a spongy feel and fibrous texture. Peat soils' decomposition may be described as '*fibrous*' (little / no decomposition), '*pseudo-fibrous*' (moderate decomposition) or '*amorphous*' (full decomposition).

Fraction	Components		Particle Size (mm)
Oversize	BOULDERS		> 200
	COBBLES		63 - 200
Coarse grained soil particles	GRAVEL	Coarse	19 - 63
		Medium	6.7 -19
		Fine	2.36 - 6.7
	SAND	Coarse	0.6 - 2.36
		Medium	0.21 - 0.6
		Fine	0.075 - 0.21
Fine grained soil particles	SILT		0.002 - 0.075
	CLAY		< 0.002

Plasticity Terms (Fine Grained Soils)		Laboratory Liquid Limit Range
Silt	**Clay**	
N/A	N/A	(Non Plastic)
Low Plasticity	*Low Plasticity*	≤ 35%
	Medium Plasticity	> 35% and ≤ 50%
High Plasticity	*High Plasticity*	> 50%

Particle Distribution Terms (Coarse Grained Soils)	
Well graded	good representation of all particle sizes
Poorly graded	one or more intermediate sizes poorly represented
Gap graded	one or more intermediate sizes absent
Uniform	essentially of one size

Particle Shape Terms (Coarse Grained Soils)		
Rounded	*Sub-angular*	*Flaky or Platy*
Sub-rounded	*Angular*	*Elongated*

Secondary and Minor Components for Coarse Grained Soils			
Fines (%)	**Modifier** (as applicable)	**Accessory coarse (%)**	**Modifier** (as applicable)
≤ 5	*'trace silt / clay'*	≤ 15	*'trace sand / gravel'*
> 5, ≤ 12	*'with clay / silt'*	> 15, ≤ 30	*'with sand / gravel'*
> 12	*prefix 'silty / clayey'*	> 30	*prefix 'gravelly / sandy'*

Secondary and Minor Components for Fine Grained Soils	
% Coarse	**Modifier** (as applicable)
≤ 15	add *"trace sand / gravel"*
> 15, ≤ 30	add *"with sand / gravel"*
> 30	prefix soil *"sandy / gravelly"*

SOIL DESCRIPTION AND CLASSIFICATION

b) Soil Condition (moisture, relative density or consistency)

Moisture: Fine grained soils are described relative to plastic or liquid limits, while coarse grained soils are assessed based on appearance and feel. The observation of seepage or free water is noted on the test hole logs.

Moisture - Coarse Grained Soils		
Term		**Tactile Properties**
Dry	*('D')*	Non-cohesive, free running
Moist	*('M')*	Feels cool, darkened colour, tends to stick together
Wet	*('W')*	Feels cool, darkened colour, tends to stick together, free water forms when handling

Moisture - Fine Grained Soils		
Term		**Tactile Properties**
Moist, dry of plastic limit	('$w < PL$')	Hard and friable or powdery
Moist, near plastic limit	('$w \approx PL$')	Can be moulded
Moist, wet of plastic limit	('$w > PL$')	Weakened, free water forms on hands with handling
Wet, near liquid limit	('$w \approx LL$')	Highly weakened, tends to flow when tapped
Wet, wet of liquid limit	('$w > LL$')	Liquid consistency, soil flows

Relative Density (Non Cohesive Soils): The Density Index is inherently difficult to assess by visual or tactile means, and is normally assessed by penetration testing (e.g. SPT, DCP, PSP or CPT) with published correlations. Assessment may be affected by moisture and *in situ* stress conditions. Density Index assessment may be refined by combination of *in situ* density testing and laboratory reference maximum and minimum density ranges.

Consistency (Cohesive Soils): May be assessed by direct measurement (shear vane, CPT etc.), or approximate tactile correlations. Cohesive soils include fine grained soils, and coarse grained soils with sufficient fine grained components to induce cohesive behaviour. A 'design shear strength' must consider the mode of testing, the *in situ* moisture content and potential for variations of moisture which may affect the shear strength.

Relative Density (Non-Cohesive Soils)		
Term and (Symbol)		**Density Index (%)**
Very Loose	*(VL)*	≤ 15
Loose	*(L)*	> 15 and ≤ 35
Medium Dense	*(MD)*	> 35 and ≤ 65
Dense	*(D)*	> 65 and ≤ 85
Very Dense	*(VD)*	> 85

Consistency assessment can be influenced by moisture variation.

Consistency (Cohesive Soils)			
Term and (Symbol)		**Tactile Properties**	**Undrained Shear Strength**
Very Soft	*(VS)*	Extrudes between fingers when squeezed	< 12 kPa
Soft	*(S)*	Can be moulded by light finger pressure	12 - 25 kPa
Firm	*(F)*	Can be moulded by strong finger pressure	25 - 50 kPa
Stiff	*(St)*	Cannot be moulded by fingers	50 - 100 kPa
Very Stiff	*(VSt)*	Can be indented by thumb nail	100 - 200 kPa
Hard	*(H)*	Can be indented with difficulty by thumb nail	> 200 kPa
Friable	*(Fr)*	Easily crumbled or broken into small pieces by hand	-

c) Structure (zoning, defects, cementing)

Zoning: The *in situ* zoning is described using the terms below. *'Intermixed'* may be used for an irregular arrangement.

'layer' (a continuous zone across the exposed sample)

'lens' (a discontinuous layer with lenticular shape)

'pocket' (an irregular inclusion of different material).

'interbedded' or *"interlaminated'* (alternating soil types)

Defects: Described using terms below, with dimension orientation and spacing described where practical.

'parting' (an open or closed surface or crack sub parallel to layering with little / no tensile strength - open or closed)

'fissure' (as per a parting, though not parallel or sub parallel to layering – may include desiccation cracks)

'sheared seam' (zone of sub parallel near planar closely spaced intersecting smooth or slickensided fissures dividing the mass into lenticular or wedge shaped blocks)

'sheared surface' (a near planar, curved or undulating smooth, polished or slickensided surface, indicative of displacement)

'softened zone' (in clayey soils, usually adjacent to a defect with associated higher moisture content)

'tube' (tubular cavity, singly or one of a large number, often formed from root holes, animal burrows or tunnel erosion)

'tube cast' (an infilled tube – infill may vary from uncemented through to cemented or have rock properties)

'infilled seam' (sheet like soil body cutting through the soil mass, formed by infilling of open defects)

Cementation: Soils may be cemented by various substances (e.g. iron oxides and hydroxides, silica, calcium carbonate, gypsum), and the cementing agent shall be identified if practical. Cemented soils are described as:

'weakly cemented'	easily disaggregated by hand in air or water
'moderately cemented'	effort required to disaggregate the soil by hand in air or water

Materials extending beyond '*moderately cemented'* are encompassed within the rock strength range. Where consistent cementation throughout a soil mass is identified as a duricrust, it is described in accordance with duricrust rock descriptors. Where alternate descriptors of cementation development are applied for consistency with regional practices or geology, or client requirements, these are outlined separately.

d) Origin

An interpretation is provided based on observations of landform, geology and fabric, and may further include assignment of a stratigraphic unit. The use of terms 'possibly' or 'probably' indicates a higher degree of uncertainty regarding the assessed origin or stratigraphic unit. Typical origin descriptors include:

Residual	Formed directly from in situ weathering with no visible structure or fabric of the parent soil or rock.
Extremely weathered	Formed directly from in situ weathering, with remnant and/or fabric from the parent rock.
Alluvial	Deposited by streams and rivers (may be applied more generically as transported by water).
Estuarine	Deposited in coastal estuaries, including sediments from inflowing rivers, streams, and tidal currents.
Marine	Deposited in a marine environment.
Lacustrine	Deposited in freshwater lakes.
Aeolian	Transported by wind.
Colluvial and Slopewash	Soil and rock debris transported down slopes by gravity (with or without assistance of water). Colluvium is typically applied to thicker / localised deposits, and slopewash for thinner / widespread deposits.
TOPSOIL	Surficial soil, typically with high levels of organic material. Topsoils buried by other transported soils are termed *'remnant topsoil'*. Tree roots within otherwise unaltered soil does not characterise topsoil.
FILL	Any material which has been placed by anthropogenic processes (i.e. human activity).

e) Additional Observations

Additional observations may be included to supplement the soil description. Additional observations may consist of notations relating to soil characteristics (odour, contamination, colour changes with time), inferred geology (with delineation of soil horizons or geological time scale) or notes on sampling and testing application (including the reliability, recovery, representativeness, or condition of samples or test conditions and limitations). If the material is assessed to be not representative, terms such as 'poor recovery', 'non-intact', 'recovered as' or 'probably' are applied.

SOIL CLASSIFICATION

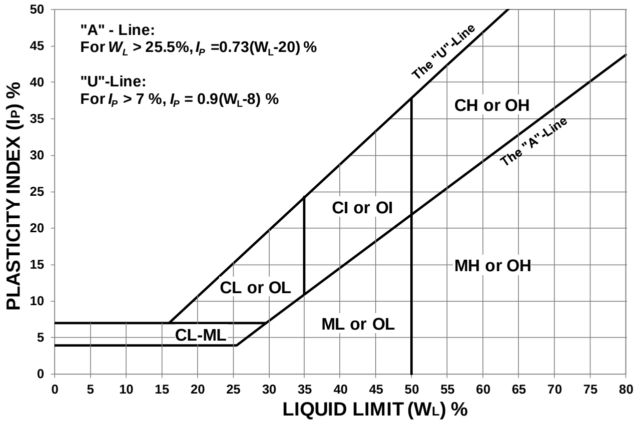
Classification allocates the material within distinct soil groups assigned a two character Group Symbol:

Coarse Grained Soils (sand and gravel: more than 65% of soil coarser than 0.075 mm)			**Fine Grained Soils** (silt and clay: more than 35% of soil finer than 0.075 mm)		
Major Division	**Group Symbol**	**Soil Group**	**Major division**	**Group Symbol**	**Soil Group**
GRAVEL (more than half of the coarse fraction is > 2.36 mm)	GW	GRAVEL, well graded	SILT and CLAY (low to medium plasticity)	ML	SILT, low plasticity
	GP	GRAVEL, poorly graded		CL	CLAY, low plasticity
	GM	Silty GRAVEL		CI	CLAY, medium plasticity
	GC	Clayey GRAVEL		OL	Organic SILT
SAND (more than half of the coarse fraction is < 2.36 mm)	SW	SAND, well graded	SILT and CLAY (high plasticity)	MH	SILT, high plasticity
	SP	SAND, poorly graded		CH	CLAY, high plasticity
	SM	Silty SAND		OH	Organic CLAY / SILT
	SC	Clayey SAND	Highly Organic	Pt	PEAT

Coarse grained soils with fines contents between 5% and 12% are provided a dual classification comprising the two group symbols separated by a dash, e.g. for a poorly graded gravel with between 5% and 12% silt fines (poorly graded 'GRAVEL with silt'), the classification is GP-GM.

For the purpose of classification, *poorly graded, uniform,* or *gap graded* soils are all designated as poorly graded. Soils that are dominated by boulders or cobbles are described separately and are not classified.

Classification is routinely undertaken based on tactile assessment with the soil description. Refinement of soil classification may be applied using laboratory assessment, including particle size distribution and Atterberg Limits. Atterberg Limits testing is applied to the sample portion finer than 0.425 mm. Fine grained soil components are assessed on the basis of regions defined within the Modified Casagrande Chart.



GLOSSARY OF SYMBOLS

GHD
Specialist Services in Geotechnical Engineering,
Geology, Field/Laboratory Testing and Hydrogeology
www.ghd.com/Geotechnical

This standard sheet should be read in conjunction with all test hole log sheets and any idealised geological sections prepared for the investigation report.

GENERAL

Symbol	Description	Symbol	Description
D	Disturbed Sample	**R**	Rising Head Permeability Test
B	Bulk Sample	**F**	Falling Head Permeability Test
U(50)	Undisturbed Sampled (suffixed by sample size or tube diameter in mm if applicable)	**PBT**	Plate Bearing Test
CS	Core Sample (suffixed by diameter in mm)	▶—	Water Inflow (make)
ES	Soil sample for environmental sampling	—◀	Water Outflow (loss)
PID	Photoionisation Detector	▽	Temporary Water Level
SPT	Standard Penetration Test (with blows per 0.15m)	▼	Final Water Level
N	SPT Value	●	Point Load Test (axial)
HB/HW	SPT Hammer Bouncing/Hammer Weight	○	Point Load Test (diametric)
PP/HP	Pocket/Hand Penetrometer (suffixed by value kPa)	**PL**	Point Load (kPa)
PK	Packer Test (kPa)	**IMP**	Impression Device Test
PZ	Piezometer Installation	**PM**	Pressuremeter Test
SV/VS	Shear Vane Test (suffixed by value in kPa)		

SOIL SYMBOLS

Main Components				Minor Components			
⁙	SAND	▩	FILL	⁖	sandy	⁑	vegetation, roots
◦	GRAVEL	▥	SILT	◦	gravelly	▥	silty
▨	CLAY	▒	TOPSOIL	▨	clayey	*Note: Natural soils are generally a combination of constituents, e.g. sandy CLAY*	▨

ROCK SYMBOLS

Sedimentary						Igneous			
⁙	SANDSTONE	▤	SILTSTONE	▩	CONGLOMERATE	✚	GRANITIC ROCK	≋	IGNEOUS DYKE
▤	CLAYSTONE	▤	SHALE	■	COAL	▧	BASALTIC ROCK		

Note: Additional rock symbols may be allocated for a particular project

NATURAL DEFECTS *(Coding)*

Defect Type	
Jt	Joint
Pt	Parting
SS	Sheared Surface
WSm	Weathered Seam
SSm	Sheared Seam
CSm	Crushed Seam
ISm	Infilled Seam
SZ	Sheared Zone
VN	Vein

Orientation
For vertical non-oriented core ... “Dip” angle (eg. 5°) measured relative to horizontal.
For inclined non-oriented core ... “Angle” measured relative to core axis.
For inclined oriented core ... “Dip” angle and “Dip Direction” angle (eg. 45°/225° mag.).

Orientation (con’t)		Roughness		Coating	
VT	Vertical	**Pol**	Polished	**Cn**	Clean
HZ or 0°	Horizontal	**So**	Smooth	**Sn**	Stained
d / °	Degrees	**Rf**	Rough	**Ve**	Veneer
		VR	Very Rough	**Co**	Coating
		Slk	Slickensided		

Shape			
Pln	Planar	**St**	Stepped
Cu	Curved	**Ir**	Irregular
Un	Undulating	**Dis**	Discontinuous

Others					
OP	Open	**CL**	Closed	**Ti**	Tight

Infilling / Common Materials			
CLAY	Clay	**Mi**	Micaceous
Ca	Calcite	**Mn**	Manganese
X	Carbonaceous	**Py**	Pyrite
Kt	Chlorite	**Qz**	Quartz
Fe	Iron Oxide	**MU**	Unidentified Mineral

Ref: DS6.5.3 Rev 1 Date : 25/09/2019

SKM

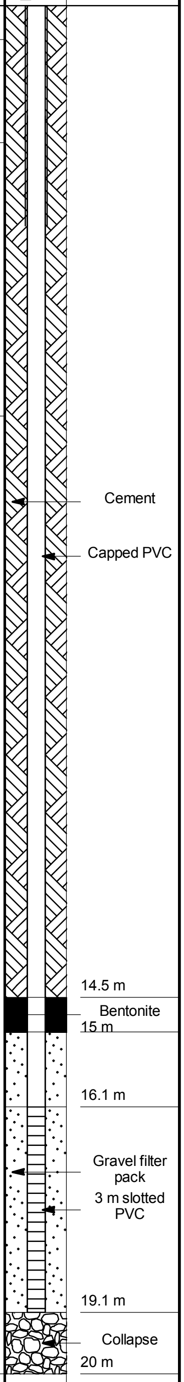
INSTALLATION DETAIL

HOLE NO: **BH18**
PAGE : 1 OF 1

PROJECT : Brukunga Site Investigation	SURFACE ELEVATION : 365.84 m (AHD)	JOB NO : VE23688
POSITION : E: 311640, N: 6124814 (MGA94)	SURFACE CONDITIONS : Made ground	LOCATION : Brukunga Mine Site
RIG TYPE : MK5/1 Investigator	CONTRACTOR : Drilling Solutions	DIP / AZIMUTH : 90°
DATE DRILLED : 16/10/12 to 16/10/12	LOGGED BY : KF CHECKED BY : HB	STANDARD : AS1726-1993

DRILLING & WATER DETAIL	TCR/RQD DRILL DEPTH	FIELD TESTS	RL (m)	DEPTH (m)	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering
AH 25/10/12					(GM) Silty GRAVEL with some sand, fine to coarse grained gravel up to 10 mm diameter, tan, non-plastic silt, fine to coarse grained quartz and mica sands.	SW
					QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, strength estimated from chippings.	FR
			363.8	2.0	QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, evidence of iron staining, strength estimated from chippings.	SW to FR
			361.8	4.0		
			359.8	6.0	QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, strength estimated from chippings.	FR
			357.8	8.0		
			355.8	10.0		
			353.8	12.0		
			351.8	14.0		
			349.8	16.0		
			347.8	18.0		
			345.8	20.0		

INSTALLATION DETAIL / COMMENTS



DRILLING

HA	Hand Auger	HQ	HQ Coring	TCR	% core run recovered
AD	Auger Drilling	NQ	NQ Coring	RQD	% core run > 100mm long (rock fraction only measured)
WB	Washbore	PQ	PQ Coring		
RR	Rock Rolling	NMLC	NMLC Coring		
AH	Air Hammer				

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

SAMPLES & FIELD TESTS

D	Disturbed Sample	ES	Env Soil Sample
W	Water Sample	EW	Env Water Sample
SPT	SPT Sample		
U	Undisturbed Tube Sample		

PHOTOGRAPHS NOTES ☐ YES ☒ NO

SKM

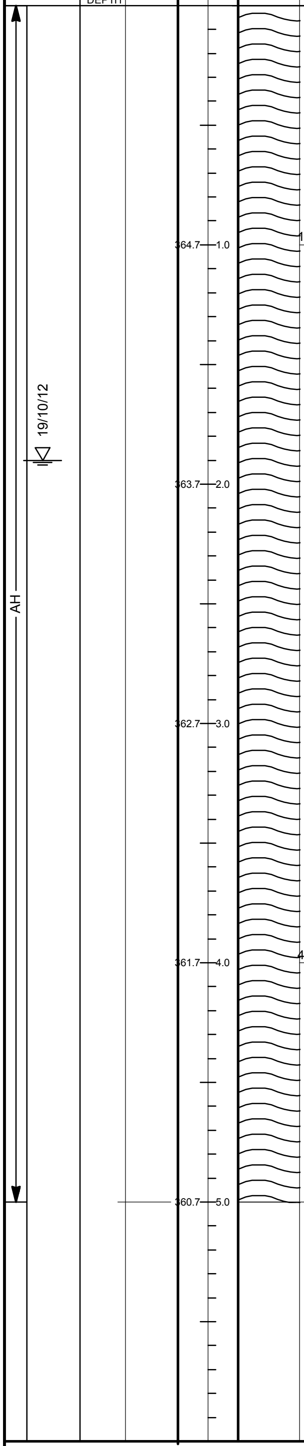
INSTALLATION DETAIL

HOLE NO: **BH19**
PAGE : 1 OF 1

PROJECT : Brukunga Site Investigation	SURFACE ELEVATION : 365.71 m (AHD)	JOB NO : VE23688
POSITION : E: 311643, N: 6124814 (MGA94)	SURFACE CONDITIONS : Made ground	LOCATION : Brukunga Mine Site
RIG TYPE : MK5/1 Investigator	CONTRACTOR : Drilling Solutions	DIP / AZIMUTH : 90°
DATE DRILLED : 19/10/12 to 19/10/12	LOGGED BY : HB CHECKED BY : ST	STANDARD : AS1726-1993

DRILLING | MATERIAL

DRILLING & WATER DETAIL | TCR/RQD (DRILL DEPTH) | FIELD TESTS | RL (m) | DEPTH (m) | GRAPHIC LOG | DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable) | Weathering | INSTALLATION DETAIL | COMMENTS

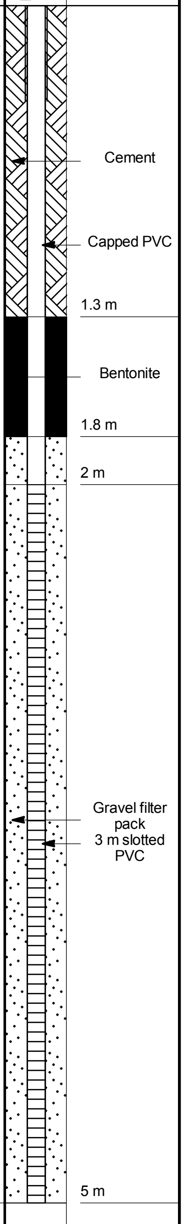


QUARTZ MICA SCHIST, fine grained, grey, pyritic, inferred from air hammer chippings (angular, fine to coarse, up to 50 mm diameter), strength estimated from chippings.

SW to DW

1.00m
chippings up to 60 mm diameter

4.00m
chippings up to 20 mm diameter



DRILLING

HA	Hand Auger
AD	Auger Drilling
WB	Washbore
RR	Rock Rolling
AH	Air Hammer

HQ	HQ Coring
NQ	NQ Coring
PQ	PQ Coring
NMLC	NMLC Coring

TCR	% core run recovered
RQD	% core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

SAMPLES & FIELD TESTS

D	Disturbed Sample
W	Water Sample
SPT	SPT Sample
U	Undisturbed Tube Sample
ES	Env Soil Sample
EW	Env Water Sample

PHOTOGRAPHS NOTES ☐ YES ☒ NO

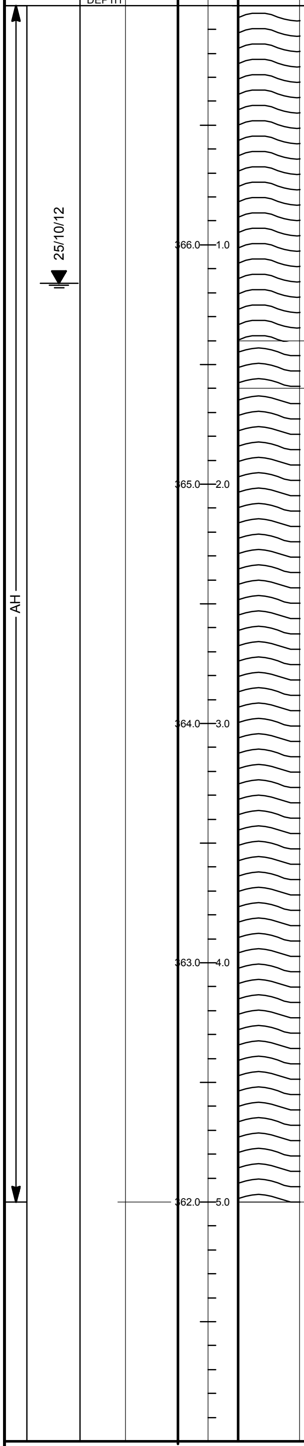
SKM

INSTALLATION DETAIL

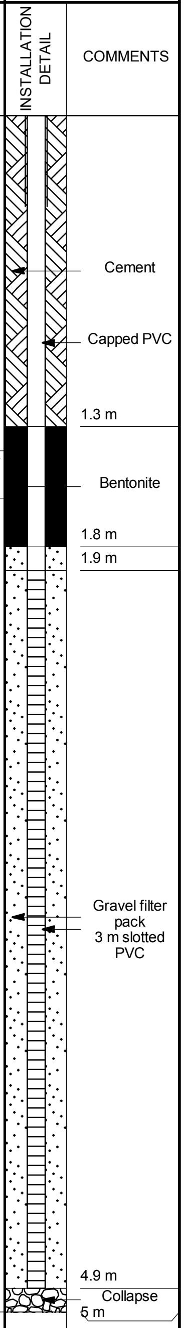
HOLE NO: **BH22**
PAGE : 1 OF 1

PROJECT : Brukunga Site Investigation	SURFACE ELEVATION : 367.01 m (AHD)	JOB NO : VE23688
POSITION : E: 311565, N: 6124188 (MGA94)	SURFACE CONDITIONS : Made ground	LOCATION : Brukunga Mine Site
RIG TYPE : MK5/1 Investigator	CONTRACTOR : Drilling Solutions	DIP / AZIMUTH : 90°
DATE DRILLED : 15/10/12 to 15/10/12	LOGGED BY : KF CHECKED BY : HB	STANDARD : AS1726-1993

DRILLING | MATERIAL



DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering
QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, strength estimated from chippings.	SW
QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, vuggy, iron stained, strength estimated from chippings.	DW
QUARTZ MICA SCHIST, medium grained, grey, 1% pyrite, strength estimated from chippings.	FR



DRILLING

HA	Hand Auger	HQ	HQ Coring	TCR	% core run recovered
AD	Auger Drilling	NQ	NQ Coring	RQD	% core run > 100mm long (rock fraction only measured)
WB	Washbore	PQ	PQ Coring		
RR	Rock Rolling	NMLC	NMLC Coring		
AH	Air Hammer				

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

SAMPLES & FIELD TESTS

D	Disturbed Sample	ES	Env Soil Sample
W	Water Sample	EW	Env Water Sample
SPT	SPT Sample		
U	Undisturbed Tube Sample		

PHOTOGRAPHS NOTES ☐ YES ☒ NO

DRILLHOLE No. C05

Sheet 1 of 1

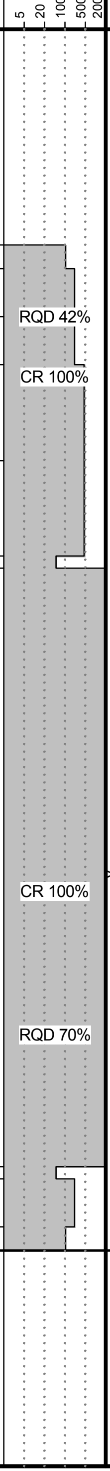
SKM

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6124036mN	Logged: KF
Location: Brukunga	Start - Finish Date: 19/2/09 - 19/2/09	Rig: UDR 650	Eastings: 312470mE	Checked: KF
Job No: VE23151	Bore dia: 96.0 mm	Surface Conditions: Topsoil	RL: 377m AHD	Oriented: -90

Point Load (MPa): Axial Is50; Diametral Is50

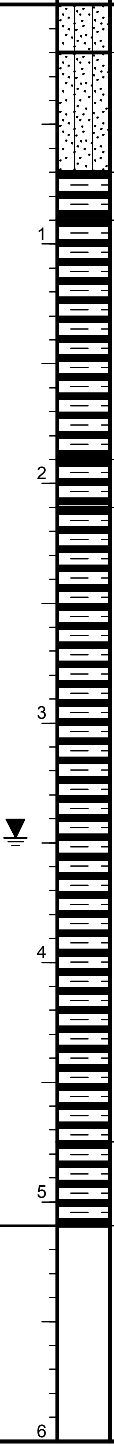
MINOR DEFECT DATA: minor defect description: type, dip/dip direction, colour, coating, thickness (mm), roughness; minor defect spacing (mm)

Sv70(op)2(sm)
B60(op)60(sm)
Sh45-10(op)1(ro)
Sh20(op)<1(ro)
Sh20(op)<1(ro)
T0(cl)<1(ro)
Sv90(cl)<1(ro)
B60(cl)<1(sm)
2Sh45,0(cl)<1(sm,ro)
B60(cl)<1(sm)



FIELD DATA: field & other tests; sample type; field tests; ground water; depth (m)

>>



ROCK DESCRIPTION: rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation; major defect description - type, dip, colour, filling, thickness (mm), roughness

SILT (SM)
orange-red, crumbly, moderate strength, slightly micaceous, dry

SILTSTONE (SM)
mottled tan-yellow, weathered saprolite, 70% micas, soft, fine, smooth, crumbly

SCHIST (SW)
grey, slightly weathered at base, fine grained, ~90% micas, soft, crumbly

SCHIST (SW)
grey, slightly weathered, fine grained, ~40% micas, strong

SCHIST (SW)
grey, slightly weathered at base, fine grained, ~90% micas, soft, crumbly

SCHIST (FR)
grey, unweathered, fine-med grained, 40% micas, strong, bedding at 45-70 degrees

SCHIST (FR)
grey, unweathered, fine-med grained, 60% micas, strong, bedding at 45-70 degrees

Borehole terminated at 5.1 m

ROCK CONDITION: rock or soil strength; moisture condition

COMMENTS: drilling method, well construction, water and additional observations

100 mm, Class 9 PVC casing 0-0.7m

Hollow Flight Auger with Split Spoon 0-0.7m

Diamond Core Drilling 0.7-5.1m

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

I	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
■	% Core Loss per Run
█	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

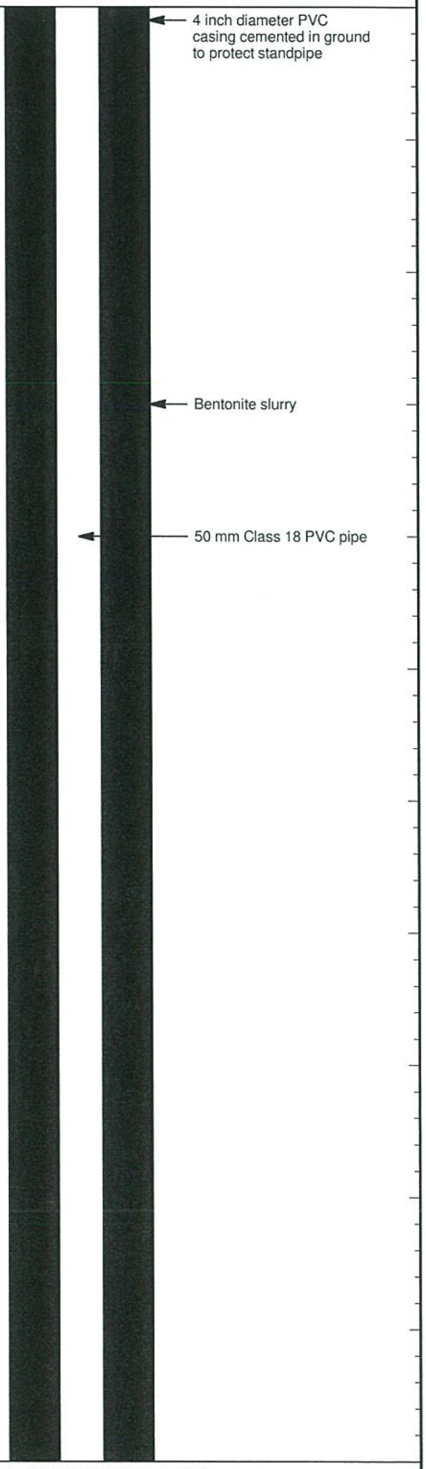
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

Golder Associates

DRAFT REPORT OF BOREHOLE: GAMW-03

CLIENT:	DMITRE	COORDS:	311927.0 m 6124980.0 m GDA94 MGA54	SHEET:	1 OF 3
PROJECT:	WELL INSTALLATION	SURFACE RL:	DATUM: AHD	DRILL RIG:	LX12 BOART LONGYEAR
LOCATION:	BRUKUNGA MINE, SA	INCLINATION:	-90°	CONTRACTOR:	CRC CARE
JOB NO:	137666003	HOLE DIA:	120 mm HOLE DEPTH: 25.00 m	LOGGED:	AJB DATE: 14/3/13
				CHECKED:	AP DATE: 7/4/13

Drilling				Field Material Description and Instrumentation			
METHOD	WATER	DEPTH (metres)	DEPTH RL	SOIL/ROCK MATERIAL DESCRIPTION	CAVITY/FRACTURE	AIRLIFT YIELD (L/s)	CONSTRUCTION
PQ		0		FILL GRAVEL, fine to coarse grained, pale grey, with cobbles up to 0.25 m in size, orange brown and red brown, trace of clayey sand in some zones, core loss from 0.0m to 1.2m	0.10: Core Run: 0.0m to 1.9m, TCR=35% 0.40: drilling water loss from 0.4m depth		
		1					
		2	1.90	1.9m to 2.5m, core loss	1.90: Core Run: 1.9m to 3.3m TCR=55%		
		3	3.20	3.2m to 3.3m, Clayey SAND, fine grained, brown, low plasticity clay 3.3m to 3.9m, core loss	3.30: Core Run: 3.3m to 4.5m TCR=50%		
		4					
		5 6 7	4.60 4.80 5.10 5.70 6.00 6.70	QUARTZ MICA SCHIST fine grained, slightly foliated, abundant mica, grey brown medium strength, extremely weathered to highly weathered pale orange, pale brown and red brown in thin layers, very low to low strength, extremely weathered extremely low to very low strength, residual soil medium strength, highly weathered dark grey, low to medium strength, extremely weathered medium to high strength, moderately weathered high strength, moderately weathered to slightly weathered	4.50: Core Run: 4.5m to 6.0m TCR=50%, RQD=45%, SCR=55% 4.60: Average Defect Spacing (ADS) 10mm to 30mm 4.60: Defects are generally observed to be joints, Set 1: 30 degrees to 45 degrees, Un, Ro, Vr fines or Sn Fe; Set 2: 60 degrees to 85 degrees, Un Ro,Sn Fe, some joints are closed or partially closed. Descriptions of individual defects are retained on Golder's project file. 4.80: roots present 5.10: ADS 100mm to 300mm 5.70: ADS 10mm to 30mm 6.00: Core Run: 6.0m to 9.1m: TCR=100%, RQD=95%, SCR=100% 6.00: ADS 300mm to 1000mm		
		8	8.00 8.30	QUARTZITE medium to coarse grained, very high to extremely high strength, slightly weathered, clear and colourless, white and orange brown QUARTZ MICA SCHIST fine grained, slightly foliated, dark grey low to high strength, extremely weathered to highly weathered	8.00: ADS 100mm to 300mm 8.30: strength and weathering is variable, 8.30m to 11.15m		
		9 10 11			9.10: Core Run: 9.1m to 12.2m: TCR=100%, RQD=95%, SCR=100% 10.95: weathered zone, orange brown,		



4 inch diameter PVC casing cemented in ground to protect standpipe

Bentonite slurry

50 mm Class 18 PVC pipe

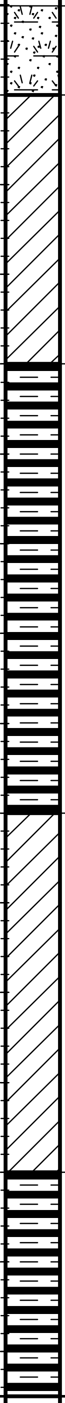
This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for hydrogeological purposes only, without attempt to assess geotechnical properties or possible contamination. Any reference to geotechnical properties or potential contamination are for information only and do not necessarily indicate the presence or absence of the properties stated.

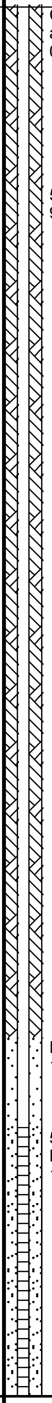
SKM

DRILLHOLE No. H01

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6124478.0mN	Logged: KH
Location: Brukunga	Start - Finish Date: 05/02/2009 - 5/2/09	Rig: UDR 650	Eastings: 311784.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 350.0m AHD	Oriented: -90





Water Quality: EC (mS/cm)	Water Quality: pH	FIELD DATA: field & other tests	FIELD DATA: sample type field tests ground water	ROCK DESCRIPTION: rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	ROCK CONDITION: rock or soil strength	ROCK CONDITION: moisture condition	COMMENTS: drilling method, well construction, water and additional observations
				SILT (GM) grey fine grained with schist, tan and grey, highly weathered			Cement bentonite and backfill 0-12.5m
			▼	CLAY (CL) brown, medium plasticity with muscovite rich schist; grey and tan, medium-highly weathered			50 mm, Class 9 PVC (blank)
				SCHIST (HW) brown and grey, medium-highly weathered with abundant muscovite and some SILTY CLAY; grey			
			10.2m minor WC	Silty CLAY (CL) brown and grey, medium plasticity with muscovite rich schist; grey and tan, highly weathered			Filter pack 11.5-15.5m 50 mm, Class 9 PVC (slotted) 12.5-15.5m
			14.7m major WC	SCHIST (MW) moderately weathered, fine grained, very hard (hard drilling)			
				Borehole terminated at 15.5 m			

LABORATORY DATA
UCN Unconfined Comp. Strength (MPa)
UCS Unconfined Comp. Strength (MPa)
TQN Unconsolidated Undrained Triaxial
TQS Unconsolidated Undrained Triaxial
N = Natural S = Saturated

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)
B Bedding plane joint
Sv Sub-vertical joint
Sh Sub-horizontal joint
T Transverse to bedding plane
RQD % core run >100mm long

FIELD DATA ABBREVIATIONS
Is(50) Point Load Index (MPa)
N SPT blows per 300mm
FPM Field permeability (packer)

FIELD DATA SYMBOLS
I Packer Interval
⊗ Point Load Test
▽ Standard Penetration Test (SPT top = start of N blowcount)
▨ Core recovered
10% % Core Loss per Run
■ Large core >100mm long
● Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)
SH Sheared seam
CR Crushed seam
NF Infilled seam
EW Extremely Weathered seam

MOISTURE CONDITION
D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

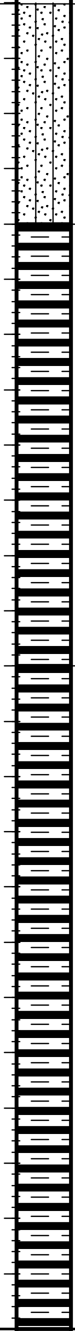
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

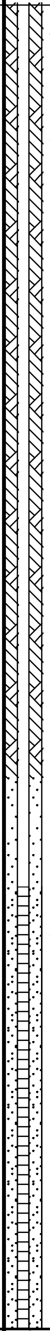
SKM

DRILLHOLE No. H02

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6124383.0mN Logged: KH
Location: Brukunga	Start - Finish Date: 06/02/2009 - 6/2/09	Rig: UDR 650	Eastings: 311950.0mE Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 342.0m AHD Oriented: -90





Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
				0		Silty SAND (SM) tan, fine grained, low plasticity with some schist, tan and grey, highly weathered increasing with depth			Cement bentonite and backfill 0-7m
				1					50 mm, Class 9 PVC (blank)
			▼						
				2		SCHIST (MW) light grey, fine grained, moderate weathered with abundant muscovite, <1% schist; tan, highly weathered and minor white quartz			
				3					
				4					
				5					
				6		SCHIST (MW) light grey, fine grained, hard, moderate-slight weathering with abundant muscovite			
				7					Filter pack 7-12m
				8					50 mm, Class 9 PVC (slotted) 8-12m
				9					
2.91	6.1								
				10					
				11					
4.89	6.0								
4.94	5.9			12		Borehole terminated at 12 m			
				13					

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)

▽ = Water level (during drilling)

◄ ► = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

⌶	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

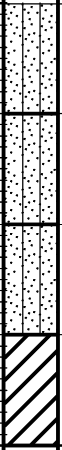
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

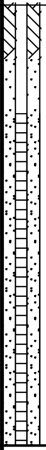
SKM

DRILLHOLE No. H04a

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6124210.0mN Logged: KF
Location: Brukunga	Start - Finish Date: 9/02/2009 - 9/2/09	Rig: UDR 650	Eastings: 311973.0mE Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 342.0m AHD Oriented: -90





Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
				1		Silty SAND (SM) brown, fine-medium grained with minor clay and weathered schist gravels			Cement bentonite and backfill 0-0.5m Filter pack 0.5-4m
				2		Silty SAND (SM) brown, medium grained with minor clay low- medium plasticity			50 mm, Class 9 PVC (slotted) 1-4m
			▼	3		Silty SAND (SM) dark brown, increasing clay content, medium plasticity			
				4		CLAY (CH) dark brown, medium plasticity			
				5 6 7 8 9 10 11 12 13		Borehole terminated at 4 m			

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

I	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

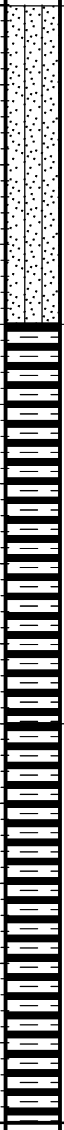
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

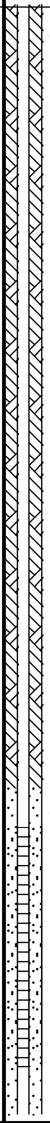
SKM

DRILLHOLE No. H04b

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6124213.0mN	Logged: KF
Location: Brukunga	Start - Finish Date: 11/02/2009 - 27/2/09	Rig: UDR 650/Sonic	Eastings: 311970.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 342.0m AHD	Oriented: -90





Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
						Silty SAND (SM) tan-light brown, fine grained, quartz sands, well sorted			Cement bentonite and backfill 0-9.8m
			▼						
				2					
				4		SCHIST (MW) light grey, fine to grained, moderate weathered with abundant muscovite with 5% highly weathered, tan schist.			
				6					
				8					
			9.5m minor WC			SCHIST (MW) dark grey, fine to medium grained, moderate weathered with abundant muscovite Fracture at 9.5 m			
				10					Filter pack 9.8-13.8m 50 mm, Class 9 PVC (slotted) 10.3-13.3m
				12					
5.20			WC 12.5m						
3.93									
				14		Borehole terminated at 14 m			
				16					
				18					

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◄ ► = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

⌶	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
▮	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

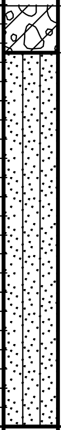
SKM

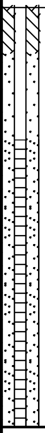
DRILLHOLE No. H06a

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings:	6124217.0mN	Logged: KH
Location: Brukunga	Start - Finish Date: 11/02/2009 - 11/2/09	Rig: UDR 650	Eastings:	312024.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL:	341.0m AHD	Oriented: -90

Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
						Gravelly SAND (GC) red and orange, fine to medium grained with highly weathered schist gravels			Cement bentonite and backfill 0-0.5m
			▼	2		Silty SAND (SM) dark brown, grey, increasing clay content, very low plasticity			Filter pack 0.5-4.4m 50 mm, Class 9 PVC (slotted) 1.4-4.4m Noticable odour
7.80	3.4			4					
				6 8 10 12 14		Borehole terminated at 4.4 m			





LABORATORY DATA
- UCN Unconfined Comp. Strength (MPa)
- UCS Unconfined Comp. Strength (MPa)
- TQN Unconsolidated Undrained Triaxial
- TQS Unconsolidated Undrained Triaxial
- N = Natural S = Saturated

GROUNDWATER SYMBOLS
- ▼ = Water level (static)
- ▽ = Water level (during drilling)
- ◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA (<10mm thickness)
- B Bedding plane joint
- Sv Sub-vertical joint
- Sh Sub-horizontal joint
- T Transverse to bedding plane
- RQD % core run >100mm long

FIELD DATA ABBREVIATIONS
- Is(50) Point Load Index (MPa)
- N SPT blows per 300mm
- FPM Field permeability (packer)

FIELD DATA SYMBOLS
- I Packer Interval
- ⧗ Point Load Test
- ▽ Standard Penetration Test (SPT top = start of N blowcount)
- ▨ Core recovered
- 10% % Core Loss per Run
- ■ Large core >100mm long
- ● Small core <100mm long

MAJOR DEFECT DATA (>10mm thickness)
- SH Sheared seam
- CR Crushed seam
- NF Infilled seam
- EW Extremely Weathered seam

MOISTURE CONDITION
D = Dry M = Moist W = Wet

ROCK STRENGTH (Is(50) Point Load Index)

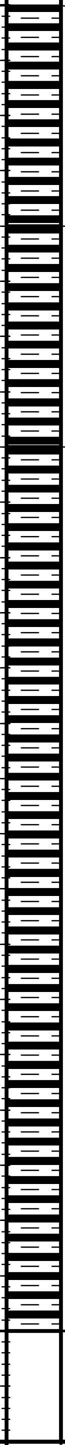
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

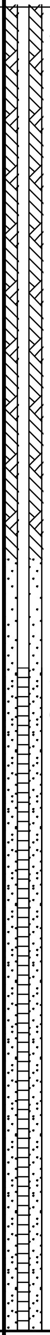
SKM

DRILLHOLE No. H09

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings:	6123667.0mN	Logged: KH
Location: Brukunga	Start - Finish Date: 04/02/2009 - 4/2/09	Rig: UDR 650	Eastings:	311762.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL:	333.0m AHD	Oriented: -90





Water Quality		FIELD DATA			ROCK DESCRIPTION	ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
					SCHIST (MW) light grey, fine to medium grained, moderate weathered with abundant muscovite with minor clay; light brown medium plasticity.			Cement bentonite and backfill 0-5m
				1				
				2	SCHIST (MW) light grey, fine to medium grained, moderate weathered with abundant muscovite with 5% highly weathered, tan schist, very minor clay; light brown medium plasticity.			
			▼	3	fracture at 3 m			
			3.2m minor WC					
				4	SCHIST (MW) grey, fine grained, moderately weathered with abundant muscovite with <2% quartzite white, coarse grained.			
				5				Filter pack 15-12m
					small fracture at 5.2 m			
				6				50 mm, Class 9 PVC (slotted) 6-12m
				7				
3.87	5.7		7.6m WC					
				8	7.8-8.4 m fracture zone			
				9				
4.39	6.0		Yield 0.05-0.2L/s					
				10				
4.50	5.8		Yield 0.05-0.2L/s					
				11				
4.36	5.9		Yield 0.05-0.2L/s					
4.42	6.0		Yield 0.05-0.2L/s					
				12	Borehole terminated at 12 m			
				13				

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA (<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

I	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA (>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH (Is(50) Point Load Index)

EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

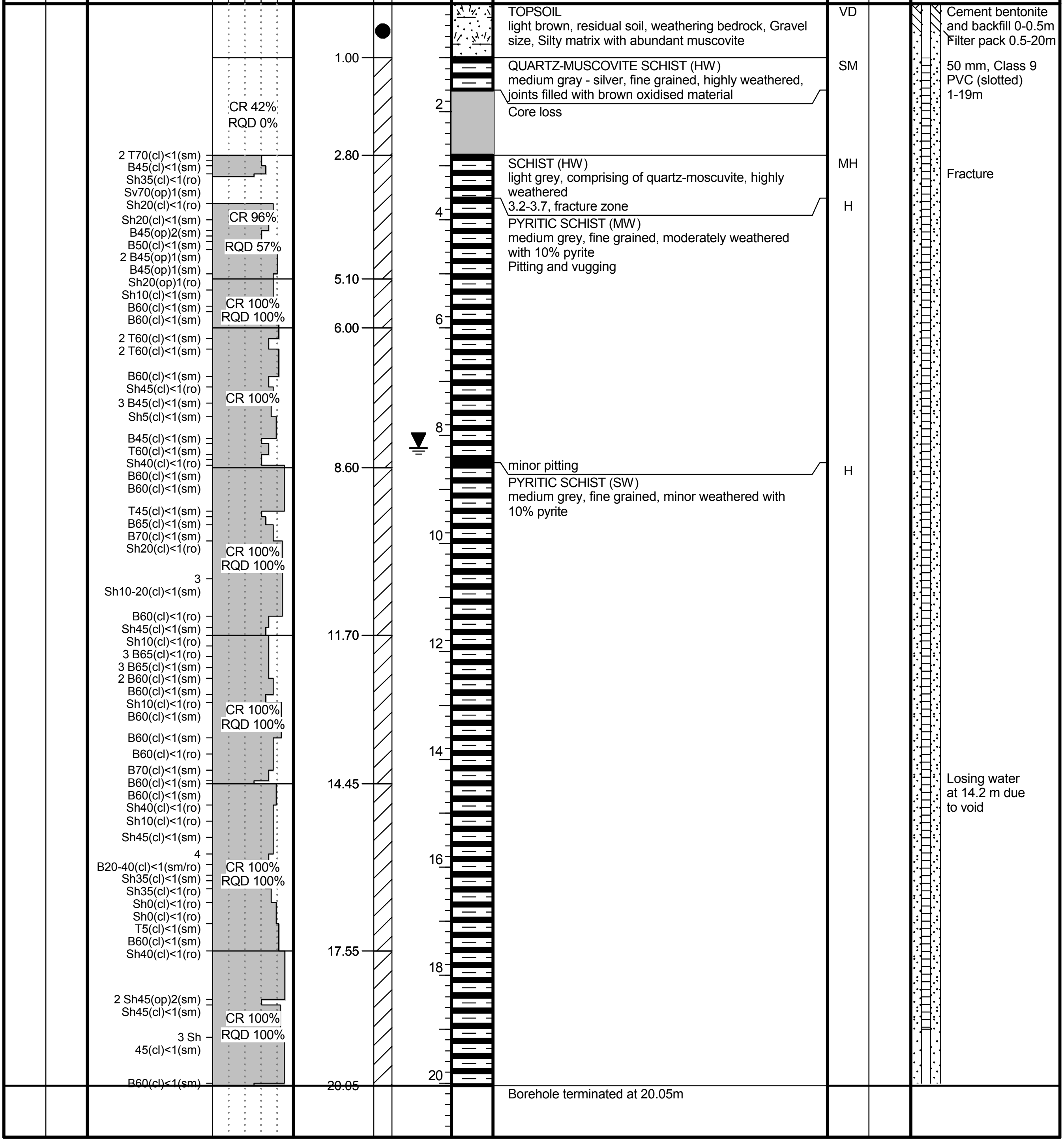
SKM

BOREHOLE No. H10

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6123131mN	Logged: KH
Location: Brukunga	Start - Finish Date: 27/01/2009 - 28/1/09	Rig: Edson 3000	Eastings: 311834mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 323m AHD	Oriented: -90

Point Load (MPa)		MINOR DEFECT DATA		FIELD DATA					ROCK DESCRIPTION	ROCK CONDITION		COMMENTS
Axial Is50	Diametral Is50	minor defect description: type, dip/dip direction, colour, coating, thickness (mm), roughness	minor defect spacing (mm) 5 20 100 500 2000	field & other tests	sample type	field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations



field & other tests	minor defect spacing	minor defect description	rock description	rock or soil strength	comments
			TOPSOIL light brown, residual soil, weathering bedrock, Gravel size, Silty matrix with abundant muscovite	VD	Cement bentonite and backfill 0-0.5m Filter pack 0.5-20m
1.00	CR 42% RQD 0%		QUARTZ-MUSCOVITE SCHIST (HW) medium gray - silver, fine grained, highly weathered, joints filled with brown oxidised material Core loss	SM	50 mm, Class 9 PVC (slotted) 1-19m
2.80	CR 96% RQD 57%	2 T70(cl)<1(sm) B45(cl)<1(sm) Sh35(cl)<1(ro) Sv70(op)1(sm) Sh20(cl)<1(ro) Sh20(cl)<1(sm) B45(op)2(sm) B50(cl)<1(sm) 2 B45(op)1(sm) B45(op)1(sm)	SCHIST (HW) light grey, comprising of quartz-moscuvite, highly weathered 3.2-3.7, fracture zone	MH	Fracture
			PYRITIC SCHIST (MW) medium grey, fine grained, moderately weathered with 10% pyrite Pitting and vugging	H	
5.10	CR 100% RQD 100%	Sh20(op)1(ro) Sh10(cl)<1(sm) B60(cl)<1(sm) B60(cl)<1(sm)			
6.00	CR 100%	2 T60(cl)<1(sm) 2 T60(cl)<1(sm) B60(cl)<1(sm) Sh45(cl)<1(ro) 3 B45(cl)<1(sm) Sh5(cl)<1(sm) B45(cl)<1(sm) T60(cl)<1(sm) Sh40(cl)<1(ro)			
8.60	CR 100% RQD 100%	B60(cl)<1(sm) B60(cl)<1(sm) T45(cl)<1(sm) B65(cl)<1(sm) B70(cl)<1(sm) Sh20(cl)<1(ro) 3 Sh10-20(cl)<1(sm) B60(cl)<1(ro) Sh45(cl)<1(sm)	minor pitting PYRITIC SCHIST (SW) medium grey, fine grained, minor weathered with 10% pyrite	H	
11.70	CR 100% RQD 100%	Sh10(cl)<1(ro) 3 B65(cl)<1(ro) 3 B65(cl)<1(sm) 2 B60(cl)<1(sm) B60(cl)<1(sm) Sh10(cl)<1(ro) B60(cl)<1(sm) B60(cl)<1(sm) B60(cl)<1(ro) B70(cl)<1(sm) B60(cl)<1(sm)			
14.45	CR 100% RQD 100%	B60(cl)<1(sm) Sh40(cl)<1(ro) Sh10(cl)<1(ro) Sh45(cl)<1(sm) 4 B20-40(cl)<1(sm/ro) Sh35(cl)<1(sm) Sh35(cl)<1(ro) Sh0(cl)<1(ro) Sh0(cl)<1(ro) T5(cl)<1(sm) B60(cl)<1(sm) Sh40(cl)<1(ro)			Losing water at 14.2 m due to void
17.55	CR 100% RQD 100%	2 Sh45(op)2(sm) Sh45(cl)<1(sm) 3 Sh 45(cl)<1(sm) B60(cl)<1(sm)			
20.05			Borehole terminated at 20.05m		

LABORATORY DATA		MINOR DEFECT DATA (<10mm thickness)		FIELD DATA SYMBOLS	MAJOR DEFECT DATA (>10mm thickness)		ROCK STRENGTH (Is(50) Point Load Index)		
UCN	Unconfined Comp. Strength (MPa)	B	Bedding plane joint	Packer Interval	SH	Sheared seam	EL	Ext. low	<0.03
UCS	Unconfined Comp. Strength (MPa)	Sv	Sub-vertical joint	Point Load Test	CR	Crushed seam	VL	Very low	0.03-0.1
TQN	Unconsolidated Undrained Triaxial	Sh	Sub-horizontal joint	▽ Standard Penetration Test (SPT top = start of N blowcount)	NF	Infilled seam	L	Low	0.1-0.3
TQS	Unconsolidated Undrained Triaxial	T	Transverse to bedding plane	▨ Core recovered	EW	Extremely Weathered seam	M	Medium	0.3-1.0
N = Natural	S = Saturated	RQD	% core run >100mm long	10% % Core Loss per Run			H	High	1.0-3.0
GROUNDWATER SYMBOLS		**FIELD DATA ABBREVIATIONS**		■ Large core >100mm long	**MOISTURE CONDITION**		VH	Very high	3-10
▼ = Water level (static)		Is(50)	Point Load Index (MPa)	● Small core <100mm long	D = Dry M = Moist W = Wet		EH	Ext. high	>10
▽ = Water level (during drilling)		N	SPT blows per 300mm						
◀ ▶ = Outflow / Inflow		FPM	Field permeability (packer)						

SKM 001 ROCK 1 BRUKUNGA_ARE_24_02_09.GPJ SKM_001_2008 05 07_DS.GDT 24/3/09

SKM

DRILLHOLE No. H12

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings:	6124185.0mN	Logged: KH
Location: Brukunga	Start - Finish Date: 16/02/2009 - 16/2/09	Rig: UDR 650	Eastings:	311922.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL:	342.0m AHD	Oriented: -90

Water Quality		**FIELD DATA**			**ROCK DESCRIPTION**		**ROCK CONDITION**		**COMMENTS**
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
				0–1		Silty SAND (SM) red and orange , fine to medium grained with gravel schists, moderatly- highly weathered, grey with some oxidation			Cement/bentonite and backfill 0-2.5m
				1–2		SCHIST (MW) light grey, fine to medium grained, moderate weathered with abundant muscovite			
			▼	2–3		SCHIST (MW) light grey, fine to medium grained, moderate weathered with abundant muscovite with minorsilty clay, light brown low plasticity.			Filter pack 2.5-6 m
			3.5 m minor WC 4.5 m WC	3–6		SCHIST (MW) light grey, fine to medium grained, moderate weathered with abundant muscovite			50 mm, Class 9 PVC (slotted) 3-6m
				6		Borehole terminated at 6 m			
				7					

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◄ ►— = Outflow / Inflow

MINOR DEFECT DATA (<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

⌶	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA (>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH (Is(50) Point Load Index)

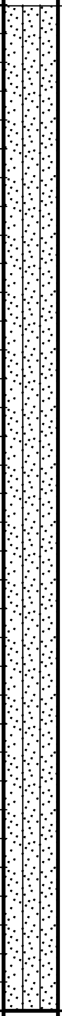
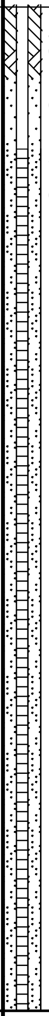
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

SKM

DRILLHOLE No. H13

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6123853.0mN	Logged: KH
Location: Brukunga	Start - Finish Date: 16/02/2009 - 16/2/09	Rig: UDR 650	Eastings: 311842.0mE	Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 330.0m AHD	Oriented: -90

Water Quality		**FIELD DATA**			**ROCK DESCRIPTION**		**ROCK CONDITION**		**COMMENTS**
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
						Silty SAND (SM) light brown, low plasticity with abundant muscovite and schist, grey, moderatly weathered		M	 Cement bentonite and backfill 0-0.25m Filter pack 0.25-3.5m 50 mm, Class 9 PVC (slotted) 0.5-3.5m
				1					
			▼						
				2					
			2.5m WC						
				3					
						Borehole terminated at 3.5 m			
				4					
				5					

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◄ ► = Outflow / Inflow

MINOR DEFECT DATA (<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

⌶	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA (>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH (Is(50) Point Load Index)

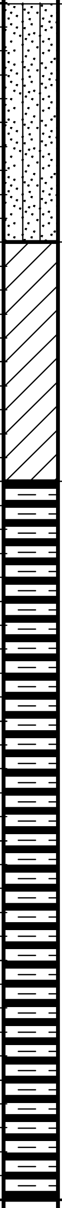
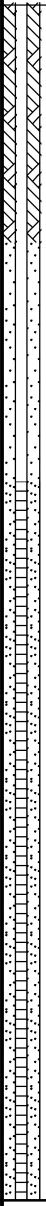
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

SKM

DRILLHOLE No. H14a

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6123542.0mN Logged: KH
Location: Brukunga	Start - Finish Date: 16/02/2009 - 16/2/09	Rig: UDR 650	Eastings: 311750.0mE Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 327.0m AHD Oriented: -90

Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
						Silty SAND (SM) light brown, with minor clay, low plasticity with abundant muscovite and schist, grey, moderatly weathered			 Cement bentonite and backfill 0-1m
				1		Silty CLAY (CL) brown, low- medium plasticity		M	Filter pack 1-5m
			▼	2		SCHIST (HW) highly weathered, tan with light brown silty clay, low plasticity			50 mm, Class 9 PVC (slotted) 2-5m
				3					
				4					
			4.5m WC						
				5		Borehole terminated at 5 m			
				6					

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

⌶	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

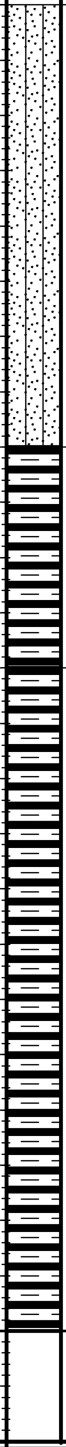
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

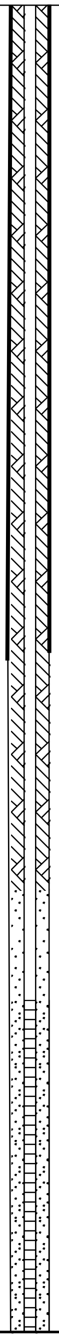
SKM

DRILLHOLE No. H14b

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6123545.7mN Logged: KF
Location: Brukunga	Start - Finish Date: 16/2/09 - 17/2/09	Rig: UDR 650	Eastings: 311750.2mE Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 326.7m AHD Oriented: -90





Water Quality EC (mS/cm)	pH	FIELD DATA field & other tests	sample type field tests ground water	depth (m)	ROCK DESCRIPTION rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	ROCK CONDITION rock or soil strength	moisture condition	COMMENTS drilling method, well construction, water and additional observations
				0	Silty SAND (SM) grey and orange-tan, fine grained, loose, dry			Cement bentonite and backfill 0-8m
			▼	1				
				2				100 mm, Class 12 PVC, Precoller
				3				
				4	SCHIST (HW) grey-orange, highly weathered, moderate-hard, with some weathered clays and iron stained micas			
				5				100 mm, Class 12 PVC, Precoller
				6	SCHIST (SW) grey and minor orange, slightly weathered, some iron staining, fine grained			
			6.5 m minor WC	7				
5.69	4.1		Yield 0.2L/s	8				Filter pack 8-12m
5.11	4.3		Yield 0.2-0.5L/s	9				50 mm, Class 9 PVC (slotted) 9-12m
				10				
4.49	5.0		10.5 m WC Yield 0.2-0.5L/s					
6.18	5.6			11	Fracturing at 11 m			
6.18	5.6		Yield 0.2-0.5L/s					
6.16	5.2		Yield 0.2-0.5L/s	12	Borehole terminated at 12 m			
				13				

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◀ ▶ = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

I	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

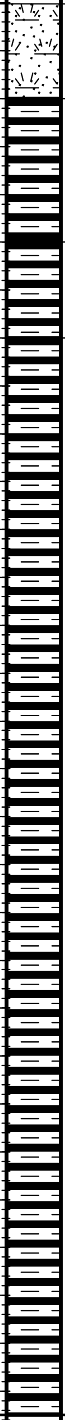
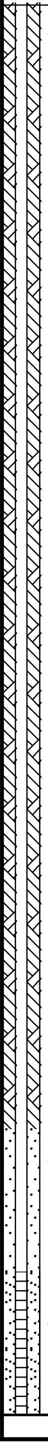
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

SKM

DRILLHOLE No. H15

Sheet 1 of 1

Project: Brukunga Mine Remediation	Client: PIRSA	Driller: SPK Geodrill	Northings: 6123586.0mN Logged: KF
Location: Brukunga	Start - Finish Date: 18/02/09 - 24/2/09	Rig: UDR 650	Eastings: 312478.0mE Checked: KF
Job No: VE23151	Bore dia: 96.0mm	Surface Conditions: Topsoil	RL: 361.0m AHD Oriented: -90

Water Quality		FIELD DATA			ROCK DESCRIPTION		ROCK CONDITION		COMMENTS
EC (mS/cm)	pH	field & other tests	sample type field tests ground water	depth (m)	graphic log	rock type, degree of weathering, colour, grain size, texture and fabric, structure, angle of bedding dip, geological formation major defect description - type, dip, colour, filling, thickness (mm), roughness	rock or soil strength	moisture condition	drilling method, well construction, water and additional observations
						Silty CLAY (CH) brown-tan, grey, dry, high plasticity, mottled			 Cement bentonite and backfill 0-23. m
				2		SCHIS (HW) tan-grey, highly weathered, moderate strength, ~20% micas			
				4					
				6		SCHIST (FR) grey, unweathered, strong, ~20%micas, minor kalonite from 6-7m and 12-13m			
				8		SCHIST (SW) tan-grey, slightly weathered, moderate strength, ~20% micas			
				10					
			▼	12					
				14					
				16					
				18					
				20					
				22					
				24					Filter pack 23.5-29.5m
				26					50 mm, Class 9 PVC (slotted) 26.5-29.5m
			29.5m WC	28					
				30		Borehole terminated at 29.5 m			

LABORATORY DATA

UCN	Unconfined Comp. Strength (MPa)
UCS	Unconfined Comp. Strength (MPa)
TQN	Unconsolidated Undrained Triaxial
TQS	Unconsolidated Undrained Triaxial

N = Natural S = Saturated

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)
◄ ► = Outflow / Inflow

MINOR DEFECT DATA
(<10mm thickness)

B	Bedding plane joint
Sv	Sub-vertical joint
Sh	Sub-horizontal joint
T	Transverse to bedding plane
RQD	% core run >100mm long

FIELD DATA ABBREVIATIONS

Is(50)	Point Load Index (MPa)
N	SPT blows per 300mm
FPM	Field permeability (packer)

FIELD DATA SYMBOLS

I	Packer Interval
⊗	Point Load Test
▽	Standard Penetration Test (SPT top = start of N blowcount)
▨	Core recovered
10%	% Core Loss per Run
■	Large core >100mm long
●	Small core <100mm long

MAJOR DEFECT DATA
(>10mm thickness)

SH	Sheared seam
CR	Crushed seam
NF	Infilled seam
EW	Extremely Weathered seam

MOISTURE CONDITION

D = Dry M = Moist W = Wet

ROCK STRENGTH
(Is(50) Point Load Index)

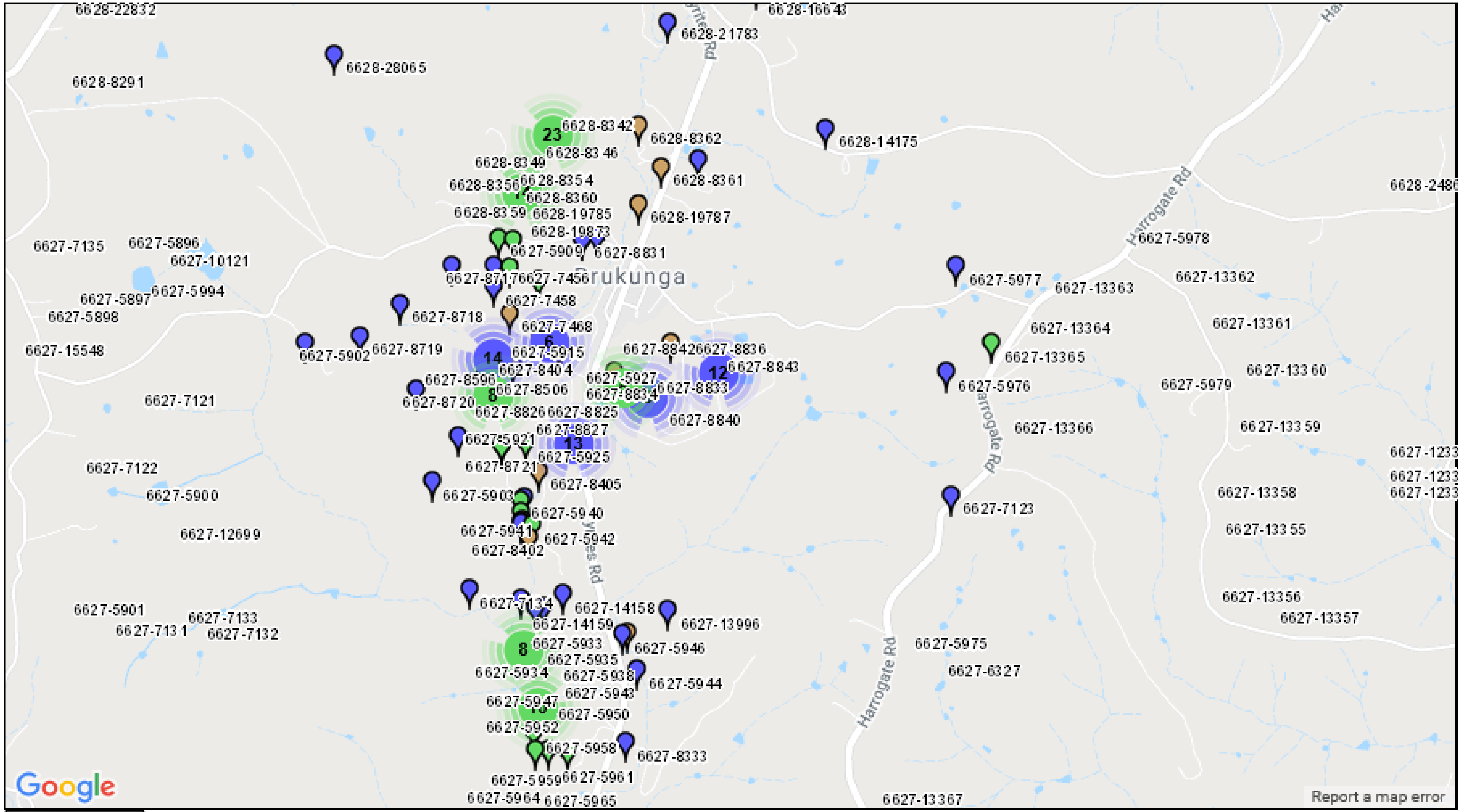
EL	Ext. low	<0.03
VL	Very low	0.03-0.1
L	Low	0.1-0.3
M	Medium	0.3-1.0
H	High	1.0-3.0
VH	Very high	3-10
EH	Ext. high	>10

Appendix C – Registered Bore Search

Government
of South Australia

WaterConnect

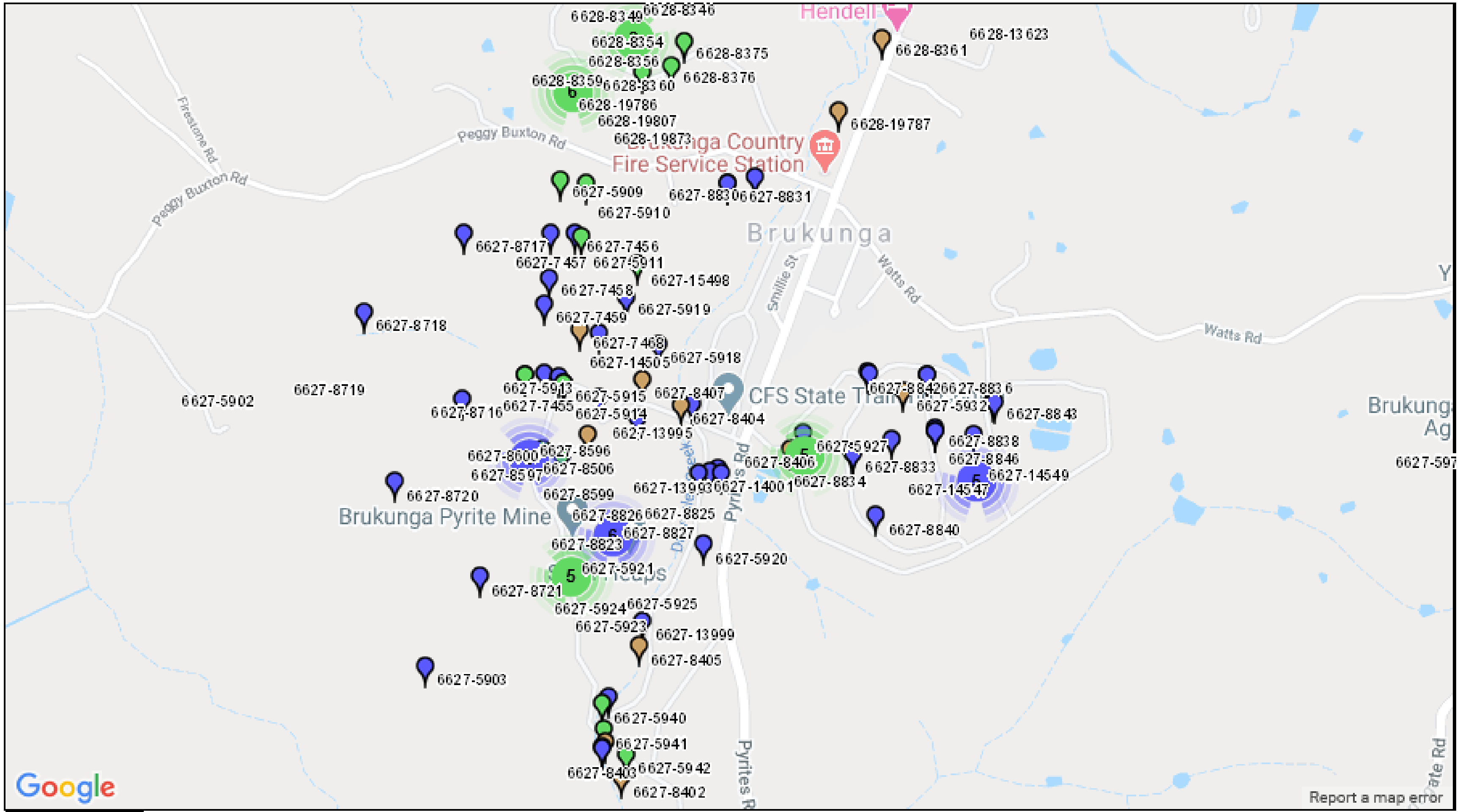
Circle Centre -35.005618,138.940212, Radius 2km



Government of South Australia

WaterConnect

Circle Centre -35.005618,138.940212, Radius 1km



WaterConnect

Groundwater Data Report

Government of South Australia
Department for Environment and Water

Circle Centre -35.005618,138.940212, Radius 2km

Unit No	Max Depth (m)	Latest Depth (m)	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Aquifer	Status	SWL (m)	SWL Date	Date	Cased To (m)	Obs No	Purpose	Permit No
6627-5902	41.45	0	0.38	01/01/1984	1644	15/02/1950	Eeb	BKF							
6627-5903	122.53	122.53			876	16/12/1970	Eeb		9.75	16/12/1970					
6627-5908	6.1	6.1			1801	18/01/1950			1.83	18/01/1950					
6627-5909	102.72	102.72						UKN			12/09/1951				
6627-5910	181.97	181.97						UKN			08/08/1951				
6627-5911	187.7	187.7									08/03/1951				
6627-5912	51.21	51.21						UKN			19/10/1951				
6627-5913	13.72	13.72						UKN			24/10/1951				
6627-5914	149.35	149.35						UKN			01/01/1950				
6627-5915	37.19	37.19						UKN			13/04/1951				
6627-5916	156.97	156						UKN			01/01/1950				
6627-5918	114	114	0.25	15/01/1952	2101	15/01/1952	Elt		0	15/01/1952					
6627-5919															
6627-5920	34.14	34.14	0.3	10/05/1950	1944	25/05/1950	Elt		1.22	10/05/1950	10/05/1950	14.4			
6627-5921	128.93	128						UKN			01/01/1950				
6627-5922	178.31	157.89						UKN			01/01/1950				
6627-5923	117.35	117.35						UKN							
6627-5924	30.78	30.78						UKN			13/04/1951				
6627-5925	170.08	170.08						UKN							
6627-5926	21.95	21.95						ABD		24/07/1997	20/11/1967		KAN009	OBS	
6627-5927	12.19	12.19						UKN							
6627-5928	7.62	7.62						UKN							
6627-5929	10.67	10.67						UKN							
6627-5930	16.76	16.76						UKN							
6627-5931	14.33	14.33						UKN							
6627-5932					8820	01/01/1972							KAN010	OBS	
6627-5933	13.11	13.11						UKN			30/05/1967				
6627-5934	15.24	15.24						UKN			25/05/1967				
6627-5935	18.29	18.29						UKN			26/05/1967				
6627-5936	14.69	14.69						UKN			09/05/1967				
6627-5937	17.01	17.01						UKN			06/05/1967				
6627-5938	85.95	85.95						UKN			18/05/1967				
6627-5939	6.1	6.1						UKN			22/05/1967				
6627-5940	50.29	50.29									12/11/1917				
6627-5941	72.24	72.24									02/10/1917				
6627-5942	178.61	178.61						UKN			20/06/1951				
6627-5943	10.67	10.67						UKN			18/05/1967				

Unit No	Max Depth (m)	Latest Depth (m)	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Aquifer	Status	SWL (m)	SWL Date	Date	Cased To (m)	Obs No	Purpose	Permit No
6627-5944	28.35	28.35	1.26	01/01/1950	1873	04/08/1960	Ek					6.1			
6627-5945					9761	05/01/1973								RIV	
6627-5946															
6627-5947	13.72	13.72						UKN			12/05/1967				
6627-5948	12.68	12.68						UKN			10/05/1967				
6627-5949	20.39	20.39						UKN			02/06/1967				
6627-5950	19.66	19.66						UKN			30/05/1967				
6627-5951	84.58	84.58						UKN			11/07/1967				
6627-5952	25.91	25.91						UKN			17/05/1967				
6627-5953	22.86	22.86						UKN			26/05/1967				
6627-5954	32	32						UKN			06/06/1967				
6627-5955	30.18	30.18						UKN			09/06/1967				
6627-5956	157.89	157.89						UKN			20/06/1951				
6627-5957	121.31	121.31						UKN			24/09/1951				
6627-5958	39.32	39.32						UKN			15/06/1967				
6627-5959	39.32	39.32						UKN			16/06/1967				
6627-5960	39.01	39.01						UKN			19/06/1967				
6627-5976	60.96	60.96	0.38	01/01/1984	5690	16/02/1950	Elt	ABD							
6627-5977	64.01	64.01			3962	11/07/1984	Elt	ABD	0.69	11/07/1984	01/01/1955				
6627-7123							Elt	ABD							
6627-7134	19	19					Eeb	OPR	7.96	17/07/1984	17/07/1984			STK	
6627-7454	21.6	21.6			14800	27/11/1985	Esa	OPR	0.99	27/12/2001	13/11/1985	0.5	KAN011	OBS	17323
6627-7455	25	25	0.13	14/11/1985			Esa		1.02	08/10/1999	14/11/1985	1	KAN012	OBS	17324
6627-7456	20.6	20.6			5690	09/05/1986	Esa		4.06	27/12/2001	15/11/1985	1	KAN013	OBS	17325
6627-7457	25	25					Esa		1.69	27/12/2001	15/11/1985	1	KAN014	OBS	17326
6627-7458	7	7	0.13	16/11/1985	4809	16/11/1985	Esa		2.23	27/12/2001	16/11/1985	1	KAN015	OBS	17327
6627-7459	25	25			9837	09/05/1986	Esa		2.2	27/12/2001	18/11/1985	1	KAN016	OBS	17328
6627-7468			0.23	01/01/1985	100	07/03/2019							KAN004	OBS	
6627-7469			0.04	01/01/1985	6659	08/09/1993							KAN005	OBS	
6627-8333	31	31	1.38	19/11/1990	1508	23/11/1990		OPR	6	23/11/1990	19/11/1990	18		DOM	95630
6627-8402					1782	08/09/1993							KAN002	OBS	
6627-8403					1788	08/09/1993							KAN007	OBS	
6627-8404					1496	08/09/1993							KAN001	OBS	
6627-8405					15370	08/09/1993							KAN006	OBS	
6627-8406					5304	08/09/1993							KAN008	DAM	
6627-8407					2210	08/09/1993							KAN003	OBS	
6627-8506					14952	04/06/1992							KAN017	OBS	
6627-8596	20	20					Esa				04/02/1992	1.5	KAN018	OBS	26924
6627-8597	20	20	0.25	03/02/1992	3408	03/02/1992	Esa		1.9	03/02/1992	03/02/1992	1	KAN019	OBS	26926
6627-8598	4	0					Esa	ABD	0		01/02/1992	0.5		OBS	26926
6627-8599	30	30					Esa				04/02/1992	1.5	KAN020	OBS	26925
6627-8600	96	96	1	15/01/1992			Esa				15/01/1992	30	KAN021	INV	26538

Unit No	Max Depth (m)	Latest Depth (m)	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Aquifer	Status	SWL (m)	SWL Date	Date	Cased To (m)	Obs No	Purpose	Permit No
6627-8601	100	100	0.3	15/01/1992	2047	20/12/1991	Esa		0	13/12/1991	15/01/1992	28	KAN022	INV	26539
6627-8716	67	67	0.33	07/05/1993	2841	07/05/1993	Eeb		8.86	27/12/2001	07/05/1993	2	KAN023	INV	29559
6627-8717	65	65	0.33	10/05/1993	2803	10/05/1943	Eeb		16.77	11/02/2000	10/05/1993	0.5	KAN024	INV	29560
6627-8718	30	30	0.33	11/05/1993	1990	12/05/1993	Eeb	FL	-8.47	27/12/2001	11/05/1993	12	KAN025	INV	29561
6627-8719	67	67	0.33	14/05/1993	1795	13/05/1993	Eeb		3.25	27/12/2001	14/05/1993	1	KAN026	INV	29562
6627-8720	67	67	0.33	18/05/1993	1310	19/05/1993	Eeb		3.75	27/12/2001	18/05/1993	1	KAN027	INV	29563
6627-8721	67	67	0.33	18/05/1993	2040	19/05/1993	Eeb		12.62	27/12/2001	18/05/1993	1	KAN028	INV	29564
6627-8823	11	0					Elt	ABD			16/02/1994			OBS	31070
6627-8824	39	39					Elt				16/02/1994	37	KAN037	OBS	31070
6627-8825	44	44					Elt				17/02/1994		KAN033	OBS	31071
6627-8826	6	4.5					Elt				17/02/1994	4.5	KAN034	OBS	31075
6627-8827	6.8	6.8					Elt				22/02/1994	6.8	KAN036	OBS	31076
6627-8828	37	16					Elt				25/02/1994	16	KAN035	OBS	31156
6627-8829	28.8	28.8					Elt				18/02/1994	27.8	KAN030	OBS	31072
6627-8830	24	24					Elt				21/02/1994	22	KAN031	OBS	31073
6627-8831	8.5	8.5					Elt				21/02/1994	8.5	KAN032	OBS	31074
6627-8832	10	10					Elt				22/02/1994	10	KAN038	OBS	31068
6627-8833	10	9.5					Elt				22/02/1994	9.5	KAN039	OBS	31069
6627-8834	33	33			3690	11/05/1994	Elt		18.6	08/01/2007	09/04/1994	12	KAN040	INV	31295
6627-8835	20	20			4834	11/05/1994	Elt		12.78	08/01/2007	25/03/1994	11	KAN041	INV	31291
6627-8836	13	13			3851	11/05/1994	Elt		6.54	08/01/2007	28/03/1994	3	KAN043	INV	31292
6627-8837	15.5	15.5			7603	10/05/1994	Elt		4.86	08/01/2007	12/04/1994	1	KAN045	INV	31296
6627-8838	21	21			5664	10/05/1994	Elt		8.17	08/01/2007	30/03/1994	3	KAN048	INV	31293
6627-8839	26	26			2273	11/05/1994	Elt		13.06	08/01/2007	14/04/1994	9	KAN051	INV	31297
6627-8840	18	18			3167	11/05/1994	Elt		16.05	08/01/2007	06/04/1994	12	KAN052	INV	31294
6627-8841	11.3	11.3					Elt				23/03/1994		KAN042		
6627-8842	3.5	3.5					Elt				23/03/1994		KAN044		
6627-8843	1	1					Elt				23/03/1994	1	KAN046		
6627-8844	2	2					Elt				23/03/1994	1	KAN047		
6627-8845	3	3					Elt				23/03/1994		KAN049		
6627-8846	3	3					Elt				23/03/1994		KAN050		
6627-13365	3	3						BKF			30/08/1996				
6627-13989	3.5	3.5					Esa				16/02/2009	0.5		INV	159863
6627-13990	5	5					Esa				16/02/2009	2		INV	159864
6627-13991	33.5	33.5					Elt				18/02/2009	30.5		INV	159850
6627-13992	15.5	15.5					Elt				05/02/2009	9.5		INV	159859
6627-13993	17	17					Elt				12/02/2009	14		INV	159861
6627-13994	12	12					Elt		3	04/02/2009	04/02/2009	6		INV	159862
6627-13995	12	12					Elt				06/02/2009	8		INV	159860
6627-13996	12	12					Elt				17/02/2009	12		INV	159865
6627-13998	4	4					Elt				09/02/2009	1		INV	159853
6627-13999	6.5	6					Elt				16/02/2009	3		INV	159866

Unit No	Max Depth (m)	Latest Depth (m)	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Aquifer	Status	SWL (m)	SWL Date	Date	Cased To (m)	Obs No	Purpose	Permit No
6627-14000	4	4					Elt				11/02/2009	1		INV	159851
6627-14001	4	4					Elt				11/02/2009	1		INV	159856
6627-14157	30	30					Elt				24/02/2009	27		INV	159846
6627-14158	29.7	29.7					Elt				15/01/2009	6		INV	159857
6627-14159	27	27					Esa				20/01/2009	12		INV	159858
6627-14504	20	20					Esa				11/10/2012				216683
6627-14505	15	15					Esa				11/10/2012				216687
6627-14506	20	20					Esa				11/10/2012	8			216878
6627-14507	20	20					Esa				09/10/2012	8			216879
6627-14508	20	20					Esa				09/10/2012	8			216880
6627-14547	20	20					Elt				16/10/2012	16		INV	216691
6627-14548	18.7	18.7					Elt		12	18/10/2012	18/10/2012	15.7		INV	216688
6627-14549	5	5					Elt		2	19/10/2012	19/10/2012	3		INV	216690
6627-14550	5	5					Elt		2	21/11/2012	21/11/2012	2		INV	216689
6627-14551	25	25					Elt				13/10/2012	19		INV	216884
6627-15498	378.5	378.5									31/07/2013				
6628-8342	21	21						UKN			19/04/1967				
6628-8343	25.27	25.27						UKN			01/04/1967				
6628-8344	25.3	25.3			1099	30/08/2004		UKN			23/03/1967				
6628-8345	33	33						UKN			10/03/1967				
6628-8346	22.8	22.8						UKN			15/03/1967				
6628-8347	20.33	20.33						UKN			18/03/1967				
6628-8348	37.49	37.49						UKN			07/03/1967				
6628-8349	39.62	39.62						UKN			01/03/1967				
6628-8350	22.46	22.46						UKN			22/02/1967				
6628-8351	42.52	42.52						UKN			06/04/1967				
6628-8352	33.22	33.22						UKN			11/04/1967				
6628-8353	19.78	19.78						UKN			18/02/1967				
6628-8354	32.67	32.67						UKN			14/04/1967				
6628-8355	16.46	16.46						UKN			19/04/1967				
6628-8356	19.66	19.66						UKN			17/04/1967				
6628-8357	17.68	17.68						UKN			21/04/1967				
6628-8358	11.55	11.55						UKN			15/02/1967				
6628-8359	14.42	14.42						UKN			20/04/1967				
6628-8360	13.29	13.29						UKN			18/04/1967				
6628-8361					3460	16/01/1950									
6628-8362					13737	05/01/1973								SOK	
6628-8363	16.83	16.83						UKN			28/04/1967				
6628-8364	16.89	16.89						UKN			22/04/1967				
6628-8365	20.73	20.73						UKN			26/04/1967				
6628-8366	16.79	16.79						UKN			23/04/1967				
6628-8367	28.56	28.56						UKN			15/04/1967				

Unit No	Max Depth (m)	Latest Depth (m)	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Aquifer	Status	SWL (m)	SWL Date	Date	Cased To (m)	Obs No	Purpose	Permit No
6628-8368	23.1	23.1						UKN			12/04/1967				
6628-8369	17.47	17.47						UKN			08/04/1967				
6628-8370	184.51	184.51						UKN			21/11/1966				
6628-8371	25.42	25.42						UKN			01/04/1967				
6628-8372	22.19	22.19						UKN			05/04/1967				
6628-8373	16.06	16.06						UKN			10/02/1967				
6628-8374	126.49	126.49						UKN			25/01/1967				
6628-8375	170.69	170.69						UKN			11/10/1951				
6628-8376	237.44	237.44						UKN			30/04/1951				
6628-13623	68	68	1	24/02/1986	4211	20/12/1985	Elt		1	21/04/1986	24/02/1986	5.5			17805
6628-14175	110	110	2.5	29/02/1988	4358	22/03/1988	Elt		12	22/03/1988	29/02/1988	6			20866
6628-16643	12.8	0	0	18/04/1994	3862	05/05/1994	Elt	ABD			18/04/1994			IRR	31464
6628-16645	22	22	0.05	20/04/1994	3539	05/05/1994	Ek				20/04/1994	11.7		IRR	31464
6628-19785	13.72	13.72						UKN			02/02/1967				
6628-19786	8.44	8.44						UKN			07/02/1967				
6628-19787		0			940	01/01/1972		BKF							
6628-19807	16.15	16.15						UKN			04/02/1967				
6628-19873	15.09	15.09						UKN			27/01/1967				
6628-21783	48	48	4.5	24/02/2004	2121	23/02/2004	Ek		1.5	24/02/2004	24/02/2004	12		IRR	64346
6628-21859		0			950	01/08/2003	Eeb	BKF							64445
6628-28065	119	119	3.5	30/11/2015					31	30/11/2015		12			253825

184 records

Appendix D – Conceptual Hydrogeological Model (GHD 2009)

Conceptual Hydrogeological Model (GHD 2009)

The conceptual hydrogeological model for the CFS STC site and Brukunga Mine is taken largely from GHD's 2009 study for the Brukunga Mine. Although the water level and climatic data are up to 2009, the concept remains valid.

Aquifer descriptions

Groundwater flow at the site and in the surrounding region can be divided into the following sub zones:

- Waste Rock;
- Tailings;
- Alluvium;
- Surficial soils/regolith;
- Shallow fractured and weathered rock;
- Intermediate fractured rock; and
- Deep bedrock.

Waste Rock

Waste rock is the primary source of acid and dissolved metals discharging to Dawesley Creek. Waste rock has been placed in several dumps adjacent to the western side of Dawesley Creek, in some cases in to the creek, resulting in diversion of creek flow, as shown in the "South Dump" in Figure 1.

The waste rock comprises pyritic meta-siltstone to schist, ranging from hard, competent rock to decomposed, friable clay/silt.

Standing water levels within the stockpiles, where observed, are generally only slightly above the base of the waste (Brukunga Remediation Project – Technical Advisory Group (TAG) pers com), indicating water infiltrates rapidly, probably flowing laterally as a thin perched layer, along the interface with underlying, less permeable material. The absence of a hydraulic gradient from significant thickness of saturated waste rock makes it difficult to quantify groundwater flow rates through the waste rock.

Based on the deposition of the waste rock on the pre-mining land surface, it is likely that most of the water that passes through the waste rock discharges directly to Dawesley Creek or to the creek via shallow fractured and weathered bedrock or alluvium.

No transient water level data were available for waste rock to enable assessment of seasonal variations.

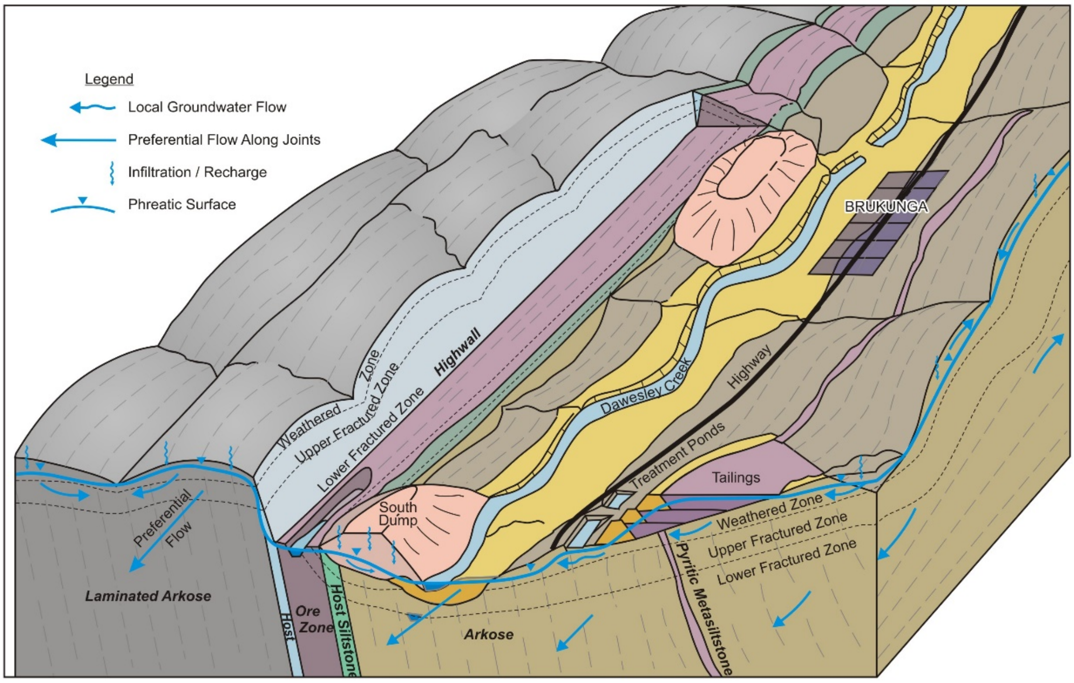


Figure 1 Conceptual hydrogeological model schematic (GHD 2009)

Tailings Dam

The pyritic tailings, deposited in a dammed valley to the east of Dawesley Creek, are hydraulically isolated from the waste rock by Dawesley Creek. Groundwater is partially mounded behind the dam embankment, with tailings adjacent to the embankment being partially dry, with water levels 12.6 m bgl (KAN41) to 16.1 m bgl (KAN52) in February 2020. Water levels within the western half of the tailings have dropped over time (Figure 2 and Figure 3) at a rate of approximately 200 mm/y, with the lack of seasonal variation (excluding what appear to be reading errors in January 2001 and July 2002) indicating recharge from rainfall over the period June 2004 to January 2008 was minimal. Assuming an unconfined storage coefficient of 0.1, the fluctuation of less than 50 mm indicates precipitation recharge is less than 5 mm/year over this period, although recharge could be partly masked by the general declining trend. This is less than the average recharge rate estimated for flat-lying, treed areas of 29 mm/y (Section Recharge) for the rest of the region. This is possibly due to the presence of clayey capping soil over the tailings, in contrast to the relatively sandy soils common in the region, and the relatively low rainfall over the period monitored. Alternatively, it is possible that seasonal fluctuations are damped in the deep monitoring bores to the extent that annual fluctuations are not discernible. Given the response noted in similar wells in the area, the former is more likely. It is likely that some of the tailings would remain saturated, due to the sub-surface damming effect of the embankment.

Although the flow of groundwater under the tailings is likely to be predominantly westwards, seeping through or beneath the embankment then beneath the CFS site, it is likely there is some preferential flow along north-south regional fracturing.

Water levels in tailings well KAN45 (Figure 4) appear to have been affected by disposal of sludge top the adjacent ponds, showing cyclic water level changes of approximately 4 m, which is in excess of what would be expected from rainfall recharge. Sludge disposal was changed to a thickened residue in late 2005, after which time the seasonal variation seems to have reduced significantly. Water levels in wells in the middle of the tailings, such as KAN48 (Figure 5) show a combination of gradual decline with a marked seasonal variation prior to 2006. To some extent, the fluctuation could also be due to runoff within the dam catchment running out over the eastern edge of the tailings.

The presence of dry, oxidised tailings represents a source of acid and metalliferous drainage beneath the southern side of the CFS site and to Dawesley Creek.

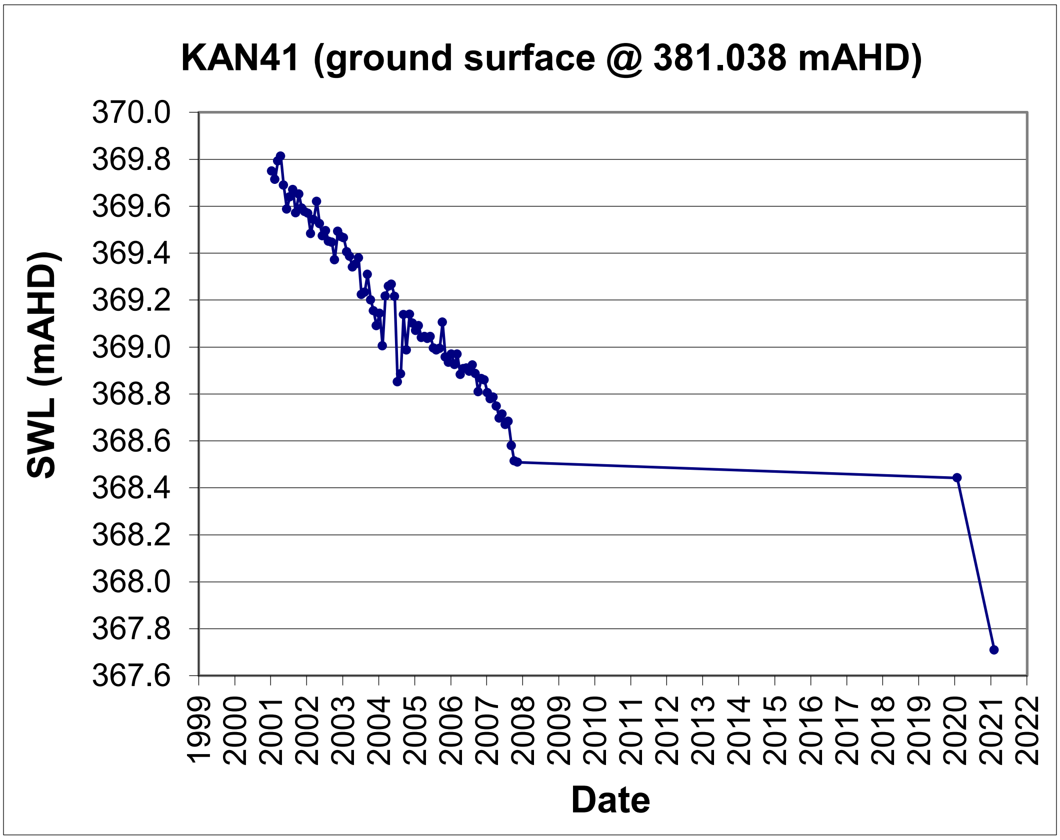


Figure 2 Tailings groundwater level time series Well KAN41

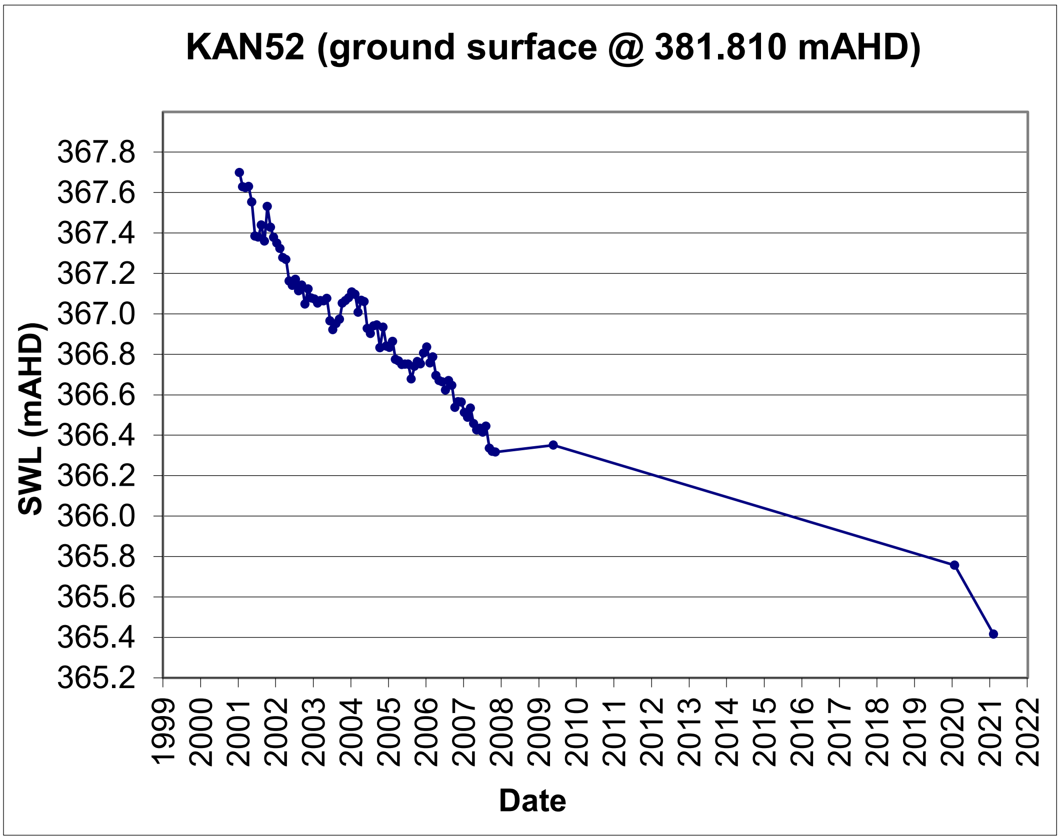


Figure 3 Tailings groundwater level time series Well KAN52.

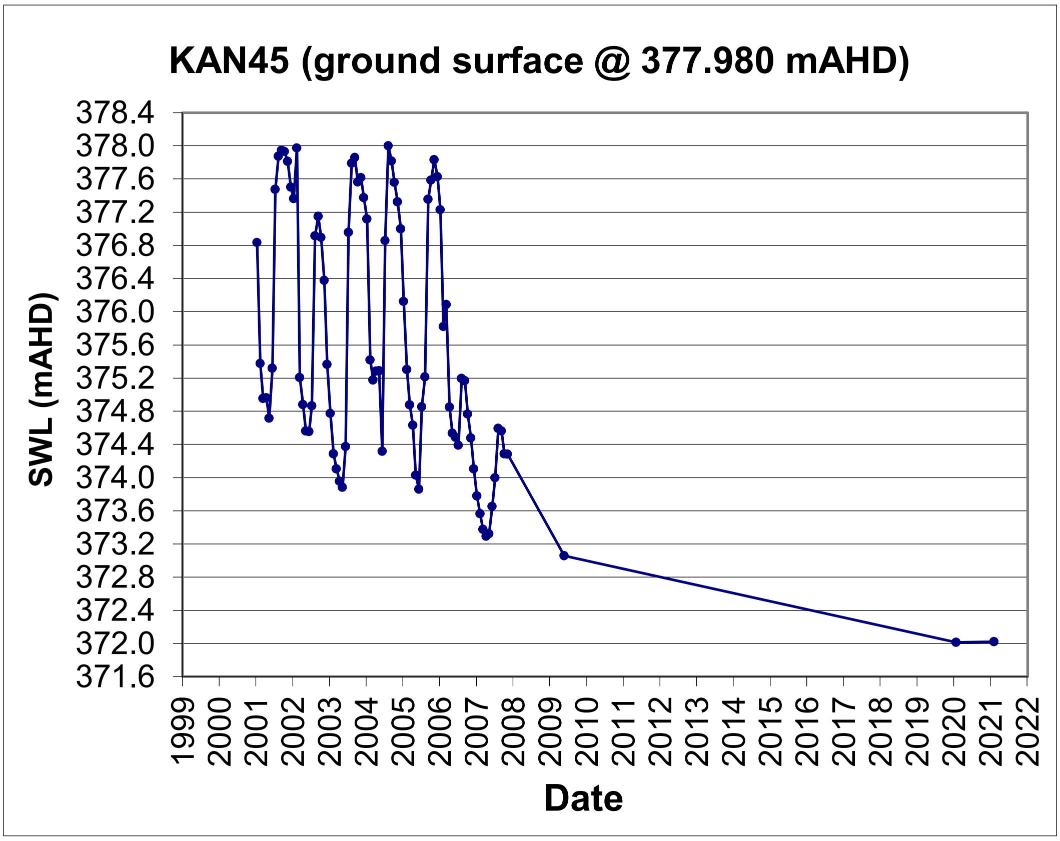


Figure 4 Tailings groundwater level time series Well KAN45.

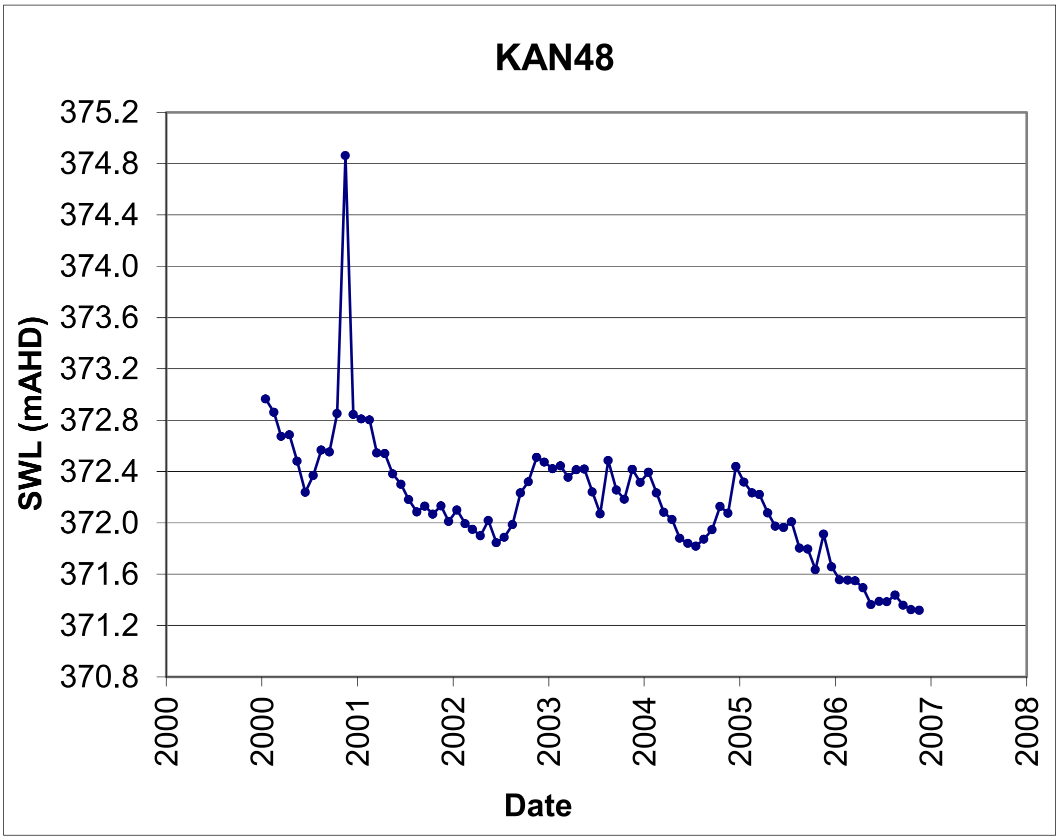


Figure 5 Tailings groundwater level time series Well KAN48

Alluvium

Drilling to date indicates there is only a thin, narrow strip of alluvium/colluvium along Dawesley Creek. SKM (2008) noted that the alluvium was generally less than 2.5 m thick, ranging from clay to bouldery gravels. Given the limited thickness and expected low permeability of the clayey alluvium, it is not likely to represent a significant aquifer, although it may be more permeable than the underlying bedrock, acting as a preferential path for contaminated groundwater emanating from the waste rock and underlying bedrock or recharging from Dawesley Creek during periods of low groundwater levels. Tonkin (2009) noted that water levels in bedrock below the alluvium were higher than in the alluvium and concluded that this was evidence for confining of the bedrock aquifer. It is, however, also consistent with upward flow from the bedrock aquifer, into the alluvium and Dawesley Creek.

Surficial soils/regolith

SKM (2008) noted that soils at the mine site are generally thin (<1 m thick) to absent. This is consistent with the general appearance of the area. Soils are generally sandy loam to clayey loam (Northcote classification Uc), (Western and McKenzie, 2004). No permeability data were available for the surface soils, however the lower clayey soil horizons are likely to have relatively low permeability. The clayey subsoil, relatively steep slopes and high evaporation rates are likely to restrict deep drainage of rainfall through the surface soils. It is likely that a significant proportion of the water infiltrating through the ground surface, will flow down-slope as interflow at the base of the upper sandy soil horizon. This is reflected in the low estimated deep drainage recharge rates of 15 mm/year to 22 mm/year estimated for the Eastern Mt Lofty Ranges, a similar environment (Banks et al. 2006).

Shallow fractured and weathered rock

Geological mapping and drilling by SKM (2008) indicates that the upper 20 m of weathered bedrock ("Weathered Zone" in Figure 1 and "upper Zone" in Figure 6 – note the orientation of tectonic fracturing is approximately north-south in the mine area) exhibits regional tectonic jointing and fracturing overprinted by sub-horizontal, stress-relief jointing. This is consistent with regional observations (Mortimer et al 2008). SKM (2008) noted that although there was increased horizontal fracturing in the upper 20 m, groundwater flow is likely to be dominantly along bedding planes and other steeply-dipping fractures as unloading tends to dilate steeply dipping fracturing with horizontal fractures remaining closed. The thickness of this layer is likely to vary with topography and local lithology, and the base of this zone is likely to have a significant control on groundwater levels, with the piezometric surface following this surface.

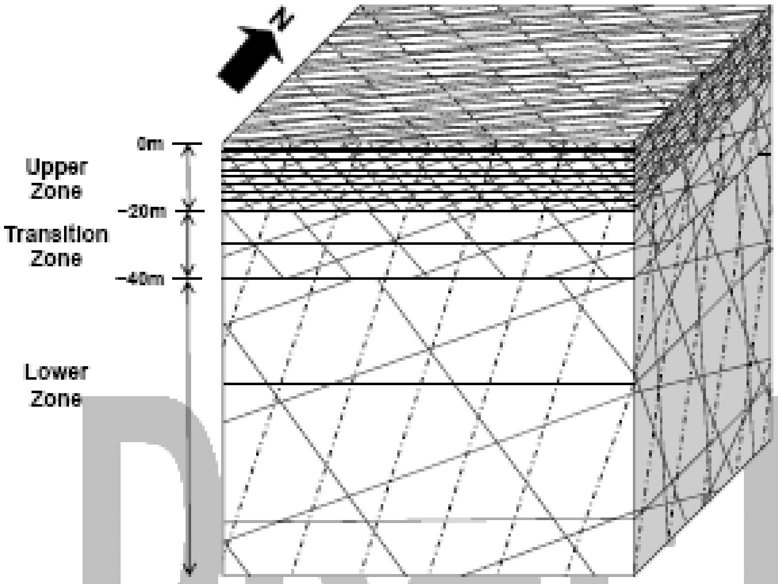


Figure 6 Rock Fracturing Conceptual Model (From SKM 2008 Fig 2-10)

Note Tectonic fracturing in Brukunga Mine area is dipping steeply/sub-vertically to the east.

The pyritic schist within the ore zone west of Dawesley Creek appears to have more closely-spaced jointing than the surrounding meta-arenite (TAG pers com), but the meta-arenite still appears to have an order of magnitude more jointing north-south, parallel to the bedding plane, than east-west.

This hypothesised anisotropy is supported by the observation that there is no sign of significant seepage along the mine's highwall face, but wells drilled horizontally in to the highwall discharge water.

Analysis of permeability data from the site indicates an increase in permeability with decreasing depth (Figure 7). In addition to general jointing and fracturing, there may be discrete fracture zones, especially sub-vertical fractures, running east-west, orthogonal to the regional strike within the model domain. None, however, were identified during surface mapping of the mine site by SKM (2008). The trellis drainage, which characterises the site (Figure 1) and surrounding region, supports the presence of preferential erodibility, if not permeability, parallel and orthogonal to the regional strike.

The shallow fractured and weathered zone has been removed from mined areas but probably extends beneath waste rock dump and tailings areas. This unit represents the most significant aquifer, in terms of permeability and extent, at the site and within the general region.

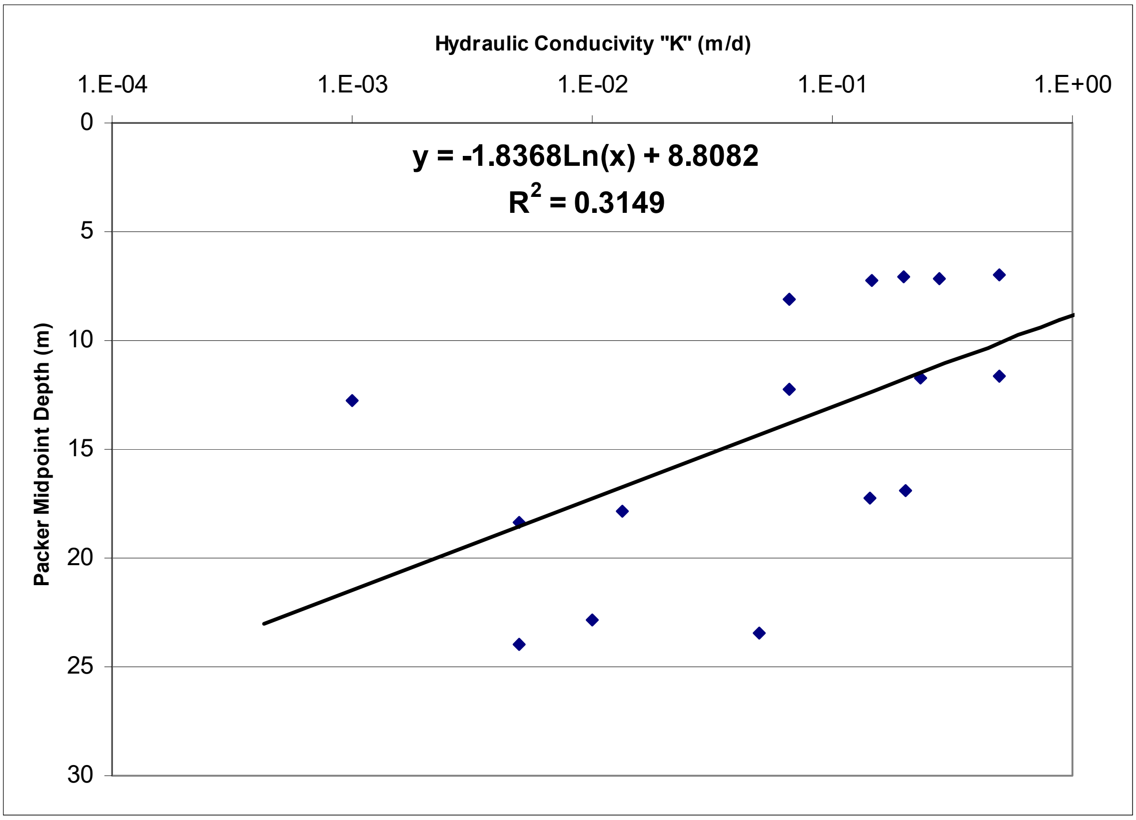


Figure 7 Packer-Tested Bedrock K variation with Depth

Upper Fractured Rock

The zone from about 20 m to 40 m below surface comprises an intermediate zone of less weathered and less fractured rock ("Upper Fractured Rock" in Figure 1 or "Transition Zone" in Figure 6). This layer is transitional between the near-surface zone with significant stress-relief jointing, and the lower bedrock with only tectonic jointing or fracturing. This zone, which has largely been removed from within the mine footprint, is also a regional aquifer, but tends to be low-yielding and represent only local flow systems, except where significant regional-scale fracturing is present.

Although there is substantial horizontal jointing, along with sub-vertical bedding plane jointing, the stress-relief dilation tends to favour the opening of sub-vertical joints. Consequently, permeability is likely to be dominated by bedding-plane joints and foliation (SKM 2008).

Plots of water levels in wells in the fractured bedrock to the west of the mine show distinct seasonal variations, of approximately 10 m, overprinting a gradual increase in base levels over the period of record from 1995 (Figure 8 and Figure 9). The seasonal response is consistent with a fractured rock aquifer, the magnitude of rainfall and thin soil cover, with the peak levels generally reflecting rainfall intensity. The slowly rising base level over the period is unusual, however, as it occurs over a period of decreasing rainfall. It is possible that it may be due to recovery from dewatering during mining or other groundwater extraction. It may also be a long-term response to increased recharge due to deforestation, although the aerial photographs of the site from 1949 show little change in the vegetation in this area. The water level record is complicated by the fact that the wells appear, from records, to be uncased, allowing interconnection between shallow and deep aquifers.

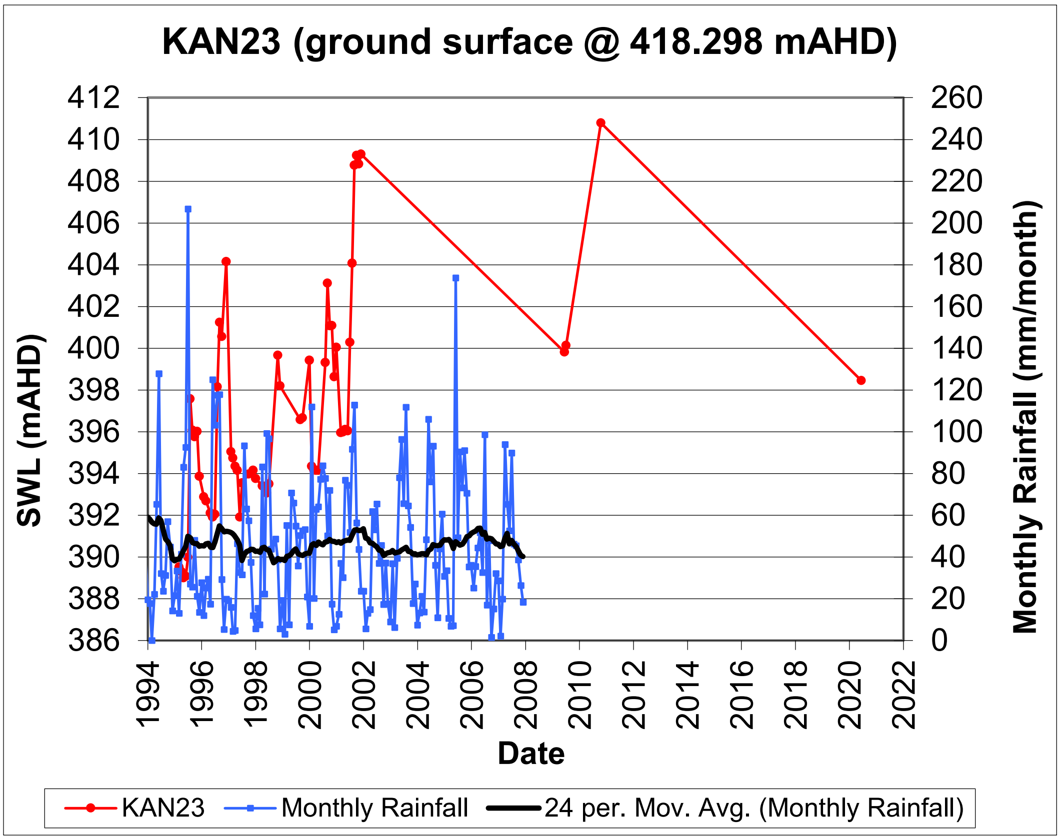


Figure 8 Western fractured rock groundwater level time series Well KAN23.

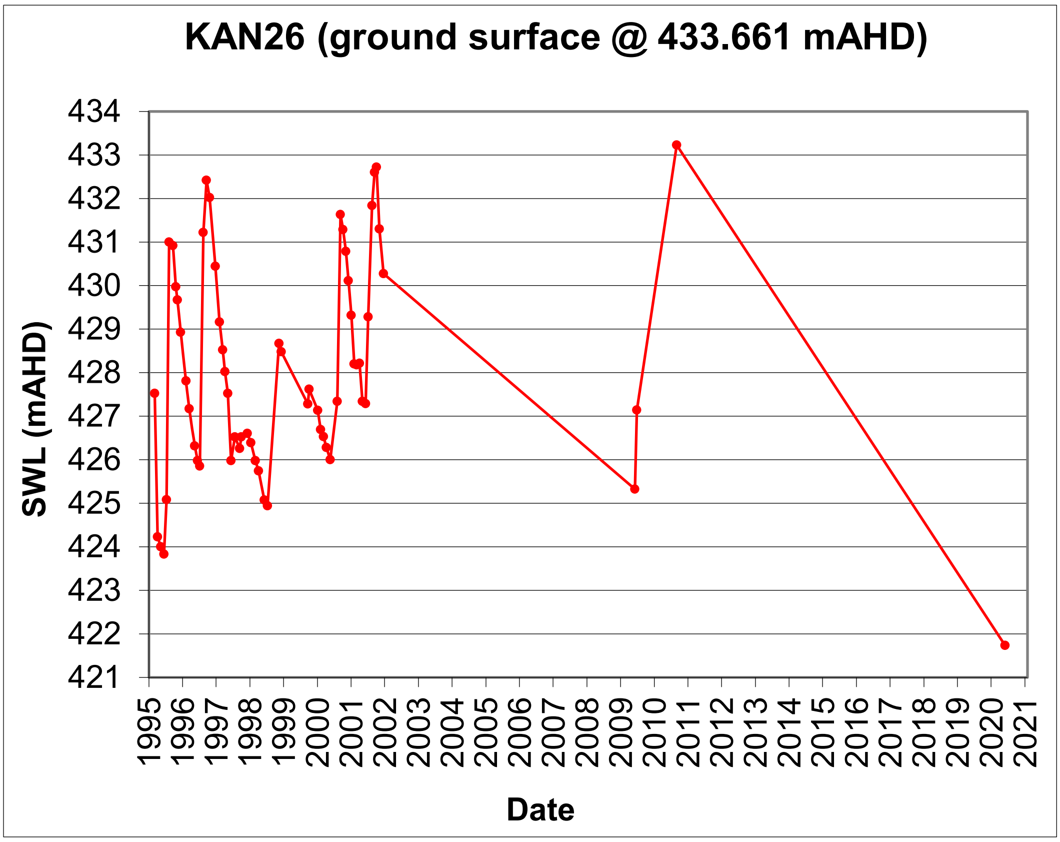


Figure 9 Western fractured rock groundwater level time series Well KAN26.

Deep bedrock

This zone is exposed in the Brukunga Mine base. Permeability within this zone is limited to fine foliation sub-parallel to bedding planes as well as widely spaced tectonic jointing. Consequently, this horizon has very low permeability. It is possible that localised areas of higher permeability may exist, associated with regional faulting. One such fault zone runs along Dawesley Creek (Golder 2016). The absence of horizontal stress-relief jointing means deep bedrock permeability, such as it is, will be dominated by jointing parallel to bedding planes, with very little cross-strike permeability. The anisotropy is likely to be significant north of the mine, where the bedding planes dip angle becomes shallower. Although the rocks to the east and west of the ore zone schist may have fewer bedding plane joints, they also have fewer cross (E-W) joints indicating that permeability anisotropy may still be strong in steeply dipping areas around the mine. This is supported by SKM's (2008) structural assessment.

The water levels in wells drilled in the bedrock in the base of the mine, such as KAN16 (Figure 10) show very little fluctuation, considering expected annual recharge and storage capacity, and rapidly return to a well-defined base level, in the case of KAN16, at 362.05 mAHD. This indicates that the lower limit may be controlled by some sort of boundary, such as the elevation of the lowest intersected fracture, which acts as a spill level, or a recharge boundary such as a creek of stable water body. In the absence of any nearby likely recharge boundaries, fracture control is the most likely cause. This indicates that at KAN16, rock above 362.05 mAHD (~5 m below surface) is permeable to some extent, but is effectively impermeable below that level. Other wells, such as KAN11 (Figure 11)and KAN12 (Figure 12) show more variable base levels, indicating fractures are open to below the lowest water level, and are not acting as a spill level.

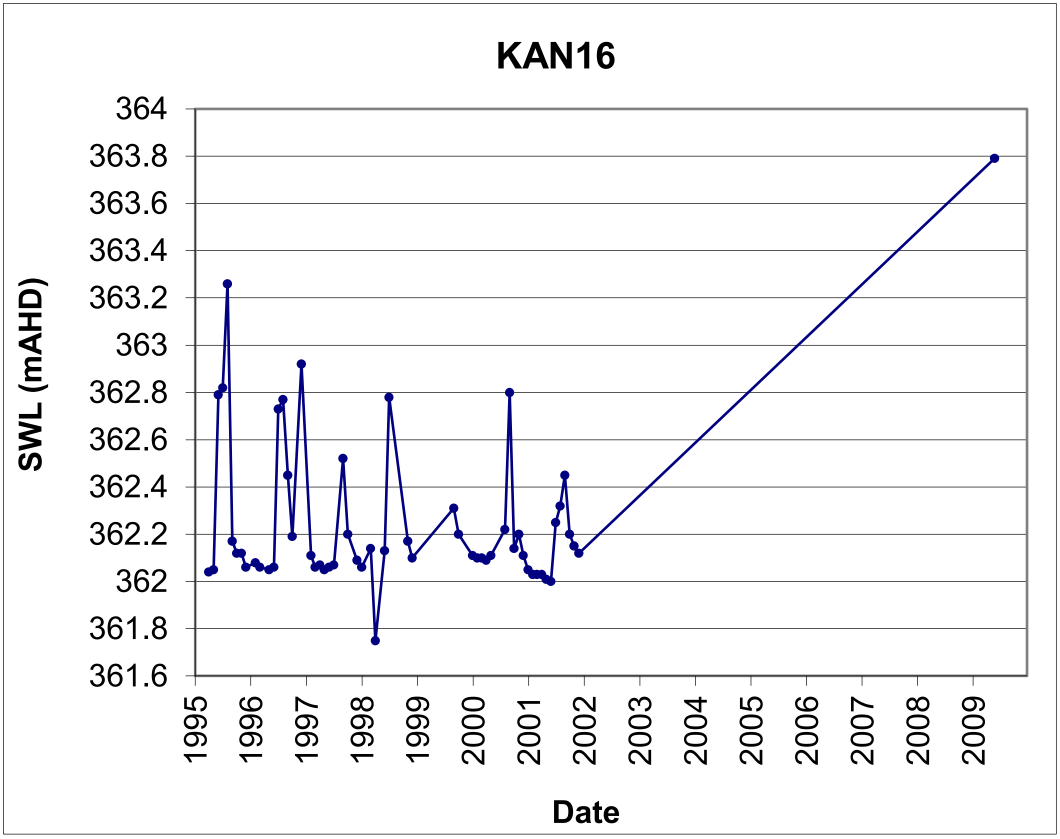


Figure 10 Bedrock groundwater level time series Well KAN16.

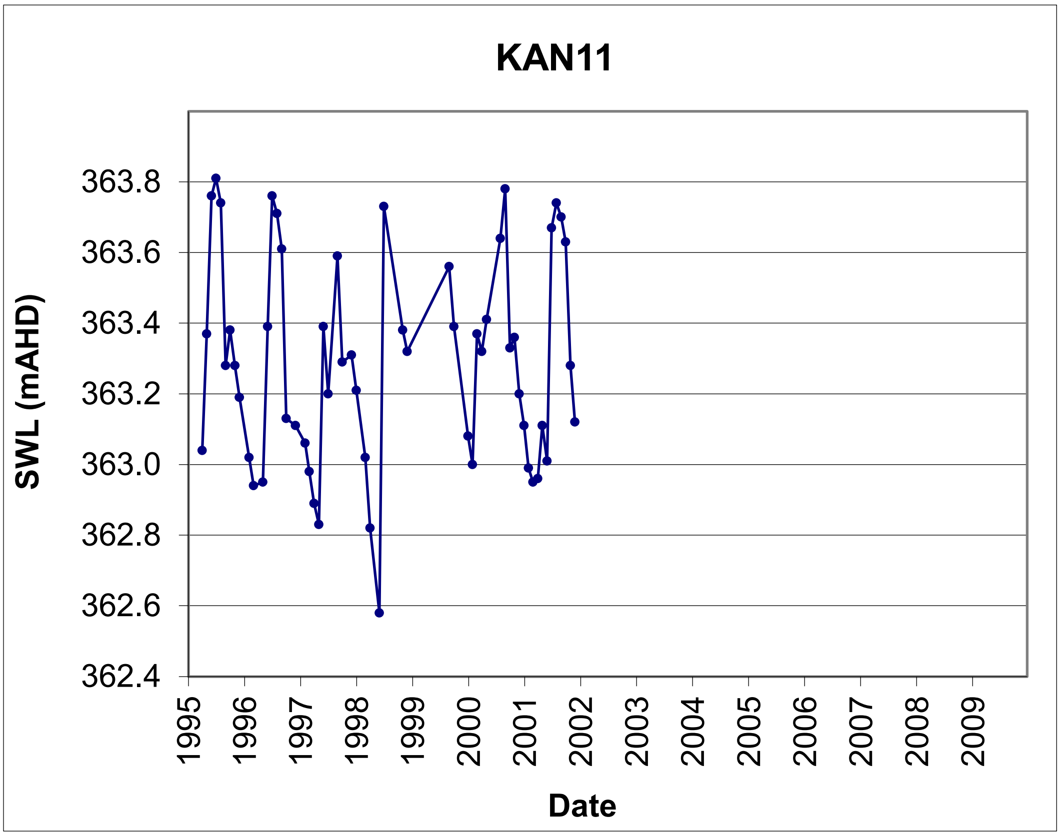


Figure 11 Bedrock groundwater level time series Well KAN11.

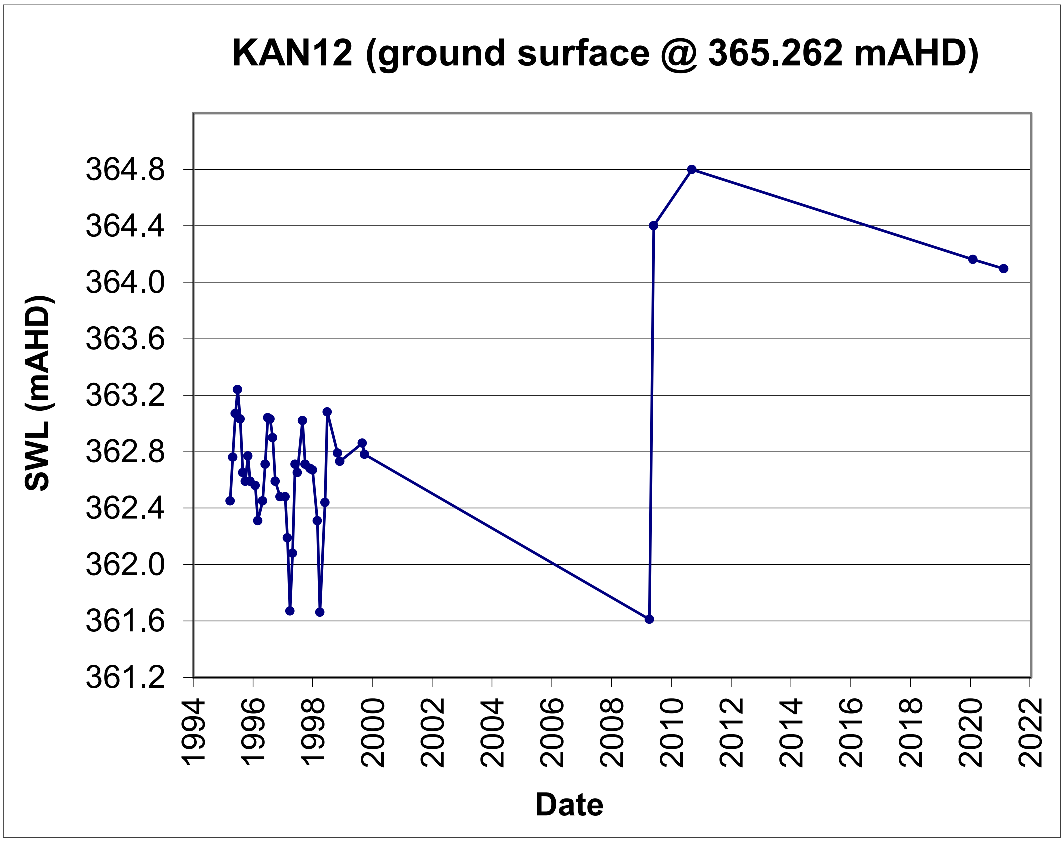


Figure 12 Bedrock groundwater level time series Well KAN12.

Major Cross Structures

A major NNW-SSE trending lenticular breccia zone is mapped on the 1:50,000 geological map approximately 1 km to the northeast of the Mine. Although on inspection, TAG did not find any evidence of this breccia zone, the high yield from private irrigation well 6628-21783 (4.5 L/s) indicates that this zone is significantly more permeable than the surrounding region. If present, it cuts across inferred the dominant groundwater flow direction and through Dawesley Creek and consequently may act as a collection system, feeding groundwater from a large area to the creek. The change in baseflow rates above and below breccia zone would be of interest.

Groundwater Flow Processes

Over most of the study area, recharge is to the surface layer of soil and weathered and fractured rock. Much of the recharge is likely to flow down-slope, at the base of the upper sand horizon in duplex soils, or at the base of the shallow weathered and fractured rock. Much of the water in the soil is likely to evaporate before it travels over any great lateral distance, but water in the base of the weathered rock is below the reach of vegetation and hence is likely to eventually discharge to major surface drainage lines as baseflow (Figure 1). Little recharge is likely to reach the deeper, less-fractured bedrock. The evaporative losses are indicated by the moderate groundwater salinity recorded in the region.

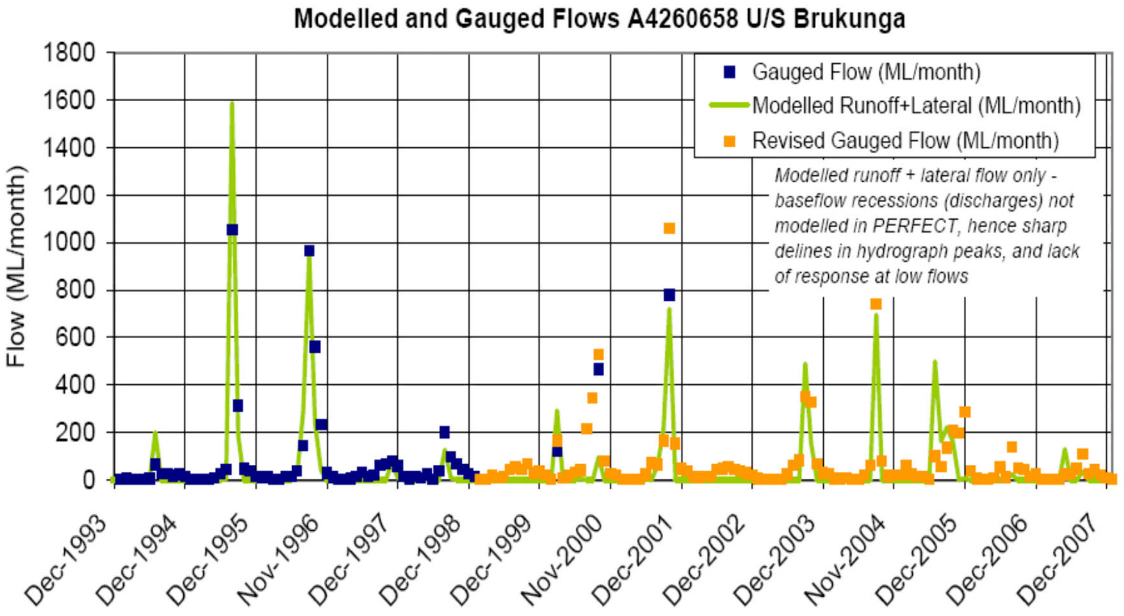
As noted above, flow in the deeper bedrock layers, greater than 10 m to 20 m below the original land surface, will be dominated by flow along the bedding plane, indicated by the large arrows in Figure 1. Permeability along the bedding plane could be expected to be an order of magnitude higher than across the bedding plane.

Surface Water Groundwater Interaction

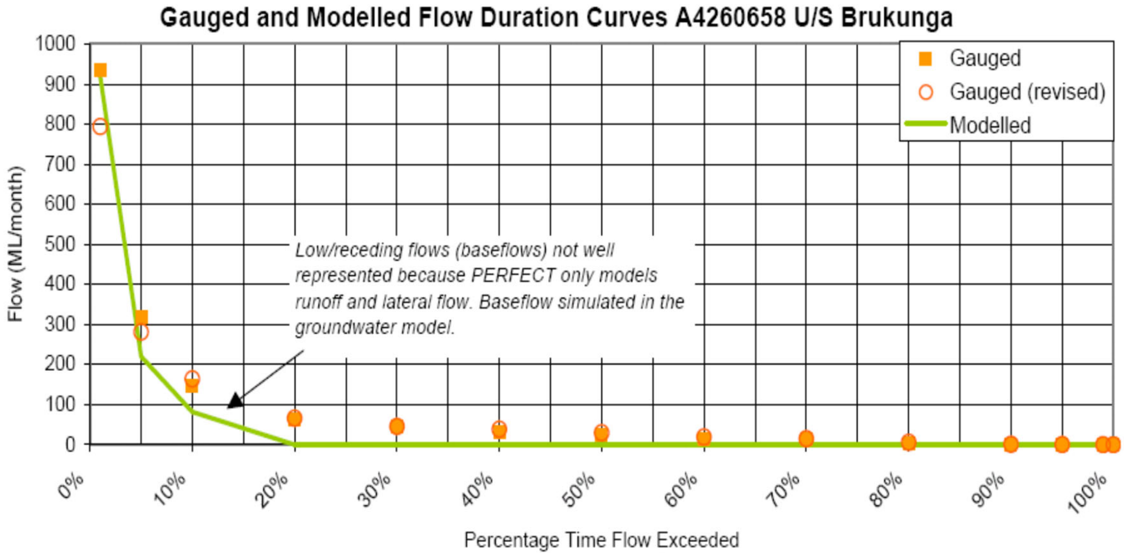
Groundwater flow is expected to generally mimic surface topography, due to the decreasing permeability with depth, and likely higher recharge rates on ridge tops with shallower slopes and soils. The possible exception is flow within the intermediate to deep bedrock, which is probably dominantly along the bedding plane to the north and south. During periods of high groundwater levels, local groundwater discharge to gullies and creeks would be expected, appearing as short-lived baseflow. Given the low permeability and expected low flow rates, however, much of the discharge to low lying areas may not be expressed as baseflow as it will be taken up by evapotranspiration before reaching the surface. Groundwater discharge to alluvium and directly to Dawesley Creek would be expected to continue for longer, and is evident in baseflow recorded at the site (Figure 13) (when flow from the upstream WWTP is removed). Over this part of the cycle, most streams would be “gaining streams”.

At the start of the wet season, during initial creek flows and in smaller side creeks and gullies, some loss to the underlying aquifers would occur, where evapotranspiration and down gradient flow has lowered the water table below the gully/creek bed. During this period, they would act as a “loosing streams”, although over a short period. Unfortunately, there are insufficient groundwater level data from the alluvial aquifer to confirm this behaviour.

Evaporative loss is expected to be significant in the alluvial aquifer, due to its limited depth and presence of deep-rooted vegetation, in contrast to the almost treeless upland areas. Areas underlain by saline or acidic groundwater, however, are likely to have significantly lower losses, as the groundwater toxicity may prevent it being extracted by vegetation.


Modelled and Gauged Flows A4260658 U/S Brukunga

Modelled runoff + lateral flow only - baseflow recessions (discharges) not modelled in PERFECT, hence sharp delines in hydrograph peaks, and lack of response at low flows


Gauged and Modelled Flow Duration Curves A4260658 U/S Brukunga

Low/receding flows (baseflows) not well represented because PERFECT only models runoff and lateral flow. Baseflow simulated in the groundwater model.

Figure 13 Modelled and gauged surface water flows

Recharge

GHD (2009) carried out recharge modelling, using PERFECT (Littleboy et al, 1989), a one-dimensional cropping and soil moisture balance model. The model took into account:

- Land use and vegetation, based on aerial photography. Predominantly pasture, with minor patches of trees, primarily along drainage lines. Rooting depth was estimated to be 100 cm for pasture and 200 cm for trees during model calibration, and considering the soil mapping data
- Slopes derived from the state-wide DTM. The catchment was divided into three slope classes – 0-5%, 5-15%, and 15-38%. Most of the catchment (>90%) falls within the 0-

15% slope range, with only a minor portion of the catchment falling within the steep slope range

- Soil data obtained from the Soil Hydrological Properties of Australia (SHPA) mapping (Western and McKenzie, 2004). The sub-catchment containing the site is mapped as containing two main soil types. The principal soil profile of the northern section, the majority of the catchment, is mapped as a uniform sandy loam to clayey loam (Northcote classification Uc), with a small section in the south consisting of a yellow-grey duplex soil (Northcote classification Dy, a sand to clay loam overlying clay-rich subsoils). The yellow duplex soil is not relevant to the scale of the groundwater model because it covers only a small area at the downstream end of the Dawesley Creek catchment, well downstream of Brukunga

The properties were combined to produce the recharge zones detailed in Table 1 and Figure 14.

Table 1 PERFECT Model Zones

Model Zone	Land Use	Slope	Average Recharge (mm/y) 1950-2007 data	Figure 14 Colour
1	Pasture	<=5%	32	🟦
2	Pasture	5-15%	21	🟥
3	Pasture	15-38%	9	🟩
4	Trees	<=5%	29	🟨
5	Trees	5-15%	19	🟪
6	Trees	15-38%	8	⬛

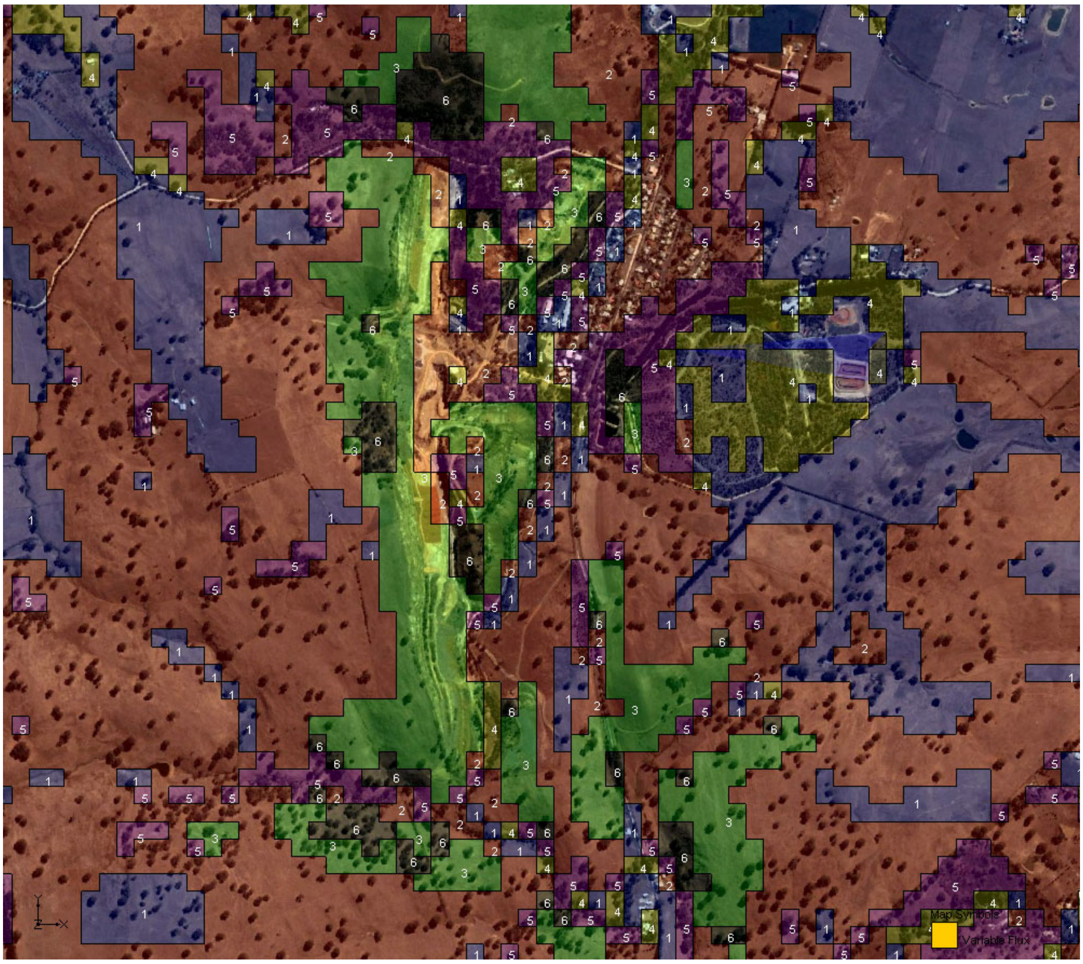


Figure 14 Recharge Model Zonation

Appendix E – Surface Water Flow Data

Surface water flow data

Historical and current flow data information for Dawesley Creek, Mt Barker Creek and Bremer River is publicly available online from the Department for Environment and Water's WaterConnect data base (DEW 2020) and was accessed between 11 and 18 October 2020 for the following five gauging stations:

- Gauging station Dawesley Creek (A4260558) – located near Old Princess Highway approximately 5.7 km downstream of the CFS site, 20.7 km upstream of the confluence with Mt Barker Creek and 240 m downstream of sampling location DC07;
- Gauging station Mt Barker Creek (A4260557) – located off Smythe Road, approximately 18.9 km upstream of the confluence with Dawesley Creek, and approximately 7.6 km upstream of sampling location MBC02;
- Gauging station Mt Barker Creek (A4260679) – located at sampling location DC17A at 430D Callington Road, Salem, approximately 5.2 km downstream of the confluence with Dawesley Creek and 470 m upstream of the confluence with Bremer River;
- Gauging station Bremer River (A4260688) – located approximately 510 m upstream of the confluence with Mt Barker Creek and 170 m downstream of sampling location BR01; and
- Gauging station Bremer River (A4260533) – located near the north-eastern corner of 219 Hassam Rd, Woodchester, approximately 13.6 km downstream of the confluence with Mt Barker Creek and 8.3 km downstream of sampling location DC19,

A site information summary for the five gauging stations is provided in Table 1.

Table 1 Gauging station site information summary

Site	A4260558 Dawesley Ck	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
Site code	DC	MBC up	MBC down	BR up	BR down
Closest sampling location	DC07 (240 m upstream)	MBC02 (7.6 km downstream)	DC17A (same location)	BR01 (170 m upstream)	DC19 (4.5 km upstream)
DEW site ID	A4260558	A4260557	A4260679	A4260688	A4260533
Operational since	01/06/1978	24/04/1979	11/06/1997	15/10/1997	11/05/1973
UTM Zone	54	54	54	54	54
Easting	313040	310089	319922	320374	318522
Northing	6120556	6115244	6109878	6110330	6101978
Latitude	-35.0403	-35.0876	-35.1378	-35.1338	-35.2087
Longitude	138.9503	138.9168	139.0234	139.0285	139.0063

Site	A4260558 Dawesley Ck	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
Elevation	265.968 m	268.017 m	65.434 m	68.204 m	38.626 m
Catchment area	41.4 km^2	88.0 km^2	229.5 km^2	194.7 km^2	492.479 km^2
Parameters	Water level Flow pH	Water level Flow	Water level Flow EC Temperature	Water level Flow EC Temperature	Water level Flow EC Temperature

All five gauging stations record hourly water level and flow data. The two Bremer River gauging stations and the Mt Barker Creek gauging station downstream of the confluence with Dawesley Creek also record water temperature and electrical conductivity (EC). Hourly and daily data is available from the WaterConnect data base for 12 months. Historical data is available as daily or monthly data.

Flow data May to September 2020

Flow rates in Dawesley Creek, Mount Barker Creek and Bremer River reported by the DEW for days on which surface water samples were collected are summarised in Table 2. The monthly discharge from the three water courses during this investigation is summarised in Table 3. The relative contribution of the different tributaries to flow in Mt Barker Creek and Bremer River was calculated based on the monthly discharge and is summarised in Table 4 and Table 5, respectively.

Table 2 Flow rates in ML/d on surface water sampling dates

Date	A4260558 Dawesley Ck	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
08/05/2020	0.974	4.730	10.466	0.001	10.980
18/05/2020	1.077	6.190	14.982	0.001	9.497
09/06/2020	0.771	6.785	16.259	0.001	9.439
08/07/2020	1.863	12.839	26.564	0.001	27.778
23/07/2020	2.382	8.811	16.739	0.001	12.659
10/08/2020	8.282	55.639	181.516	0.001	268.835
17/08/2020	3.316	16.463	32.201	0.001	30.151
11/09/2020	2.337	7.288	15.574	0.004	11.498
17/09/2020	2.509	8.663	18.188	0.001	16.921
Minimum *	0.555	2.693	9.491	0.001	4.87
Maxium *	45.444	404.097	604.383	4.781	465.054
Average *	3.6	31	49	0.084	41
Median *	2.3	12	23	0.001	19
Std. dev. *	5.2	53	74	0.42	66

Note:
* Calculated for daily flow rates in ML/d between 05/05/2020 and 19/10/2020.

Table 3 Total discharge in ML between May and October 2020

Month	A4260558 Dawesley Ck	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
05-31 May	37.8	361	646	0.027	385
01-30 Jun	66.0	846	1344	0.030	915
01-31 Jul	70.7	568	950	0.031	699
01-31 Aug	229	1,870	2,810	1.3	2,555
01-30 Sep	82.4	609	925	0.67	737
01-19 Oct	123	918	1,490	12.1	1,517
Sum *	609	5,173	8,165	14.2	6,809

* Total discharge in ML between 05/05/2020 and 19/10/2020

Table 4 Relative contribution of tributaries to total flow* in Mt Barker Creek between May and October 2020

Period	Mt Barker Creek (1) A4260558 + A4260557		Mt Barker Creek (2) A4260679		
	Dawesley Ck A4260558	Mt Barker Ck A4260557	Dawesley Ck A4260558	Mt Barker Ck A4260557	DC & MBC Combined
05-31 May	9%	91%	6%	56%	62%
01-30 Jun	7%	93%	5%	63%	68%
01-31 Jul	11%	89%	7%	60%	67%
01-31 Aug	11%	89%	8%	67%	75%
01-30 Sep	12%	88%	9%	66%	75%
01-19 Oct	12%	88%	8%	62%	70%
Total ^	11%	89%	7%	63%	71%

Notes:
* Total flow in Mt Barker Creek downstream of confluence with Dawesley Creek
(1) Flow in Mt Barker Creek calculated as combined flow of gauging stations A420558 (Dawesley Creek upstream of confluence with Mt Barker Creek) and A4260557 (Mt Barker Creek upstream of confluence with Dawesley Creek)
(2) Flow in Mt Barker Creek as flow at gauging station A4260679 (Mt Barker Creek downstream of confluence with Dawesley Creek)
^ Relative contribution to calculated total flow between 05/05/2020 and 19/10/2020

Table 5 **Relative contribution of tributaries to total flow* in Bremer River between May and October 2020**

Period	Bremer River A4260679 + A4260688		Bremer River A4260679 + A4260688		
	Mt Barker Ck A4260679	Bremer River A4260688	Dawesley Ck A4260558	Mt Barker Ck A4260557	Bremer River A4260688
05-31 May	100.0%	0.00%	5.9%	56.0%	0.00%
01-30 Jun	100.0%	0.00%	4.9%	62.9%	0.00%
01-31 Jul	100.0%	0.00%	7.4%	59.8%	0.00%
01-31 Aug	99.95%	0.05%	8.2%	66.5%	0.00%
01-30 Sep	99.93%	0.07%	8.9%	65.8%	0.07%
01-19 Oct	99.2 %	0.8%	8.2%	61.1%	0.8%
Total ^	99.8%	0.2%	7.4%	63.2%	0.2%

Notes:

* Total flow in Bremer River downstream of confluence with Mt Barker Creek; calculated as combined flow of gauging stations A420679 (Mt Barker Creek upstream of confluence with Bremer River) and A4260688 (Bremer River upstream of confluence with Mt Barker Creek)

^ Relative contribution to calculated total flow between 05/05/2020 and 19/10/2020

Historical flow data

The annual total discharge in megalitres (ML) at the five gauging stations since 2011 is summarised in Table 6 and presented in Figure 1 and Figure 2. The relative contribution of the different tributaries to flow in Mt Barker Creek and Bremer River was calculated based on the annual total discharge and is summarised in Table 7 and Table 8, respectively. Daily maximum, minimum and mean discharge is illustrated in Figure 3. Time weighted stream discharge duration curves and flow weighted yield curves are shown in Figure 4 and Figure 5, respectively.

Table 6 Historical annual total discharge in ML

Year	A4260558 Dawesley Creek	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
1997	475.4	2,391	2,425 *	1,612 *	4,528
1998	644.0	2,986 *	2,781	1,452 *	5,116
1999	369.7	2,202 *	2,400 *	945.8 *	2,811
2000	2,270	8,250	5,496 *	6,459	18,240
2001	2,232	5,598	7,600 *	5,673	12,810
2002	234.8	1,830	1,946	352.7	1,460
2003	1,528	4,589 *	9,505	3,454	9,769
2004	1,368	3,938 *	8,914	3,368	10,160
2005	1,615	4,967	6,530	7,714	12,020
2006	368.0	2,629	4,290	580.0 *	2,888
2007	353.2	3,312	4,588	505.0	3,774
2008	326.9	2,065	3,167	193.4	2,074
2009	1,786	1.4 *	10,940	3,319	10,680
2010	3,399	8,888 *	4,428	4,764	19,470
2011	694.7	4,843 *	6,237	287.5	6,684 *
2012	2,185	9,941	14,960	5,075	18,060 *
2013	2,838	8,473	16,000 *	6,581	19,060 *
2014	1,421	5,675	9,898	3,924	20,230 *
2015	333.8	1,522	3,894	375.8	2,406 *
2016	8,085	16,490 *	33,050	12,100	43,240 *
2017	4,659	9,985	16,140	7,333	23,330 *

Year	A4260558 Dawesley Creek	A4260557 Mt Barker Ck upstream	A4260679 Mt Barker Ck downstream	A4260688 Bremer River upstream	A4260533 Bremer River downstream
2018	330.9	2,836	4,536	25.9	2,769 *
2019	429.6	3,069	4,795	1.2	3,062 *
2020	266.2 *	2,801 *	1.0 *	0.0 *	4,928 *
Data range	1978-2020	1979-2020	1997-2020	1997-2020	1973-2020
Minimum	234.8	1.4 *	1.0 *	0.0 *	973.7
Maximum	9,467	19,180	33,050	12,100	71,020
Mean ^	2,266	6,018	7,689	3,171	14,860
Median ^	1,786	4,905	5,145	2,466	12,020

Notes:
* Incomplete data set due to days with missing records
^ Mean / median calculated by WaterConnect when data was accessed (either on 11 or 18 October 2020)

Table 7 Relative contribution of tributaries to total annual flow* in Mt Barker Creek

Year	Mt Barker Creek (1) A4260558 + A4260557		Mt Barker Creek (2) A4260679		
	Dawesley Ck A4260558	Mt Barker Ck A4260557	Dawesley Ck A4260558	Mt Barker Ck A4260557	DC & MBC Combined
1997	17%	83%			
1998	18%	82%	23%	107%	130%
1999			15%		
2000	22%	78%			
2001	29%	71%			
2002	11%	89%	12%	94%	106%
2003			16%		
2004			15%		
2005	25%	75%	25%	76%	101%
2006	12%	88%	9%	61%	70%

Year	Mt Barker Creek (1) A4260558 + A4260557		Mt Barker Creek (2) A4260679		
	Dawesley Ck A4260558	Mt Barker Ck A4260557	Dawesley Ck A4260558	Mt Barker Ck A4260557	DC & MBC Combined
2007	10%	90%	8%	-	-
2008	14%	86%	10%	-	-
2009	-	-	16%	-	-
2010	-	-	77%	-	-
2011	13%	87%	11%	78%	89%
2012	18%	82%	15%	66%	81%
2013	25%	75%			
2014	20%	80%	14%	57%	72%
2015	18%	82%	9%	39%	48%
2016	33%	67%	24%	50%	74%
2017	32%	68%	29%	62%	91%
2018	10%	90%	7%	63%	70%
2019	12%	88%	9%	64%	73%
Minimum ^	10%	67%	7%	39%	48%
Maximum ^	33%	90%	77%	107%	130%
Average ^	19%	80%	18%	68%	83%

Notes:
* Total annual flow in Mt Barker Creek downstream of confluence with Dawesley Creek
(1) Flow in Mt Barker Creek calculated as combined flow of gauging stations A420558 (Dawesley Creek upstream of confluence with Mt Barker Creek) and A4260557 (Mt Barker Creek upstream of confluence with Dawesley Creek)
(2) Flow in Mt Barker Creek as flow at gauging station A4260679 (Mt Barker Creek downstream of confluence with Dawesley Creek)
^ Relative contribution to flow between 1997 and 2019 excluding data where >60 days/year were missing

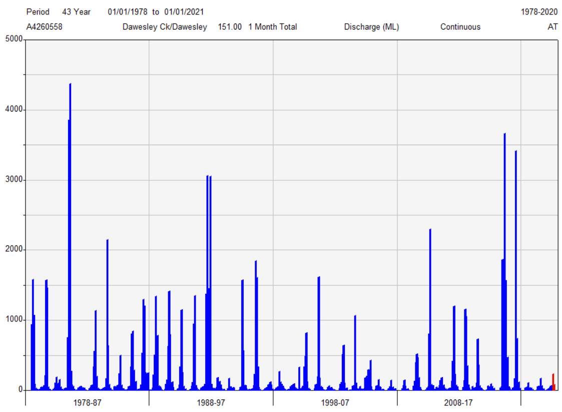
Table 8 Relative contribution of tributaries to total annual flow* in Bremer River

Year	Bremer River A4260679 + A4260688		Bremer River A4260679 + A4260688		
	Mt Barker Ck A4260679	Bremer River A4260688	Dawesley Ck A4260558	Mt Barker Ck A4260557	Bremer River A4260688
2002	85%	15%	10%	80%	15%
2003	73%	27%	12%	-	27%
2004	73%	27%	11%	-	27%
2005	46%	54%	11%	35%	54%
2006	88%	12%	8%	54%	12%
2007	90%	10%	7%	65%	10%
2008	94%	6%	10%	61%	6%
2009	77%	23%	13%		23%
2010	48%	52%	37%		52%
2011	96%	4%	11%	74%	4%
2012	75%	25%	11%	50%	25%
2013	-	-	-	-	-
2014	72%	28%	10%	41%	28%
2015	91%	9%	8%	36%	9%
2016	73%	27%	18%	37%	27%
2017	69%	31%	20%	43%	31%
2018	99%	0.6%	7%	62%	0.6%
2019	100%	0.03%	9%	64%	0.03%
Minimum ^	46%	0.03%	7%	35%	0.03%
Maximum ^	100%	54%	37%	80%	54%
Average ^	79%	21%	12%	54%	21%

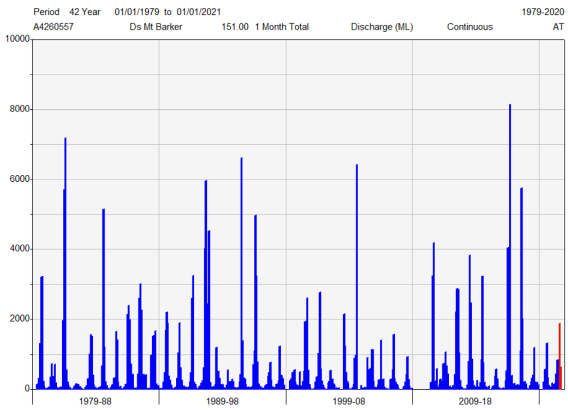
* Total annual flow in Bremer River downstream of confluence with Mt Barker Creek; calculated as combined flow of gauging stations A420679 (Mt Barker Creek upstream of confluence with Bremer River) and A4260688 (Bremer River upstream of confluence with Mt Barker Creek)

^ Relative contribution to flow between 1997 and 2019 excluding data where >60 days/year were missing

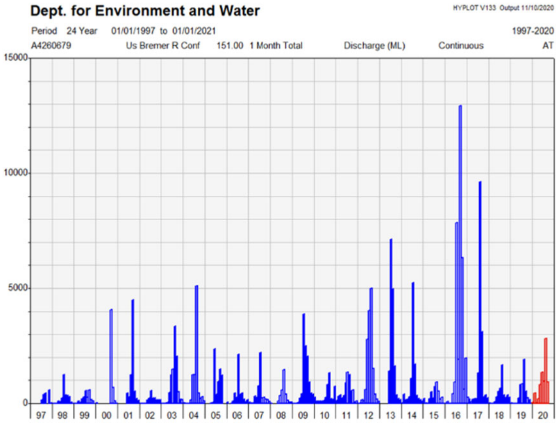
A4260558 – Dawesley Ck



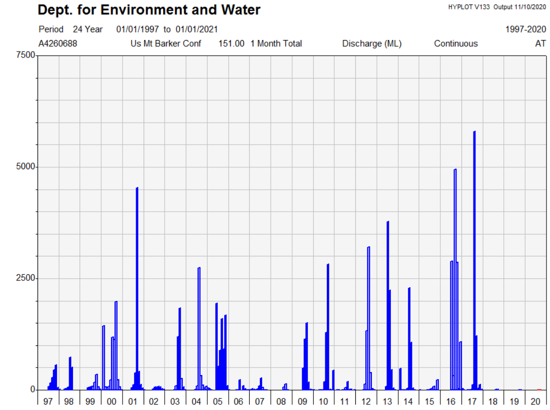
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

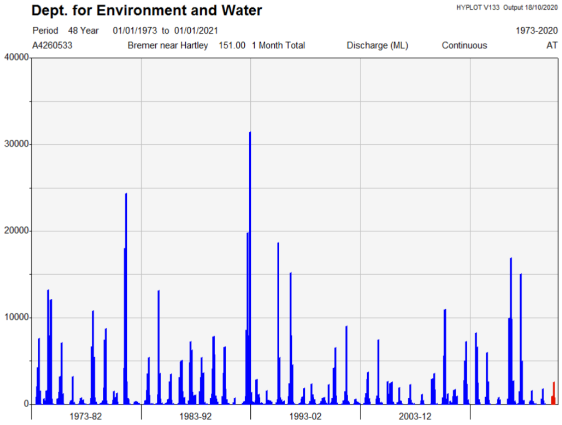
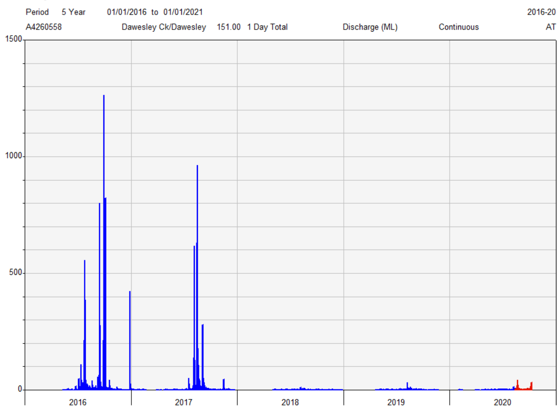
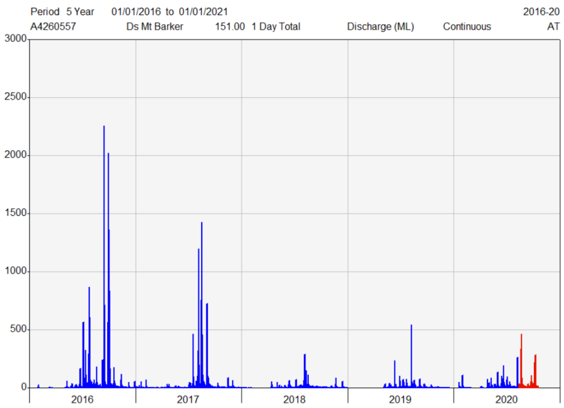


Figure 1 Historical discharge in ML – whole data set

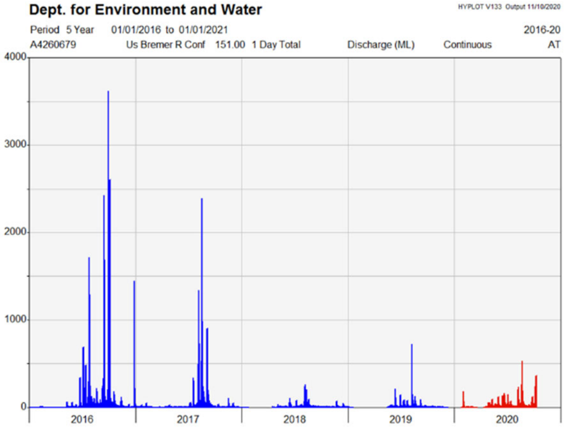
A4260558 – Dawesley Ck



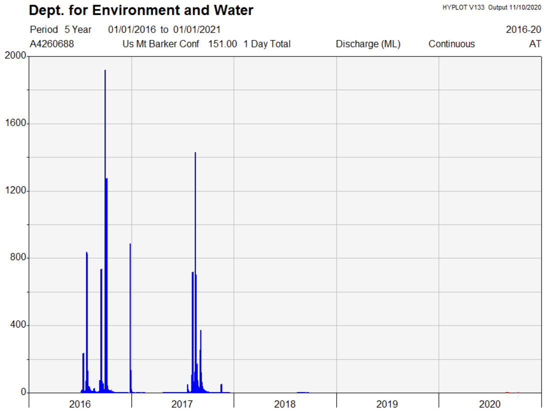
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

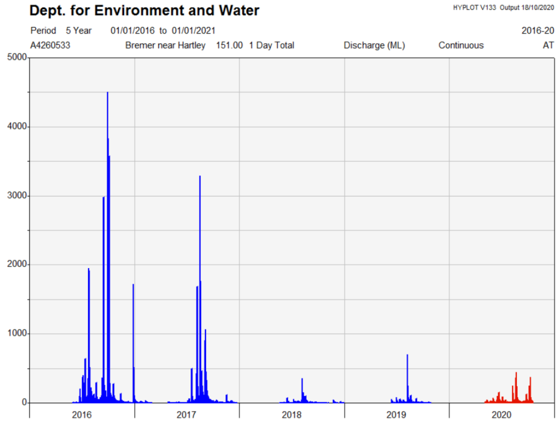
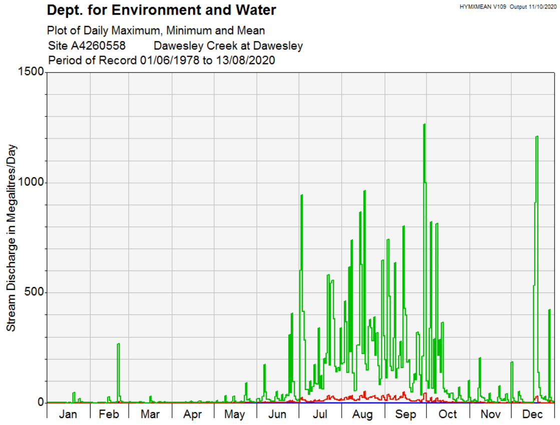
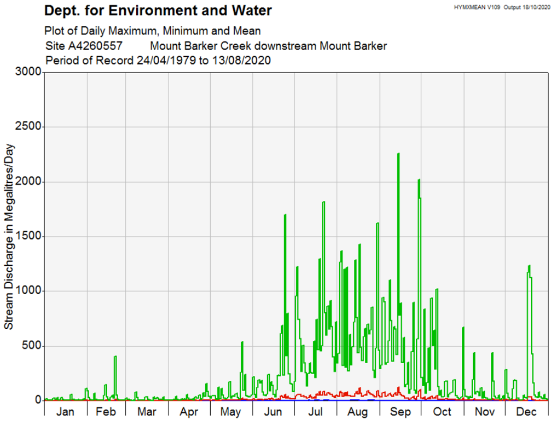


Figure 2 Recent discharge in ML – 2016 to 2020

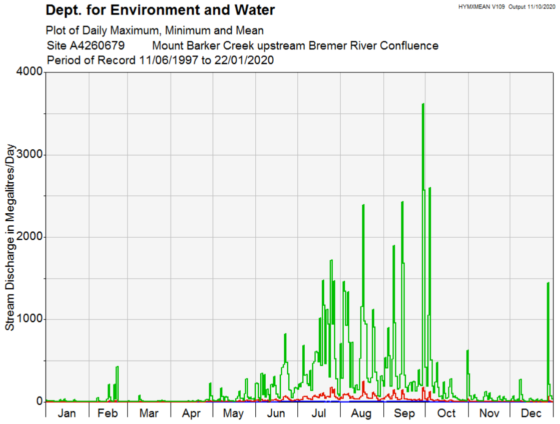
A4260558 – Dawesley Ck



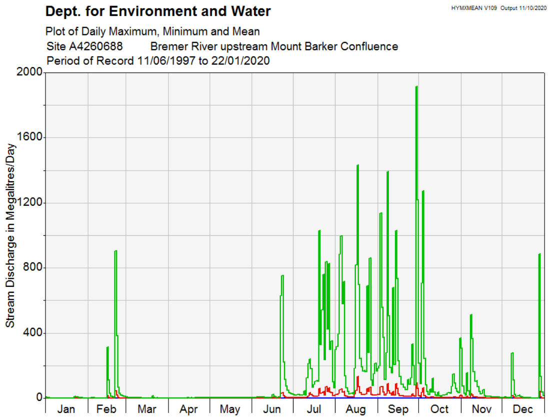
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

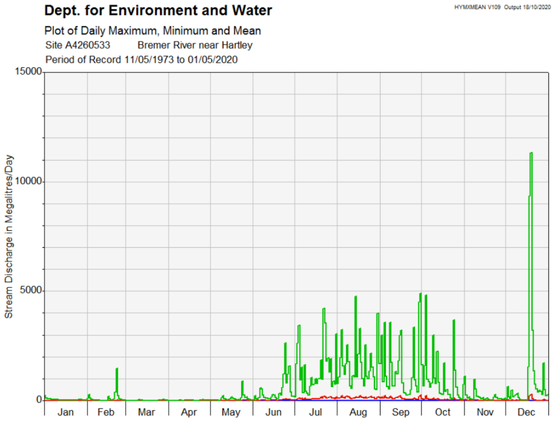
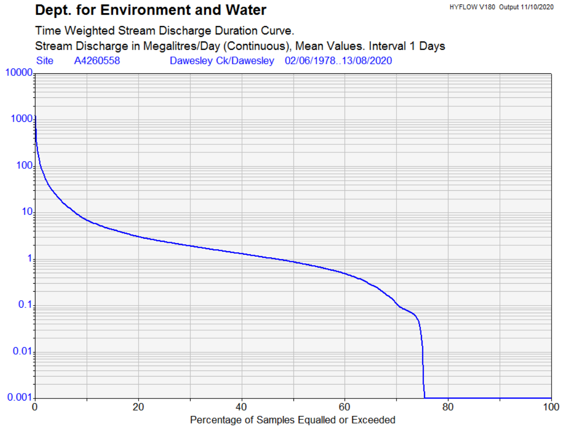
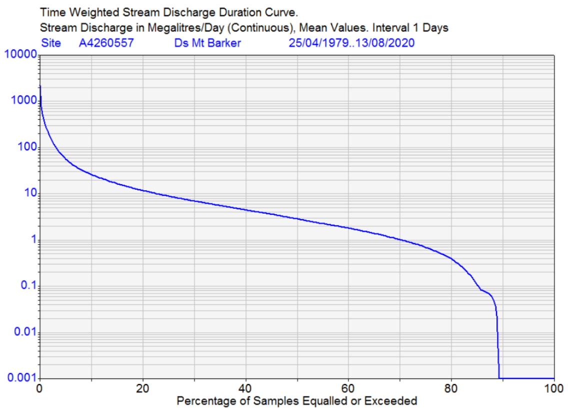


Figure 3 Daily maximum, minimum and mean discharge in ML

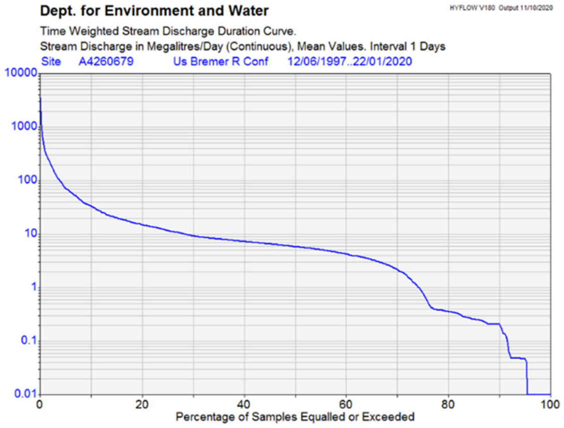
A4260558 – Dawesley Ck



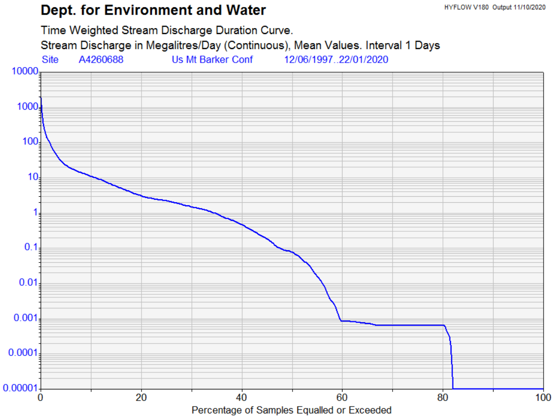
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

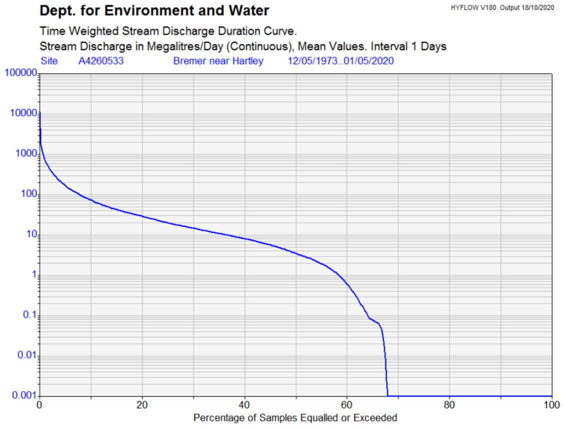
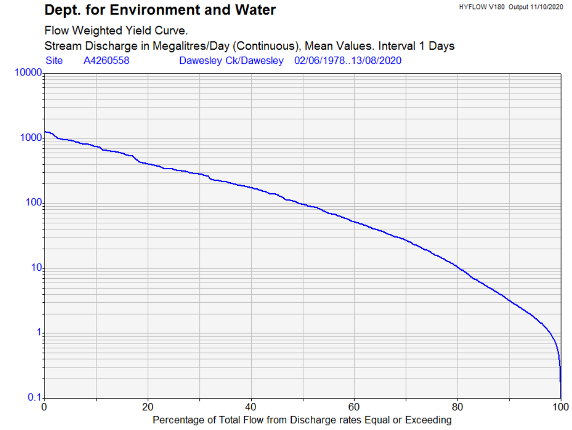
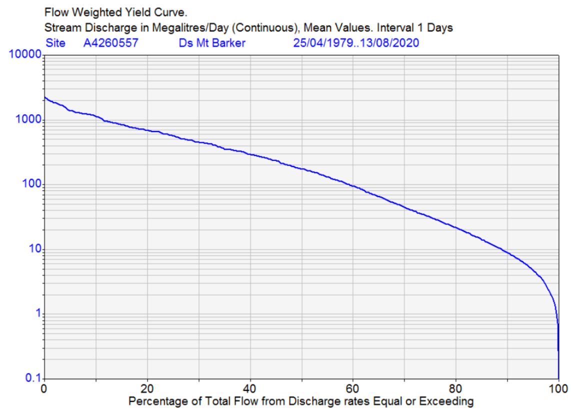


Figure 4 Time weighted stream discharge duration curves in ML/d

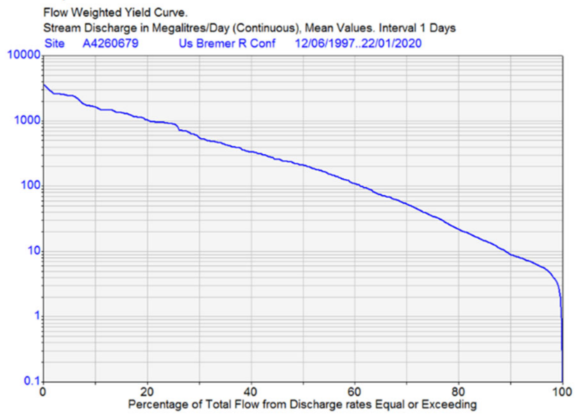
A4260558 – Dawesley Ck



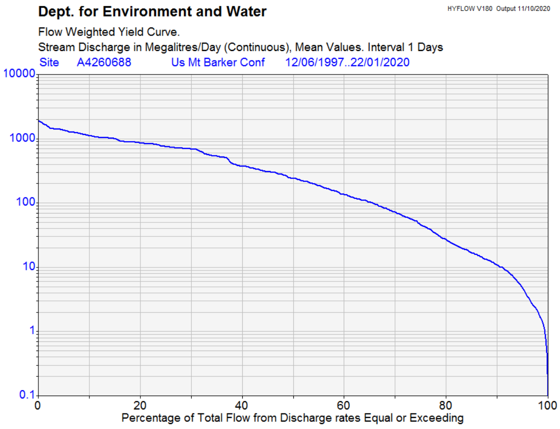
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

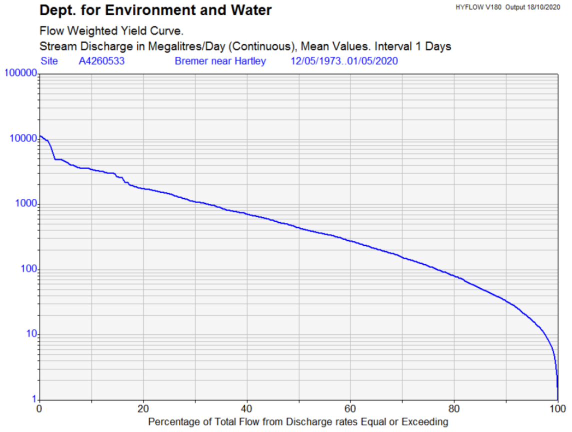
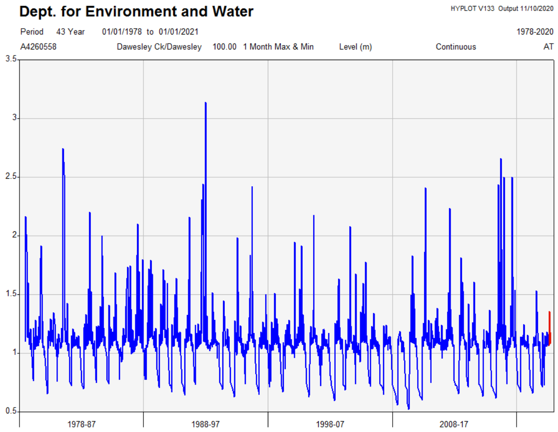
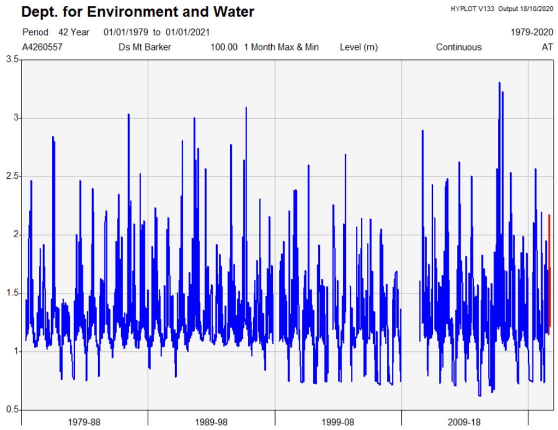


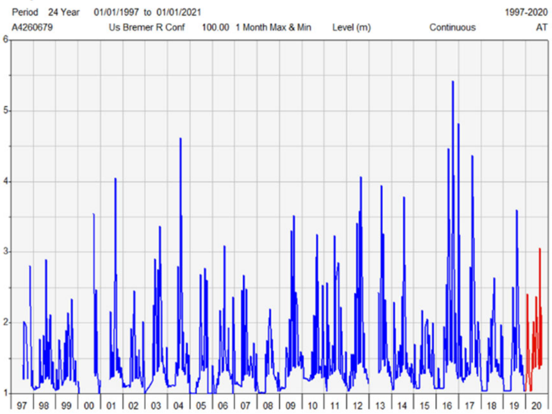
Figure 5 Flow weighted yield curves in ML/d

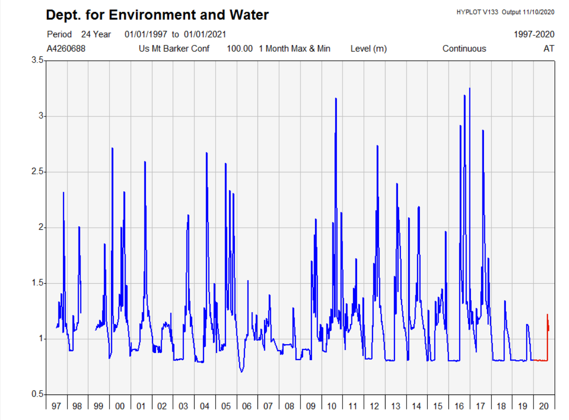
Historical water level data

Historical and recent water levels are presented in Figure 6 and Figure 7, respectively.


A4260558 – Dawesley Ck


A4260557 – Mt Barker Ck, upstream


A4260679 – Mt Barker Ck, downstream


A4260688 – Bremer River upstream

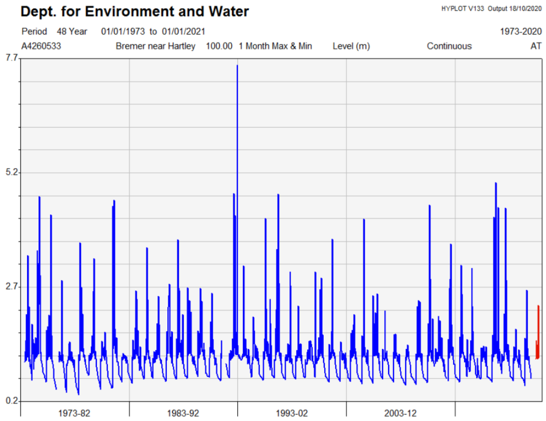
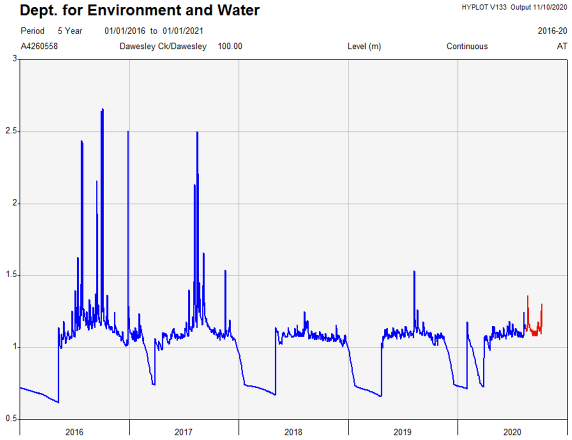
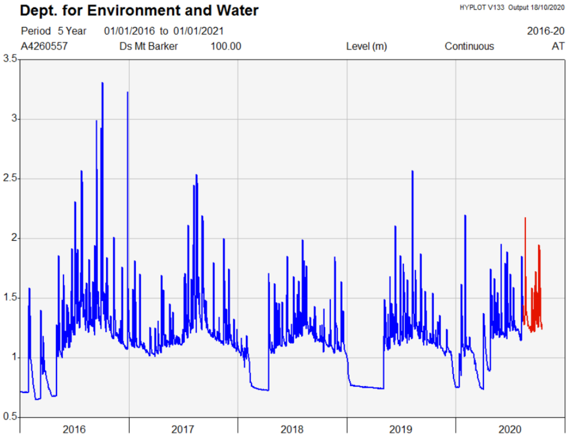

A4260533 – Bremer River, downstream

Figure 6 Historical water levels in metres

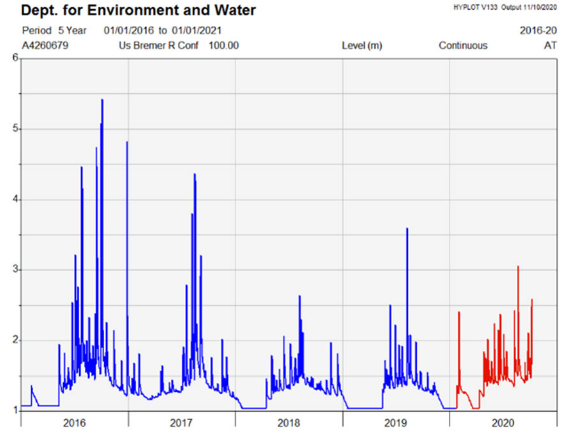
A4260558 – Dawesley Ck



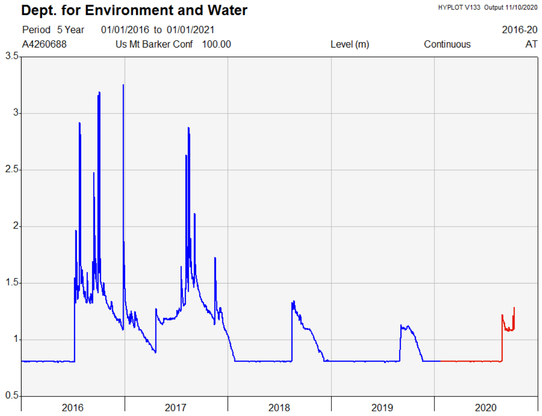
A4260557 – Mt Barker Ck, upstream



A4260679 – Mt Barker Ck, downstream



A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

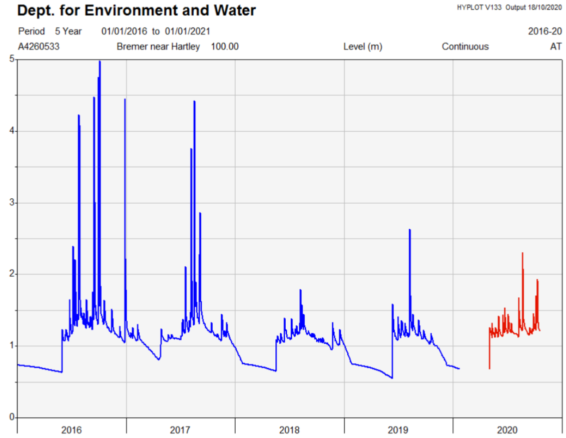
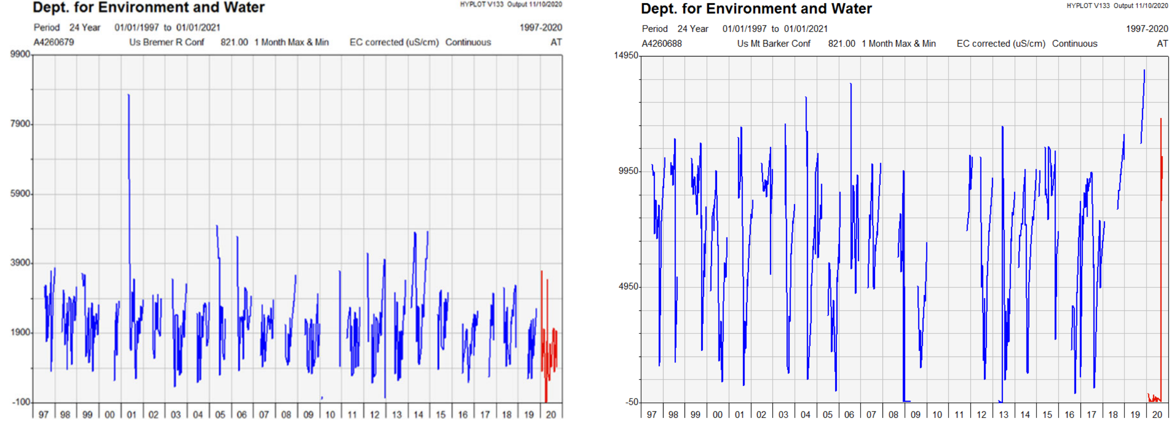


Figure 7 Recent water levels in metres – 2016 to 2020

Historical water quality data

Historical salinity data as electrical conductivity is presented in Figure 8. Historical water temperature data is shown in Figure 9. Historical pH data for Dawesley Creek between 1980 and 1991 is provided in Figure 10.



A4260679 – Mt Barker Ck, downstream

A4260688 – Bremer River upstream

A4260533 – Bremer River, downstream

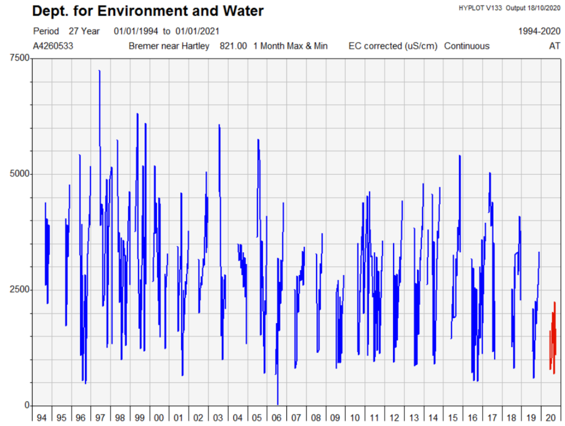
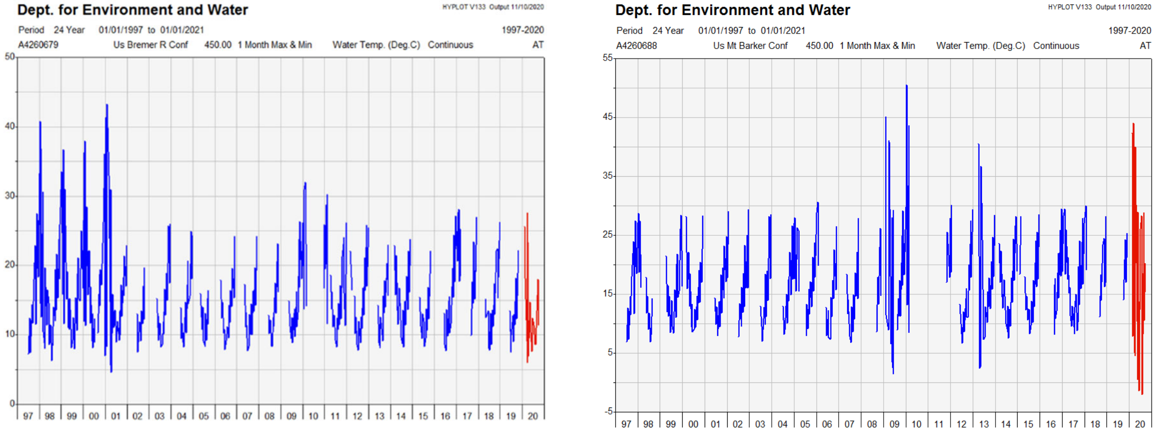


Figure 8 Historical salinity data as electrical conductivity in µS/cm

A4260679 – Mt Barker Ck, downstream

A4260688 – Bremer River upstream



A4260533 – Bremer River, downstream

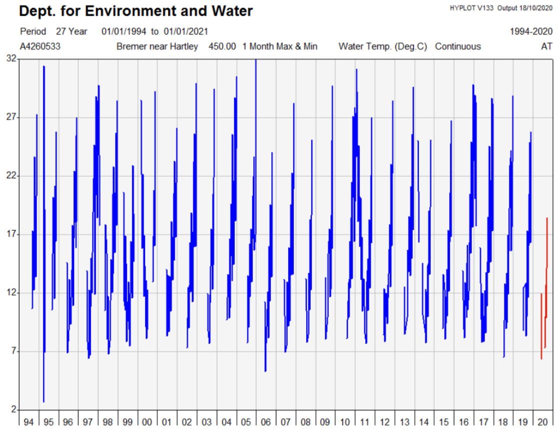


Figure 9 Historical water temperature data in °C

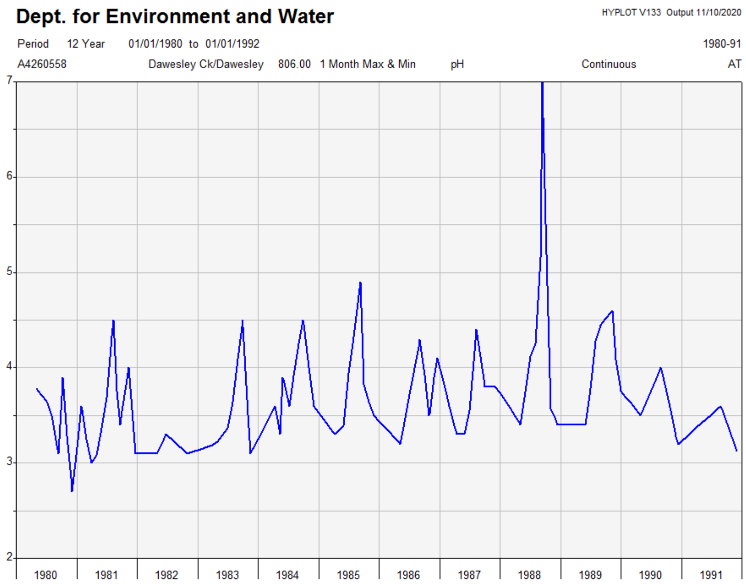


Figure 10 Historical pH data for Dawesley Creek between 1980 and 1991

Appendix F – Derivation of Catchment Specific Water Quality Guideline Values

				PFAS in Water TRACE Short							
				Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*	PFAS (Sum of Total)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.0002	0.0002	0.0002	0.0004	0.0004	0.0002	0.0002	0.0002
NHMRC 2019 Recreational Water PFAS Guidelines						10			2		
PFAS NEMP 2020 Health Drinking Water						0.56			0.07		
PFAS NEMP 2020 Freshwater - 90% - highly disturbed systems					2	632					
PFAS NEMP 2020 Freshwater - 95% - slightly to moderately disturbed systems					0.13	220					
PFAS NEMP 2020 Freshwater - 99% - high conservation value systems					0.00023	19					
Location Code	**Date**	**Sampling Location**	**Field ID**								
MBC01	23/07/20	MBC01	MBC01	0.0021	0.0025	0.0031	<0.0004	<0.0004	0.0046	0.0055	0.0076
	11/09/20	MBC01_A	MBC01_1A	0.0037	0.0038	0.0032	<0.0004	<0.0004	0.0075	0.0070	0.0110
		MBC01_B	MBC01_1B	0.0037	0.0040	0.0032	<0.0004	<0.0004	0.0078	0.0072	0.0110
		MBC01_C	MBC01_1C	0.0040	0.0032	0.0035	<0.0004	<0.0004	0.0072	0.0067	0.0110
	17/09/20	MBC01_A	MBC01_2A	0.0046	0.0041	0.0043	<0.0004	<0.0004	0.0087	0.0084	0.0130
			QC35	0.0046	0.0044	0.0041	<0.0004	<0.0004	0.0090	0.0085	0.0130
			QC35A	0.0050	0.0070	0.0040	<0.005#	<0.005#	0.0120	0.0110	0.0230
		MBC01_B	MBC01_2B	0.0046	0.0045	0.0042	<0.0004	<0.0004	0.0091	0.0087	0.0130
		MBC01_C	MBC01_2C	0.0044	0.0040	0.0044	<0.0004	<0.0004	0.0084	0.0084	0.0130
MBC02	23/07/20	MBC02	MBC02	0.0027	0.0029	0.0034	<0.0004	<0.0004	0.0055	0.0063	0.0090
			QC28	0.0030	0.0032	0.0033	<0.0004	<0.0004	0.0062	0.0065	0.0095
			QC28A	0.0040	0.0040	0.0030	<0.005	<0.005	0.0080	0.0070	0.0210
	11/09/20	MBC02_A	MBC02_1A	0.0036	0.0045	0.0040	<0.0004	<0.0004	0.0082	0.0085	0.0120
			QC32	0.0038	0.0047	0.0043	<0.0004	<0.0004	0.0085	0.0090	0.0130
			QC32A	0.0040	0.0050	0.0040	<0.005#	<0.005#	0.0090	0.0090	0.0220
		MBC02_B	MBC02_1B	0.0037	0.0045	0.0040	<0.0004	<0.0004	0.0082	0.0085	0.0120
		MBC02_C	MBC02_1C	0.0036	0.0042	0.0038	<0.0004	<0.0004	0.0078	0.0080	0.0120
	17/09/20	MBC02_A	MBC02_2A	0.0038	0.0071	0.0050	<0.0004	<0.0004	0.0110	0.0120	0.0160
		MBC02_B	MBC02_2B	0.0035	0.0066	0.0049	<0.0004	<0.0004	0.0100	0.0120	0.0150
		MBC02_C	MBC02_2C	0.0032	0.0042	0.0043	<0.0004	<0.0004	0.0075	0.0086	0.0120

Statistics

Number of Results	20	20	20	20	20	20	20	20
Number of Detects	20	20	20	0	0	20	20	20
Minimum Concentration	0.0021	0.0025	0.0030	<0.0004	<0.0004	0.0046	0.0055	0.0076
Minimum Detect	0.0021	0.0025	0.0030	ND	ND	0.0046	0.0055	0.0076
Maximum Concentration	0.0050	0.0071	0.0050	<0.005	<0.005	0.0120	0.0120	0.0230
Average Concentration *	0.0038	0.0044	0.0039	0.00056	0.00056	0.0082	0.0083	0.0135
Standard Deviation *	0.0007	0.0012	0.0006	0.00086	0.00086	0.0017	0.0018	0.0042
Median Concentration (50th percentile) *	0.0038	0.0042	0.0040	0.00020	0.00020	0.0082	0.0085	0.0125
80th percentile *	**0.0044**	**0.0048**	0.0043	0.0002	0.0002	0.0090	0.0090	0.0152
90th percentile *	**0.0046**	**0.0066**	0.0045	0.0025	0.0025	0.0101	0.0111	0.0211

* A Non Detect Multiplier of 0.5 has been applied.

Appendix F EPA email re: Classification of Dawesley Creek as Highly Disturbed

From: Custance, Hannah (EPA) <Hannah.Custance@sa.gov.au>
Sent: Friday, 28 August 2020 2:41 PM
To: Ruth Keogh <Ruth.Keogh@fyfe.com.au>; Dilara Valiff <Dilara.Valiff@ghd.com>
Cc: Jeffree, David (CFS) <David.Jeffree@sa.gov.au>; Eden, Brenton (CFS) <Brenton.Eden@sa.gov.au>; Hughes, Rebecca (EPA) <Rebecca.Hughes@sa.gov.au>
Subject: RE: CFS Brukunga DSI - Properties that fish/yabby

Hi Ruth & Dilara,

The EPA undertakes regular monitoring of South Australia surface water systems to assess their condition, and produces aquatic ecosystem condition reports (AECRs) every year (for further information see https://www.epa.sa.gov.au/environmental_info/water_quality/water_quality_monitoring). Stream condition assessments have previously included sites from Nairne Creek, Mount Barker Creek and the Bremer River. These stream systems generally rate in a fair condition, which represents a moderately degraded system, due nutrient enrichment and degraded riparian habitats. The Dawesley Creek, assessed for many years as a result of the Brukunga Mine, continues to show evidence of adverse impacts from the mine based on the most recent 2015 assessment (see https://www.energymining.sa.gov.au/minerals/mining/former_mines/brukunga_mine_site/water_quality_monitoring). Over 26 km of stream has been adversely affected by high levels of nutrients, metals and fine sediment deposition. A 90% level of protection for the highly disturbed Dawesley Creek is considered to be appropriate based on its current and expected condition over at least the next few decades. Considerations for biomagnification or bioaccumulation effects relating to fish, reptiles or birds is unlikely to be required since the stream does not provide habitat for fish, no aquatic reptiles occur in the catchment, and only terrestrial 'hawking'-type birds (eg swallows, tree martins) are likely to consume adult aquatic insects emerging from the lower reaches of Dawesley Creek.
Given the more diverse aquatic communities and better water quality and habitat structure in Mount Barker Creek and the Bremer River, a 95% level of protection for slightly-to-moderately disturbed ecosystems is considered to be appropriate. These streams support a wide range of aquatic invertebrates and include at least two threatened native fish species but accumulation pathways into other species may be limited to long-necked tortoises and a similar suite of terrestrial birds as described above.

On advice to livestock owners, the EPA's standard position is that livestock should not have free access to watercourses. Livestock access to rivers and streams can introduce nutrients, cause excessive bank erosion and increase the turbidity of the water. Landscape SA have a similar position, and further information can be found on their website (https://landscape.sa.gov.au/hf/land/landholder-services/managing-livestock). Their website also includes a link to the following guideline (see attached PDF):

- *Best practice land management guidelines for small grazing properties in the Adelaide and Mount Lofty Ranges Natural Resources Management region* (2011, amended 2017)

The guideline states that *"fencing off watercourses to exclude livestock should be a priority for all landholders."*

Please contact me if you have any questions on the above.

Regards,

Hannah Custance
Adviser, Site Contamination

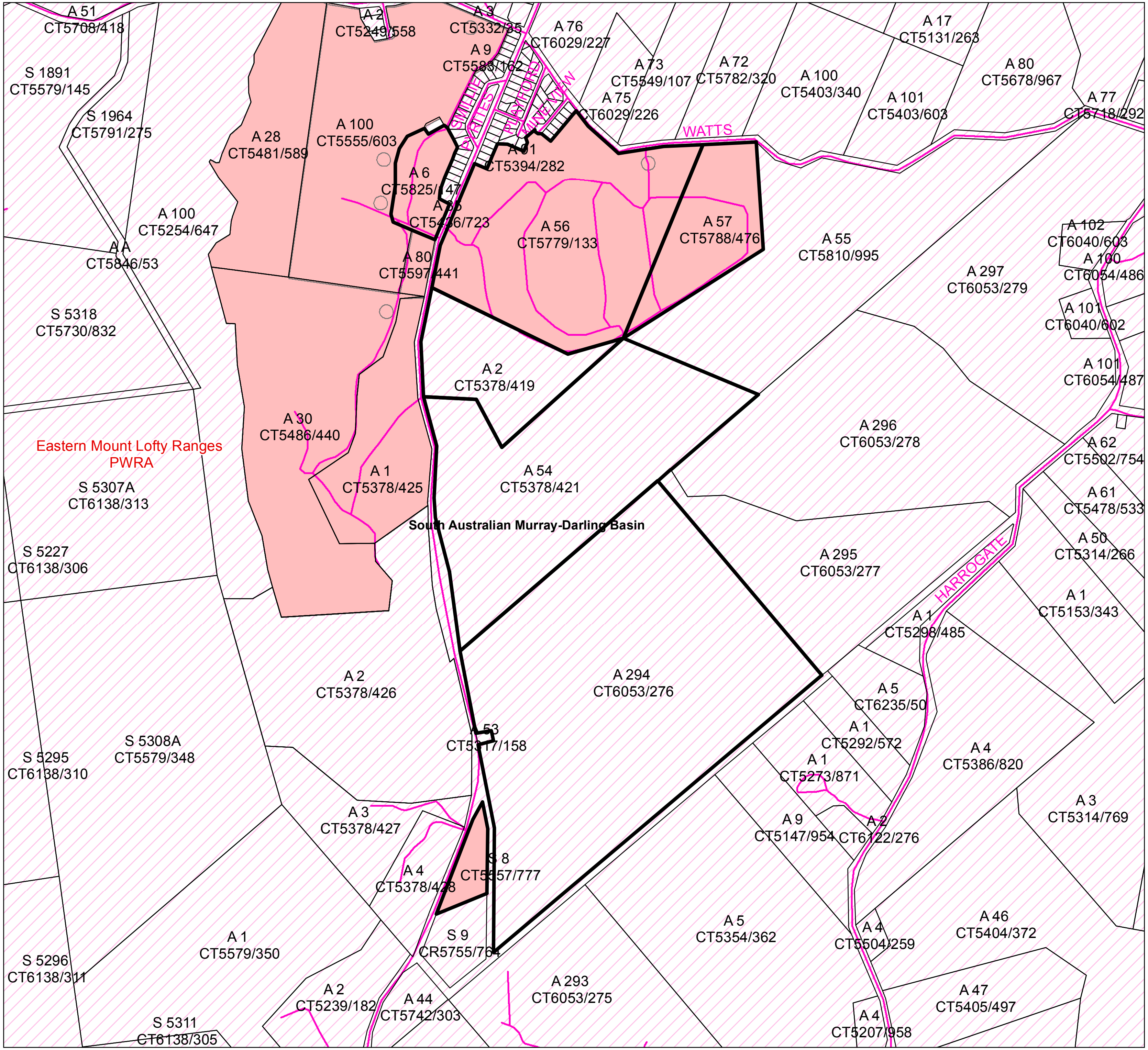
Regulation | Site Contamination
Environment Protection Authority
Phone (08) 8204 2320
Level 2, 211 Victoria Square Adelaide 5000
GPO Box 2607, Adelaide, South Australia 5001

EPA
South Australia

A better environment for the health, wellbeing and prosperity of all South Australians

www.epa.sa.gov.au

Appendix G – Well Permits



PLEASE ATTACH WELL LOCATION MAP TO THE DRILLERS REPORT

CLIENT: GHD P/L
Permit No: 363233 TO 363240 (8)
Prescribed Area/NOP: EMLR
Hundred: KANMANTOO
Suburb: BRUKUNGA
NRM Region/Plan: SAMDB
CT 5825/147, F102110, A6 X1
CT 5779/133, F160595, A56 X1
CT 5788/476, F1605096, A57 X2
CT 5378/421, F160593, A54 ADJ X1
CT 6053/276, D82233, A294 ADJ X1
CT 5557/777, H170600, S8 ADJ X1
CT 5378/419, F156402, A2 X1

Legend

☐ DCDB.ParcelCadastreFull
― Topo.Roads
🟥 TOPO.SiteContamination
☐ NrmRegions
▨ Prescribed Water Resources Area
🟦 Prescribed Watercourse

0 437.5 875
Meters

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363240
Expiry Date:	25/05/2021

Permission is hereby granted to: GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5378/419
   Allotment 2 in Filed Plan 156402
   Hundred of Kanmantoo
2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363237
Expiry Date:	25/05/2021

Permission is hereby granted to: GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5378/421
   Allotment 54 in Filed Plan 160593
   Hundred of Kanmantoo
2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.
22. This permit authorises the construction of a well on the portion of road adjacent to the land parcel described above.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363238
Expiry Date:	25/05/2021

Permission is hereby granted to:

GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 6053/276
   Allotment 294 in Deposited Plan 82233
   Hundred of Kanmantoo

2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.
22. This permit authorises the construction of a well on the portion of road adjacent to the land parcel described above.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363239
Expiry Date:	25/05/2021

Permission is hereby granted to:

GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5557/777
   Section 8
   Hundred of Kanmantoo
2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.
22. This permit authorises the construction of a well on the portion of road adjacent to the land parcel described above.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363233
Expiry Date:	25/05/2021

Permission is hereby granted to: GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5825/147
   Allotment 6 in Filed Plan 102110
   Hundred of Kanmantoo

2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SMKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 | [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363234
Expiry Date:	25/05/2021

Permission is hereby granted to: GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5779/133
   Allotment 56 in Filed Plan 160595
   Hundred of Kanmantoo

2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
10. Water samples are required from all wells drilled in respect of this permit.
11. Strata samples are not required.
12. The licensed well driller must forward with the report a plan obtained from the permit holder, who must mark thereon the location of all wells drilled in respect of this permit.
13. All wells must be drilled vertical unless written permission is obtained from the Minister.
14. Where a well passes or will pass through two or more aquifers, an impervious seal shall be made and maintained between the aquifers to prevent leakage between the aquifers.
15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.

NOTES:

1. Under section 202(1)(b)(ii) of the Natural Resources Management Act 2004, you have a right of appeal to the Environment, Resources and Development Court against the imposition of any condition on this permit. The appeal must be instituted within six weeks of the date of permit issue. The appeal must also be served upon this department within that time.
2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

7. Due to potential land contamination issues it is recommended that a hydrogeological assessment be carried out to determine the long term prospects for groundwater quality and quantity with regard to the site and desired use.
8. This permit does not authorise the taking of water from the well for any purpose other than testing.
9. If the extracted groundwater supply is required for human consumption, it is recommended that the water be quality tested.

TAKE NOTE that the permit holder, or a person acting on behalf of the permit holder, who contravenes or fails to comply with a condition of this permit is guilty of an offence, and such acts or ommisions may result in the variation, suspension or revocation of the permit.

SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363235
Expiry Date:	25/05/2021

Permission is hereby granted to: GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5788/476
   Allotment 57 in Filed Plan 160596
   Hundred of Kanmantoo
2. Well Construction must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority
3. The equipment, materials and methods used in drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not adversely affect the quality of an underground water resource.
4. Aquifers shall be protected during drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, to prevent adverse impacts upon the integrity of the aquifer.
5. This work may be subject to inspection by the Department's Drilling Inspectors.
6. If this well is incidental/ancillary to mining operations authorised under the Mining Act 1971, or a regulated activity under the Petroleum and Geothermal Energy Act 2000 (Acts), the well must be decommissioned (as outlined in the Minimum Construction Requirements for Water Bores in Australia Third Edition) prior to the relinquishment of the licence or lease under the associated Acts, unless alternative formal arrangements can be made with the owner or occupier of the land on which the well is located subject to approval by the relevant Minister or the Minister's agent.
7. Activities shall not have an unacceptable detrimental impact on cultural, heritage or social values.
8. The authorised activity must be undertaken by a licensed driller.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

9. If the well is considered unsatisfactory, it may be abandoned and a replacement well may then be constructed provided that the abandoned well is backfilled prior to the drill rig leaving the site.
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11. Strata samples are not required.
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15. All groundwater extracted during sampling and/or purging must be contained and disposed of in an appropriate manner to minimise risk to health and the environment.
16. A lithological log is to be submitted with the drillers well construction report from all wells drilled in respect of this permit as per the National Environmental Protection (assessment of Site Contamination) measure 1999.
17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
19. The activity shall not significantly increase local drawdown.
20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.

NOTES:

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2. This permit is not transferable.
3. This well construction permit is not an authorisation for a person to enter private property and prior authority must be obtained from the land owner in all circumstances.
4. The issue of this permit does not negate the requirement to comply with the provisions of other Acts that may impact on the activity undertaken pursuant to this permit.
5. This permit is not an approval to clear native vegetation.
6. It is recommended that all drilling equipment be decontaminated prior to construction of a new well or rehabilitation of an existing well to prevent the introduction or transfer of iron bacteria. Similar precautions should also be taken with pump installation equipment.

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

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SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

GOVERNMENT OF SOUTH AUSTRALIA

DEPARTMENT FOR ENVIRONMENT AND WATER

Mt Gambier Office | PO Box 1046 | Mt Gambier SA 5290 | [P] 8735 1134 [F] 8735 1135

PERMIT to undertake a WATER AFFECTING ACTIVITY

pursuant to section 135 of the *Natural Resources Management Act 2004*

WELL PERMIT

Subject to full compliance with all the procedures, specifications and limitations contained or referred to, in the conditions set out below,

Permit No:	363236
Expiry Date:	25/05/2021

Permission is hereby granted to:
GHD PTY LTD
ACN 008 488 373
PO BOX 2052
ADELAIDE SA 5001

To undertake the following water affecting activity:

Activity: Well Construction

Well Use: Investigation

CONDITIONS:

1. The activity authorised by this permit must only be undertaken on the land described below:

   CT 5788/476
   Allotment 57 in Filed Plan 160596
   Hundred of Kanmantoo
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17. Wells are to be backfilled when no longer required for ongoing monitoring and investigation purposes.
18. All wells in relation to this permit must be sealed from the surface to not less than 5 metres deep.
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20. The activity shall not adversely affect the quality, quantity and accessibility of water for supply from existing wells operated by other landholders.
21. Due to known soil/groundwater contamination in the sediments and aquifers above, caution should be taken in the drilling and/or cementing of this well.

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SmKnight

Date: 25/05/2020

Sonya Knight
Senior Water Licensing Officer
Delegate of Minister for Environment and Water

Appendix H – Groundwater Well Survey Results

LINKUP
CONSTRUCTION SURVEYS PTY LT

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To: Dilara Valiff
Company: GHD
Phone: 8111 6572

From: Lincoln Jeffery
Phone: 0414 840 569
Fax: 8351 4247
Email: Lincoln@linkupconstructionsurveys.com.au

Date: 26/06/2020

Monitoring well coordinates – Brukunga CFS

Well or Bore	Easting	Northing	R.L. Top of Casing	Natural Surface
No.	GDA20	GDA20	A.H.D.	A.H.D.
CO4A	312286.087	6123984.782	363.180	362.490
GW01	312080.993	6124662.965	349.859	349.934
GW02	312744.198	6124667.557	386.661	386.892
GW03	312959.226	6124496.012	380.353	379.566
GW04	312784.069	6124214.237	385.275	384.454
GW05	312205.219	6123128.405	307.012	307.044
GW06	312419.196	6122350.488	297.669	296.993
GW07	312230.204	6122567.985	303.330	303.386
H15	312475.410	6123587.601	355.926	356.003
K23	311383.885	6124376.168	418.192	418.298
K26	310961.761	6124446.297	433.547	433.661

All Survey information was based from the GDA20 Z54 grid system and Australian Height Datum (AHD), Triangulated from Network Survey Marks.

Appendix I – Field Sheets

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Rob Webb **Date: 6/05/2020 – 8/05/2020**

Soil Bores

Sample ID	Date	Time	Comment
SB01	7/5		Hand auger to target depth 1 meter, location of borehole moved further south due to dense vegetation Samples taken at "0-0.2", "0.2-0.4", "0.9-1.1", "1.7-1.9", "2.3-2.8", "3.0-3.2"
SB02	6/5		Borehole inside storage shed, concrete core sample collected Samples taken at "0.1-0.3", "0.6-0.8", "0.8-0.95"
QC02			Intra-lab duplicate sample of SB02_0.1-0.3
QC02A			Inter-lab triplicate sample of SB02_0.1-0.3
SB03	6/5		Borehole between Media building and Hot Pad B Samples taken at "0.0-0.2", "0.4-0.6", "0.9-1.1", "1.7-1.9", "2.3-2.8", "3.0-3.2"
SB04	7/5		Hand auger to refusal Sample taken at "0.0-0.2"
QC05			Intra-lab duplicate sample of SB04_0.0-0.2
QC05A			Inter-lab triplicate sample of SB04_0.0-0.2
SB05	6/5		Borehole on Hot Pad B, concrete core sample collected Samples taken at "0.1-0.2", "0.3-0.4", "0.8-1.0", "1.7-1.9", "3.1-3.3"
QC01			Intra-lab duplicate sample of SB05_0.8-1.0
QC01A			Inter-lab triplicate sample of SB05_0.8-1.0
SB06	6/5		Borehole on Hot Pad A, concrete core sample collected Samples taken at "0.23-0.4", "0.4-0.6", "1.0-1.2", "1.9-2.1"
SB07	7/5		Hand auger to refusal Samples taken at "0.0-0.2", "0.4-0.6"
QA03			Intra-lab duplicate sample of SB07_0.0-0.2
QC03A			Inter-lab triplicate sample of SB07_0.0-0.2
SB08	6/5		Additional borehole on Hot Pad A Samples taken at "0.2-0.4", "0.4-0.6"

Surface Water and Sediment Sampling

Sample ID	Date	Time	GPS	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
Creek_4	8/5	1629	(54H) 311927 m E 6124574 m S	15.4	5.29	7570	3.55	361.2	
Creek_5	8/5	1623	(54H) 311918 m E 6124476 m S	13.3	4.59	6360	6.15	372.7	
Creek_6	8/5	1613	(54H) 311919 m E 6124433 m S	13.6	5.25	7915	2.55	394.0	
QC13									Intra-lab duplicate water sample of Creek_6
QC13A									Inter-lab triplicate water sample of Creek_6
QC14									Intra-lab duplicate sediment sample of Creek_6
QC14A									Inter-lab triplicate sediment sample of Creek_6
DC02	7/5		(54H) 312233 m E 6123001 m S	14.8	8.57	1170	8.57	13.1	Could only acquire water samples by lowering sample bottles by bailer cord from bridge, no sediment sample
DC03	8/5		(54H) 312371 m E 6122549 m S	14.4	9.44	1492	12.82	-0.2	
DC04	8/5		(54H) 312251 m E 6122339 m S	14.0	9.47	1210	9.99	-2.1	
DC05	8/5	0931	(54H) 312841 m E 6121530 m S	12.4	7.85	1792	7.49	4.2	
QC11									Intra-lab duplicate water sample of DC05
QC11A									Inter-lab triplicate water sample of DC05

QC12									Intra-lab duplicate sediment sample of DC05
QC12A									Inter-lab triplicate sediment sample of DC05
DC07	8/5		(54H) 312994 m E 6120790 m S	12.8	8.65	1979	7.03	3.5	

Sludge samples

Sample ID	Date	Comment
SS01-SS22	8/5	Sludge stockpile samples from SS01 through to SS22, located on northern section of Pyrite quarry (towards Peggy Buxton Rd)
SS23-SS30	8/5	Sludge stockpile samples from SS23 through to SS30, located in the southern most section of the mine site, located between the quarry wall and Dawesley Creek

Rinsates/Blanks

Sample ID	Date	Time	Comment
RB01	6/5	8:00am	Drillers plastic core tray
RB02	6/5	8:00am	Drillers plastic push tube casing
RB03	7/5	8:00am	Hand auger test 1 taken before sampling started
RB04	7/5	11:30am	Hand auger test 2 taken between SW15 and SW16, observed by auditor
RB05	8/5	8:00am	Water quality meter taken at the start of 8/5 between DC02 (7/5) and DC05 (8/5)
RB06	8/5	1:00pm	Shovel
TB01	6/5		Trip blank made from rinsate water
TB02	7/5		Trip blank made from rinsate water
WB01	6/5		Water sample taken directly from the water tank on drill rig

Flux test – Hot Pad A (7/5/20)

Sample ID	Time taken (minutes)	Time between (minutes)	Comments
FX01	10	-	First flux test sample
FX02	20	10	Second flux test sample
FX03	30	10	Third flux test sample
FX04	40	10	Fourth flux test sample
FX05	50	10	Fifth flux test sample
FX06	60	10	Sixth flux test sample
FX07	70	10	Final flux test sample
FXB01	70		Blank sample taken directly from the hose at the same time as FX07

Stockpile samples

Sample ID	Date	Comment
SW01	7/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.1-0.3”, “1.9-2.0”, “3.3-3.6”
QC07		Intra-lab duplicate sample of SW01_3.3-3.6
QC07A		Inter-lab triplicate of SW01_3.3-3.6
SW02	7/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.1-0.3”, “0.9-1.1”, “1.4-1.5”
SW03	6/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.0-0.2”, “0.5-0.7”, “1.5-1.7”, “4.8-4.9”
SW04	6/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.0-0.2”, “1.0-1.3”, “2.0-2.1”, “3.85-3.9”, “4.5-4.6”
QC04		Intra-lab duplicate of SW04_1.0-1.3
QC04A		Inter-lab duplicate of SW04_1.0-1.3
SW05	6/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.0-0.2”, “1.0-1.1”, “2.0-2.2”, “3.4-3.6”
SW06	6/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.5-0.7”, “4.1-4.2”, “4.3-4.4”
SW07	7/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.2-0.3”, “1.0-1.2”, “2.5-2.8”, “4.2-4.3”
QC06		Intra-lab duplicate of SW06_2.5-2.8
QC06A		Inter-lab triplicate of SW06_2.5-2.8
SW08	7/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.5-0.6”, “2.3-2.4”, “4.0-4.1”, “4.95-5.0”
SW09	7/5	(Pyrite quarry, drill rig borehole) Samples taken at “0.1-0.2”, “1.6-1.8”, “2.0-2.2”, “4.0-4.2”, “5.5-5.7”
SW10	7/5	Retention dam east of water treatment plant Samples taken at “0.0-0.2”, “0.8-0.9”, “1.5-1.7”, “2.7-2.8”
SW11	7/5	Retention dam east of water treatment plant Samples taken at “0.0-0.1”, “0.4-0.5”, “1.3-1.5”, “2.0-2.3”, “3.0-3.2”
QC08		Intra-lab duplicate sample of SW11_2.0-2.3
QC08A		Inter-lab triplicate sample of SW11_2.0-2.3

SW12-SW15	7/5	Stockpile grab sample, area surrounding retention dam east of water treatment plant, SW15 sample collected using hand auger and observed by auditor
SW16-SW20	7/5	Stockpile grab sample, drying ponds south of retention dam and south-east of water treatment plant

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 18/05/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB02	0918							
DC06	0933	(54H) 312842 m E 6121116 m S	8.4	7.34	2587	8.32	247.2	Creek flowing freely, access requested & obtained to access road reserve (16 Hawthorn Street – property has potential exposure pathway from chickens whose pen is close to Dawesley Creek), surface water. No sediment sample collected (concrete lined channel)
QA16								Intra-lab duplicate sample of DC06 (water only)
QA16A								Inter-lab triplicate sample of DC06 (water only)
DC06A	0955	(54H) 312888 m E 6121065 m S	8.5	7.33	2995	8.20	230.1	Thin sediment layer due to fast flowing water, therefore sediment collected from various points around ford (concrete lined), keep on hold for informed consent (additional point not identified in SAQP)
QA17								Intra-lab duplicate of sediment from DC06A, keep on hold for informed consent
QA17A								Inter-lab triplicate of sediment from DC06A, keep on hold for informed consent
DC06B	1012	(54H) 312972 m E 6120925 m S	9.1	7.39	2559	8.58	226.3	Creek free flowing, concrete bridge through creek bed with diversion pipes in structure, keep on hold for informed consent (additional point not identified in SAQP)
DD01	1550	(54H) 311966 m E 6124540 m S	11.3	7.52	725	7.26	224.3	Diversion drain, sampled from grate in middle of State Training Centre compound between Media Training building and Hot Pad B
QA19								Intra-lab duplicate sample of DD01
QA19A								Inter-lab triplicate sample of DD01

16 Hawthorn Street (bore)	Will sample this in future round (8&9 June), property owner's instructions on operating bore: - Activate timer - Press blue button to start pump - Open valve - Close valve - Press white off button
RB02	Rinsate blank taken from WQM before sampling the Diversion Drain (DD01)

Flux test

Sample ID	Time taken (minutes)	Time between (minutes)	Comments
FX08	30.22	-	First flux test sample taken as water in drain reached collection point
FX09	40.57	10.35	Second flux test sample
FX10	51.30	10.33	Third flux test sample
FX11	61.47	10.17	Fourth flux test sample
FX12	71.48	10.01	Fifth flux test sample
FX13	81.57	10.08	Final flux test sample
QA18	81.57		Intra-lab duplicate sample of FX13
QA18A	81.57		Inter-lab triplicate sample of FX13
FXB2	81.57		Blank sample collected directly from hose

Sampling Record Sheet

CFS State Training Centre 12516828 18-5-20

Surface water sampling Dawesley Creek Sean Sparrow
Vera Biermann

DC06 - access requested & obtained (to jump fence & access
a) 16 Hawthorn Street „The Brae" 2 fords)
b) Ken

General Comment: Creek flowing freely

TB02 09:18

Sample ID	time	T [°C]	pH	EC [µS/cm]	DO mg/L	Redox mV	~~EAS mg/L~~
DC06	9:33	8·4	7·34	~~8~~2587	8·32	247·2	
QA16	9:35						
QA16A	9:37						

QA16, QA16A } Surface water; no sediment (concrete lined channel)

DC06 35.035318 °S 138.948260°E 280,3 m Altitude
(MGRS - WGS84) Recorded w/ Spyglass app

Pot. Exposure Pathway: Chooks

DC 06A → 10 AM ~~35.035318 °S, 138.948260°E, 28~~
SD 06A 35.035788° S, 138.948753 °E,
QA 17 } Sediment thin sediment layer due to fast
QA17A } flowing water → sediment collected from
↓ 9:58 AM various Locations ~~ata~~ at ford

DC06A T 8,5 °C ; pH 7,33, EC 2995 µS/cm, DO 8·20 mg/L
ORP 230,1 mV

DC06B 35.037062°S, 138.949636°E
SD06B
10:12 T 9,1 °C, pH 7.39, EC 2559 µS/cm, DO 8.58 mg/L, ORP 226.3 mV

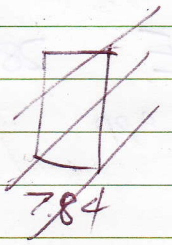
photos taken @ DC06A, DC06B (concrete bridge)
concrete ford

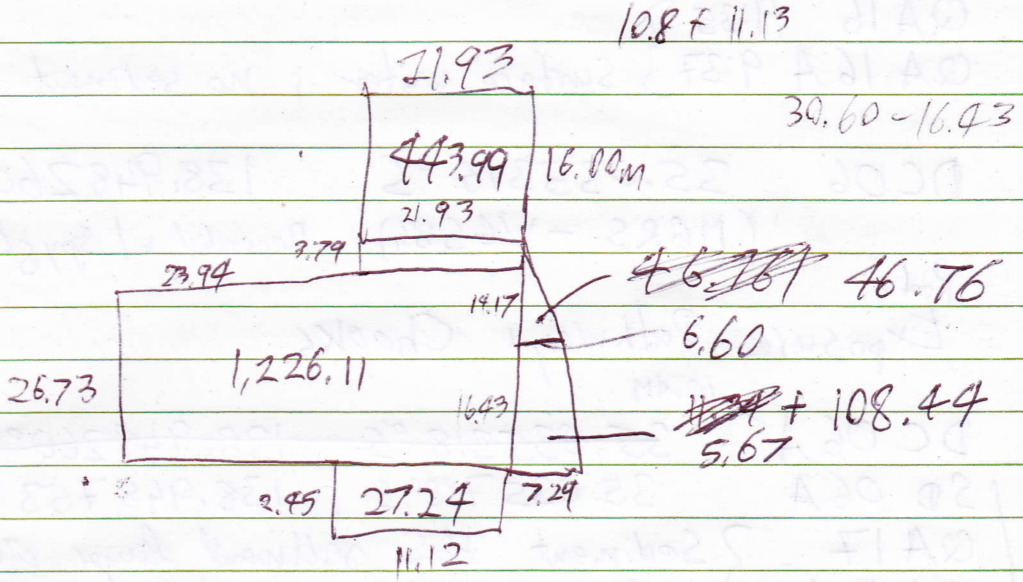
Instructions to operate bore
- activate timer
- press blue button to start pump
- open valve
- close valve
- press white off button

10.23

~~3~~~~2~~ ~~bottles for flux~~

34.79 seconds / 11L
63.25 seconds / 20L ~~1min~~ 1:03/20L



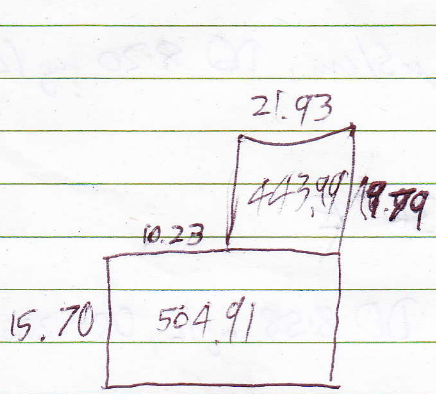


6.83 + 8.87

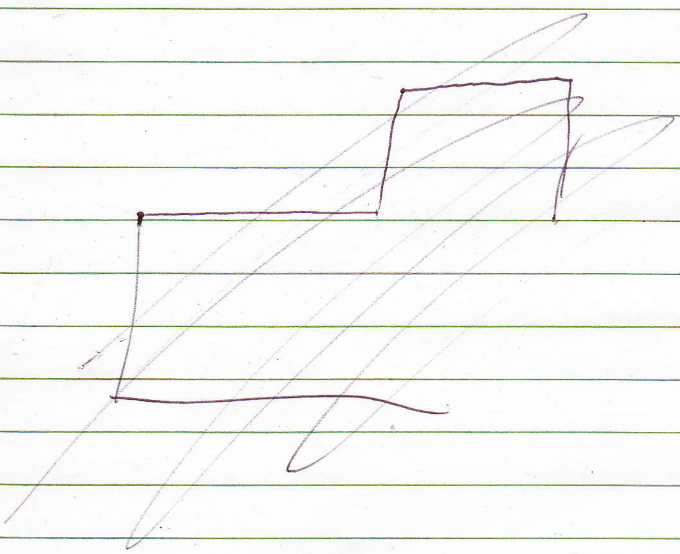
~~1,863.88~~

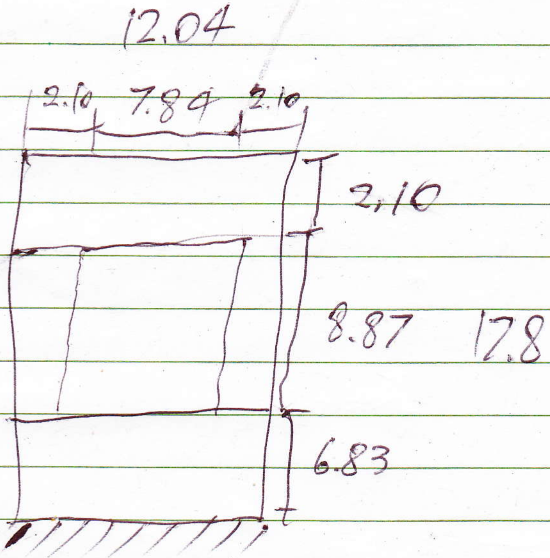
1,858.21 × 5 = 9,291.05

9291.05 ÷ 20 = 464.55



948.9 × 5 = 4,744.5 ÷ 20 = 237.23





214.31 × 5 = 1,071.56

1,071.56 ÷ 20 = 53.58

D001

GPS S 34° 40.705'
E 138° 54.410'

11.3°C

87.4% DO

726 ppm DO

725 us/cm

7.52 pH

224.3 mV

FX08	30.22	—
FX09	40.57	10.35
FX10	51.30	10.33
FX11	1.01.47	10.17
FX12	1.11.48	10.01
FX13	1.21.57	10.08

Ken Sourby

Figure: Map of proposed surface water sampling location DC06 in road reserve (public land), Dawesley SA.

OWNER MILOS JOSEPH CASTELLI

04 02 143 516

MILOSJOSEPHCASTELLI@GMAIL.COM

Field Notes

JOB ID: 12516828

Date: 19/05/2020

Weather: Overcast. Dry

Wind: < 25 kmph NW

Ground conditions: Dry

Activities: Service clearance for 8 groundwater monitoring wells.

GHD Staff / Subcontractors:

- Joel Chance (GHD)
- Matthew Willsmore (Cable Search)
- David Jeffree (CFS) – GW01
- Ray Jackson – GW06

NOTES:

GW01

Coordinates:

Lat: 35°00’11.31’’S

Lon: 138°56’26.26’’E

GW02

Coordinates:

Lat: 35°00’12.11’’S

Lon: 138°56’52.89’’E

GW03

Coordinates:

Lat: 35°00’17.48’’S

Lon: 138°57’01.05’’E

GW04

Coordinates:

Lat: 35°00’26.75’’S

Lon: 13856’53.75’’E

GW05

Coordinates:

Lat: 35°01’01.62’’S

Lon: 138°56’30.08’’E

GW06

Coordinates:

Lat: 35°01’26.94’’S

Lon: 138°56’38.09’’E

GW07

Coordinates:

Lat: 35°01’19.82’’S

Lon: 138°56’30.88’’E

C04A

Coordinates:

Lat: 35°00’33.81’’S

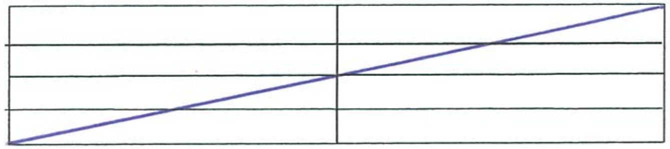
Lon: 138°56’34.32’’E

GW01

Date: 26-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air Hammer
TD: 15.5m.
Diameter: 105mm (rod)
Casing: 50mm
Surface Completion: Gatic
Water Strike: 13.5m
Walter Level Final: 2.7m.

Blank depth	0m - 12.5m. (12.5m)
Screen Depth	12.5m - 15.5m (3m)
Gravel Pack Depth	11.5m - 15.5m (4m)
Bentonite Depth	10.5m - 11.5m (1m)
Grout	0m - 10.5m (10.5m)
Concrete	Surface / Gatic

Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)

	Geology											Colour											Moisture content				Hardness							CLAY				SAND								IMPACT			
																																		Plasticity				Size			Sorting			Texture					
DEPTH	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments	PID	COMMENTS
0										X						X								X				X				X	X			X			X	X			X						Fill. Clayey Sand. trace organic matter. Gravel 5-10mm.
0.3											X					X										X						X	X				X				X								Schist. weathered. Hard. Friable
1.2											X					X										X						X					X				X								Schist Hard.
1.9											X					X						X				X						X					X				X								Schist / Pyrite (trace/fragments) silver mica. Hard.
3.4											X	X										X				X						X					X				X								Schist (light grey/silver) silver mica. Pyrite (trace/fragments)
13.5											X	X											X									X					X				X								" " wet. w/S @ 13.5m
↓																																																	
15.5											X	X											X									X					X				X								" "

Drill Rig: DH400

Page: 1 of 2

GW01

Key notes:

- WS observed @ 13.5m.
- GW under pressure – water level final (2.7m)
- Screen installed 1m above WS to target water bearing zone.

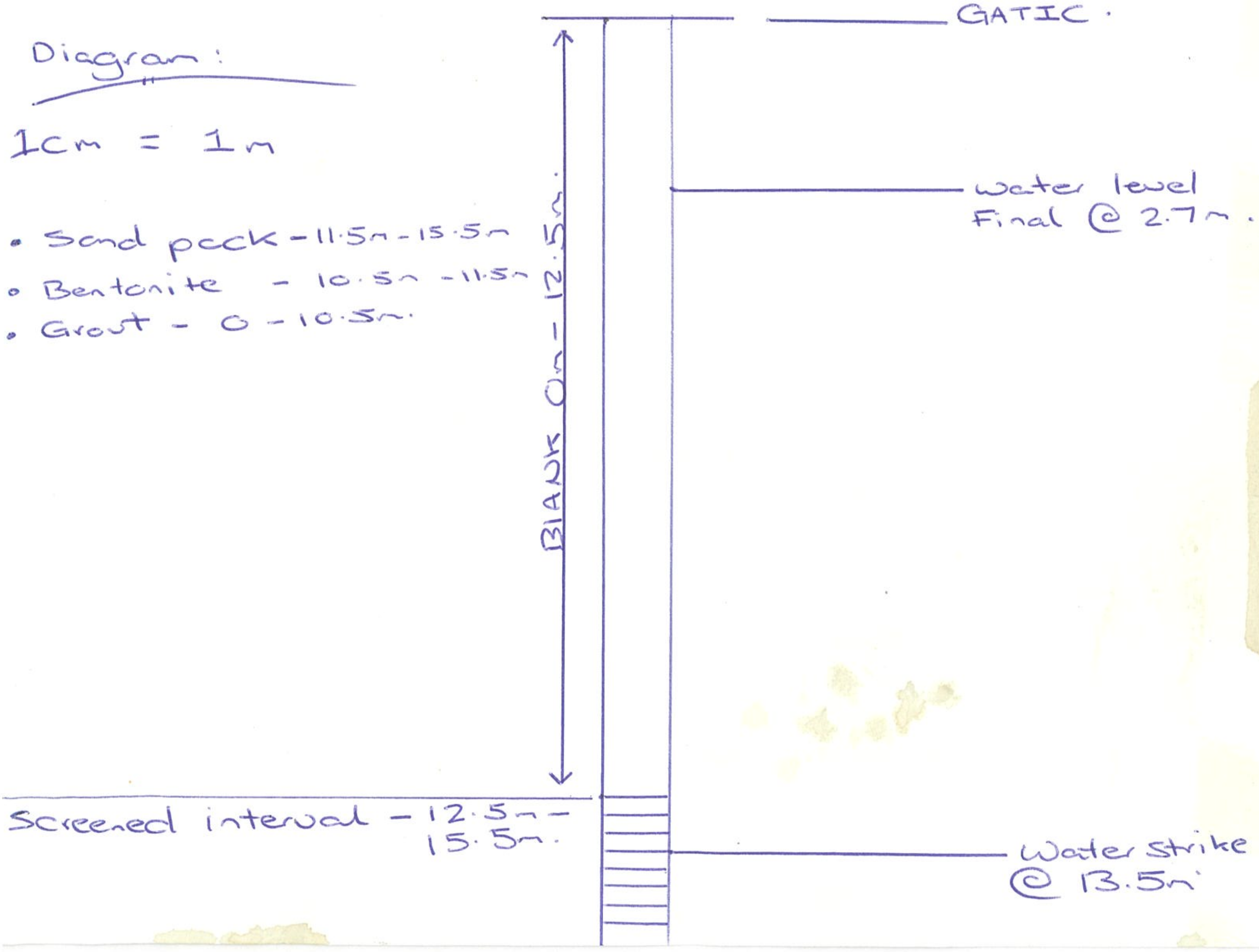
Sampling notes

- Deploy HS and tug twice @ 13.5m – 15.5m to open in order to target water bearing zone.

Diagram:

1cm = 1m

- Sand pack – 11.5m – 15.5m
- Bentonite – 10.5m – 11.5m
- Grout – 0 – 10.5m.



GW02

Date: 27-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air hammer
TD:
12516828
Job No:
Client: CFS Brukunga
Project Name: May 20 well install (GW)

Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Gatic
Water Strike:
Walter Level Final:

Blank depth	
Screen Depth	
Gravel Pack Depth	
Bentonite Depth	
Grout	
Concrete	

	Geology											Colour										
DEPTH	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments
0										X												X
0.05											X					X						
0.25											X							X				
12											X							X				
14											X				X							
18.5											X					X						

	Moisture content				Hardness							CLAY Plasticity				SAND Size			SAND Sorting			Texture		IMPACT			
DEPTH	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments	PID	COMMENTS
0		X				X								X			X	X			X						Fill. Clayey Sand. Dark brown trace organic matter. Gravel 5-10mm
0.05			X							X	X				X												Schist. Pale brown weathered.
0.25				X						X	X				X												Schist. Yellowish brown. weathered.
12			X							X	X				X												" Low moisture content. "
14			X							X	X				X												" brown grey "
18.5			X							X	X				X												" Pale brown

Page: of

GW03.

Date: 26 5-2020
Logged By: Joel Chance.
Driller: WDS.
Drill Method: Air hammer
TD: 21.8 m
Job No: 12516828
Client: CFS Brukunga

Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Standpipe
Water Strike: 19.5m
Walter Level Final: 17.2m
Project Name: May 20 well install (GW)

Blank depth	0m - 18.8m.
Screen Depth	18.8m - 21.8m
Gravel Pack Depth	17.8m - 21.8m (Sand 2mm).
Bentonite Depth	16.8m - 17.8m
Grout	0m - 16.8m.
Concrete	Surface - Standpipe.

	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			Sorting			Texture		IMPACT			
DEPTH	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments	PID	COMMENTS
0										X												X		X				X								X							X						Fill. clayey Sand. trace organic matter.
0.2										X						X		X								X						X	X				X						X						Fill. Sand. Quartzite. Silt stone. Schist. re-worked natural.
2.7											X							X								X						X	X				X												Schist. weathered.
3.2											X		X	X								X				X						X					X												Quartzite silver mica grain.
12.8											X					X						X				X						X	X				X												Schist. Pale brown. Silver mica grain.
17											X					X						X			X							X	X				X												" low moisture content ".
19.5																																																	
↓																																																	
21.8											X					X						X	X	X								X	X				X												" Moist / wet W/S ".

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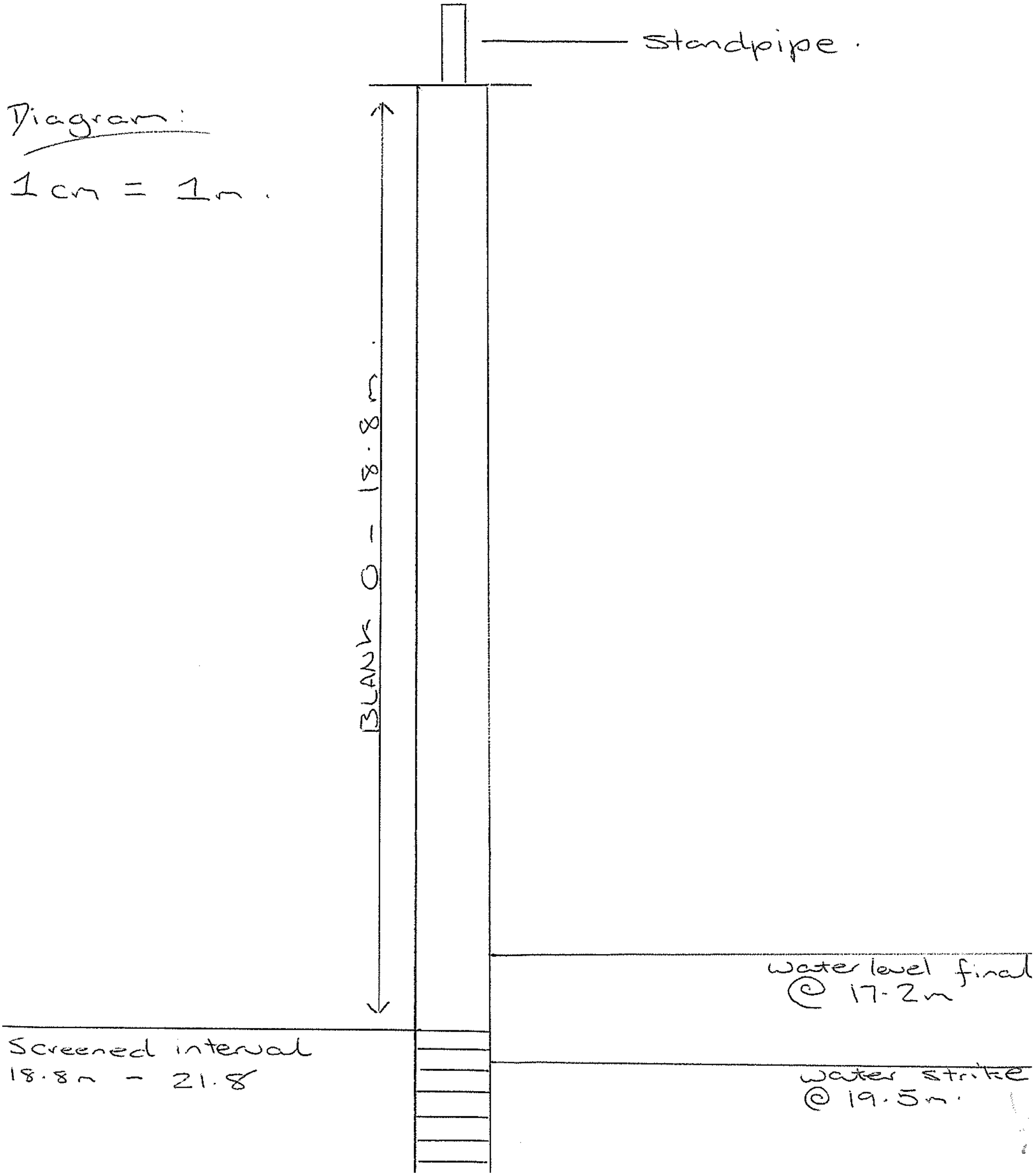
GW03

Diagram:

1cm = 1m.



GW04

Date: 27-5-2020
Logged By: Joel Chance.
Driller: WDS.
Drill Method: Air hammer.
TD:

Diameter: 104mm (Rod)
Casing: 50mm
Surface Completion: Standpipe.
Water Strike:
Walter Level Final:

Blank depth	
Screen Depth	
Gravel Pack Depth	Sand 2m.
Bentonite Depth	
Grout	
Concrete	Surface / Standpipe.

Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)

DEPTH	Geology											Colour										
	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments
0										X												X
0.15											X	X	X									
2.3											X					X						
2.7											X	X										
7.6											X				X							
~~18.5~~											~~X~~				~~X~~							

DEPTH	Moisture content				Hardness							CLAY Plasticity				SAND Size			SAND Sorting			SAND Texture		IMPACT		PID	COMMENTS
	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments		
0		X				X									X						X	X					Fill. Silty Sand trace organic matter. No odour.
0.15				X						X	X				X				X								Schist. light - med grey. fragments silver mica grain. weathered.
2.3				X						X					X				X								Schist. Pale brown. silver / gold Mica grain
2.7				X						X					X				X								Schist. light grey. Silver mica grain.
7.6				X						X					X				X								Schist. brown grey. Silver mica grain.
~~18.5~~		~~X~~		~~X~~						~~X~~					~~X~~				~~X~~								[redacted]

GW04

Date: 27-5-2020
Logged By: Joel Chance.
Driller: WDS.
Drill Method: Air hammer.
TD:
Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)

Diameter: 104mm (Rod)
Casing: 50mm
Surface Completion: Standpipe.
Water Strike:
Walter Level Final:

Blank depth	
Screen Depth	
Gravel Pack Depth	Sand 2mm.
Bentonite Depth	
Grout	
Concrete	Surface / standpipe.

DEPTH	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			Sorting			Texture		IMPACT		PID	COMMENTS
	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments		
0										X												X		X				X									X						X	X					Fill. Silty Sand trace organic matter. no odour.
0.15											X	X	X													X						X	X				X				X								Schist. light - med grey. fragments silver mica grain. weathered.
2.3											X					X										X						X					X				X								Schist. Pale brown. silver / gold Mica grain
2.7											X	X														X						X					X				X								Schist. light grey. Silver mica grain.
7.6											X				X											X						X					X				X								Schist. brown grey. Silver mica grain.
18.5											~~X~~				~~X~~									~~X~~		~~X~~						~~X~~					~~X~~				~~X~~								
																																																	Sediment remained consistent with previous drilling
																																																	Water-strike
																																																	Final well depth 23.85m
																																																	SWL

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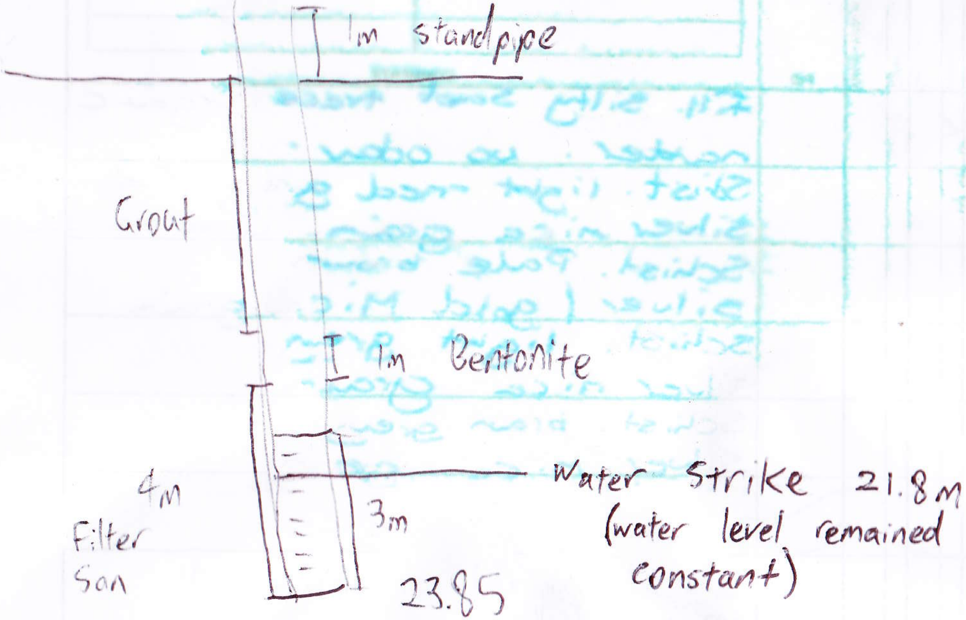
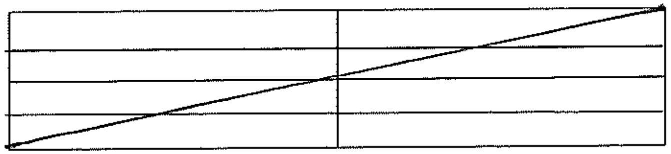

1m standpipe
Grout
1m Bentonite
4m
Filter
San
3m
Water Strike 21.8m
(water level remained
constant)
23.85

GW05.

Date: 29-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air hammer
TD: 8m
12516828
Job No:
Client: CFS Brukunga
Project Name: May 20 well install (GW)

Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Gatic
Water Strike: 6.0m.
Walter Level Final: 5.4m.

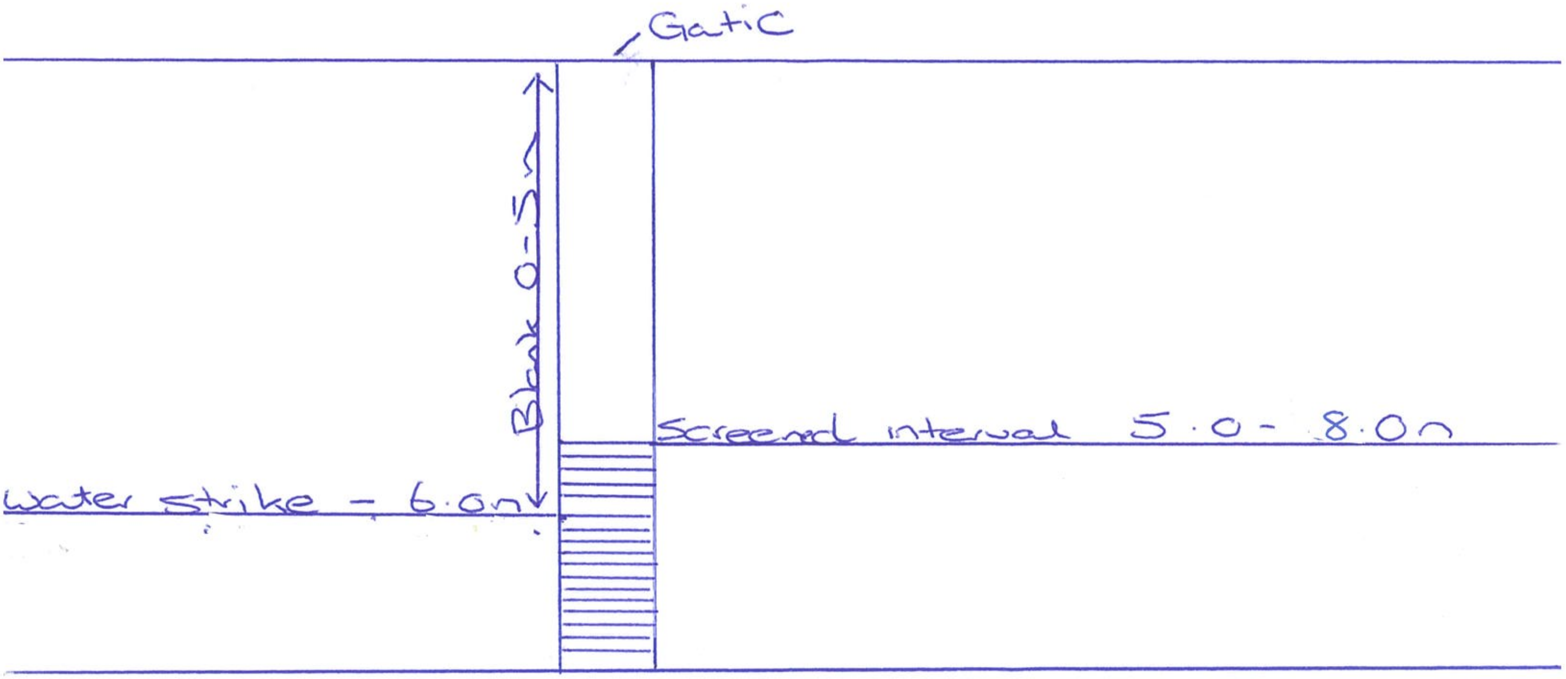
Blank depth	0m - 5m
Screen Depth	5m - 8m
Gravel Pack Depth	4m - 8m (Sand 2mm).
Bentonite Depth	3m - 4m.
Grout	0m - 3m.
Concrete	Surface - gatic.



DEPTH	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			SAND Sorting			SAND Texture		IMPACT		PID	COMMENTS
	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments		
0										X												X		X				X				X	X				X						X						Fill. Clayey sand. Road base, grael, alluvial material.
0.8											X					X										X						X	X				X												Schist. weathered. Hard/friable.
3						X					X					X								X				X				X	X				X						X						Sand. Alluvial material. low-moist moisture content.
3.5											X		X									X		X								X	X				X												Schist. weathered. moist. silver mica grain.
4											X					X									X							X	X				X												Schist. Pale brown low moisture content.
5.8											X	X										X				X						X	X				X												Schist. light grey / silver
6											X					X							X									X	X				X												Schist. Wet W/S.
7.5											X		X									X				X						X					X												Schist. Silver mica grain Hard, Dry.
↓																																																	
8																																																	

Page: 1 of 1

GW05.



GW06.

Date: 26-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air hammer.
TD: 10.0m
Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Standpipe
Water Strike: 8.0m
Walter Level Final: 6.3m.

Blank depth	0m - 5.5m.
Screen Depth	5.5m - 10m
Gravel Pack Depth	5m - 10m (Sand - 2mm)
Bentonite Depth	4m - 5m
Grout	0m - 4m
Concrete	Surface / Standpipe

Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)

DEPTH	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			Sorting			Texture		IMPACT		PID	COMMENTS
	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments		
0											X					X								X				X								X							X						Natural top soil. trace orgaic matter.
0.15						X										X									X			X									X			X	X								Sand.
0.8						X					X					X										X		X				X	X				X												Sand. Alluvial material.
1.9											X											X				X						X	X				X												Sand stone. white / yellow. weathered / friable
3.0											X											X		X								X					X												Sand stone. white / yellow. Hard. Moist. Perched aquifer.
4.1											X											X			X							X	X				X												Sand stone. orange.
5.5											X	X	X												X							X	X				X												Schist. light / med grey. DRY
6											X	X	X										X									X	X				X												" — " Moist w/S? Fracture?
8																																																	" Wet w/S!
10																																																	

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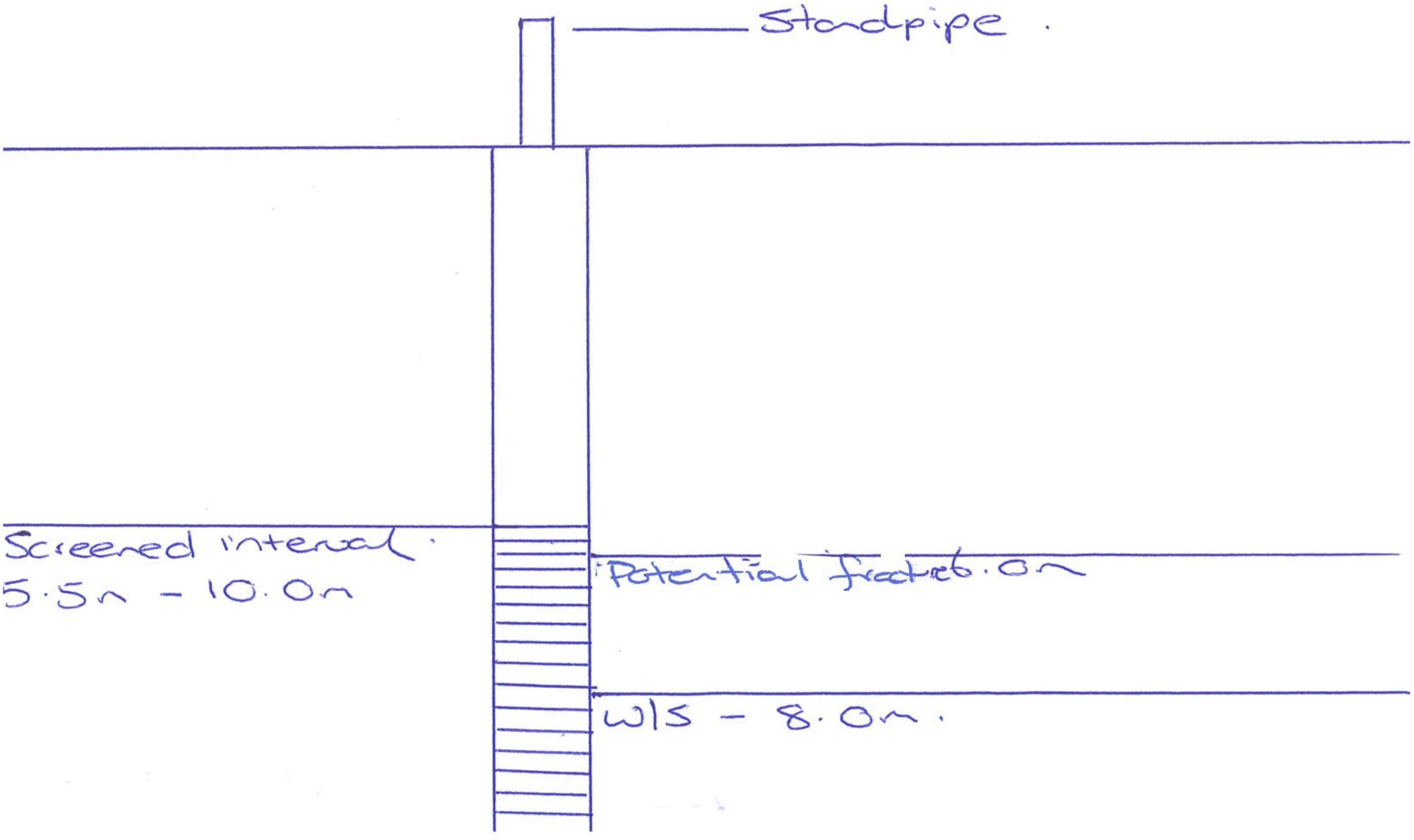
GW06.

Key notes.

- Potential fracture encountered @ 6m Schist moist.
- W/S @ 8m.
- Screen interval extended to 5.5m to capture water from potential fracture @ 6.0m.

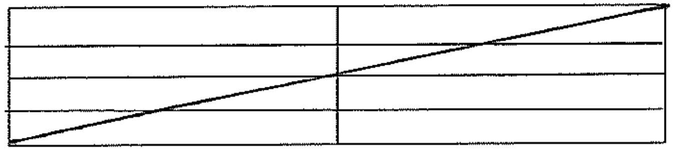


GW07

Date: 29-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air hammer
TD: 23.0 m
Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Gatic
Water Strike: 21m
Walter Level Final: 15.8m.

Blank depth: 0m - 20m
Screen Depth: 20 - 23m (3m screen)
Gravel Pack Depth: 19m - 23m (Sand 2mm)
Bentonite Depth: 18m - 19m
Grout: 0m - 18m
Concrete: Surface - gatic

Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)



DEPTH	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			Sorting			Texture		IMPACT		PID	COMMENTS
	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments		
0										X						X								X				X				X	X				X						X						Fill. Clayey Sand. Road base. Trace organic matter. Gravel.
1.2											X					X									X							X	X				X												Schist. Weathered. Silver mica grain.
1.5											X					X										X						X	X				X												" " Dry.
5.8											X	X										X				X						X	X				X												Schist. Silver mica grain light grey / silver.
6.2											X					X										X						X	X				X												Schist. Pale brown. Silver mica grain.
6.5											X	X	X													X						X	X				X												Schist. light grey / silver. Silver mica grain
21											X	X										X	X									X	X				X												" " Wet W/S.
↓																																																	
23																																																	

Drill Rig: DH400

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key notes

GW07.

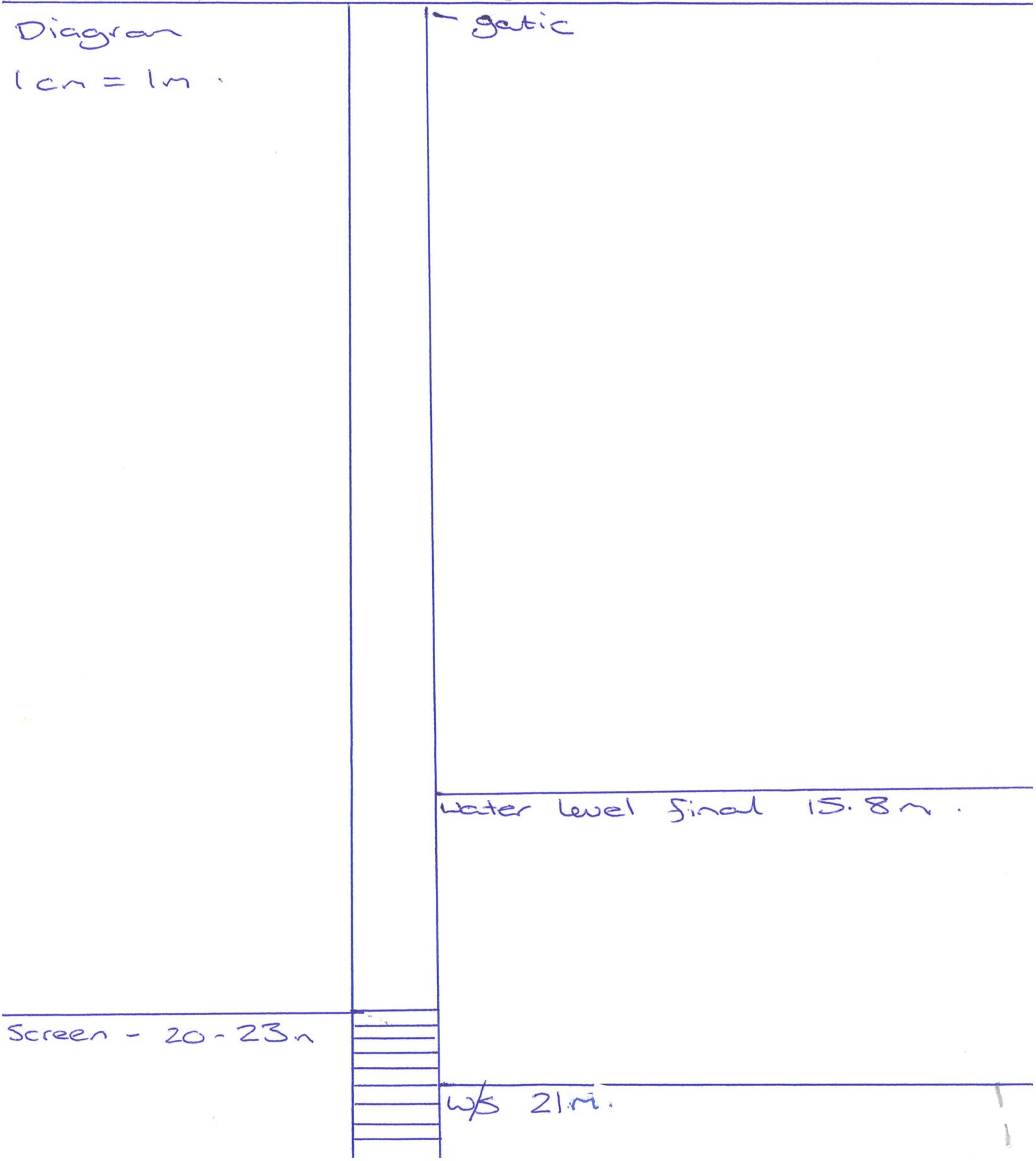
GW under pressure - water level final 15.8m. Screen installed 1m above w/s to target water bearing zone.

Sampling notes

Deploy HIS and tug twice @ 21-23m to open in order to target water bearing zone.

Diagram

1cm = 1m.



C04A.

Date: 28-5-2020
Logged By: Joel Chance.
Driller: WDS
Drill Method: Air hammer
TD: 14.0m
Diameter: 104mm (rod)
Casing: 50mm
Surface Completion: Standpipe.
Water Strike: 11.5m
Walter Level Final: 5.4m

Blank depth	0m - 11m
Screen Depth	11m - 14m
Gravel Pack Depth	10m - 14m (Sand - 2mm).
Bentonite Depth	9m - 10m
Grout	0m - 9m
Concrete	Surface - standpipe.

Job No: 12516828
Client: CFS Brukunga
Project Name: May 20 well install (GW)

	Geology											Colour											Moisture content				Hardness							CLAY Plasticity				SAND Size			Sorting			Texture		IMPACT			
DEPTH	Clay	Silt	Sandy Clay	Clayey Sand	Silty Sand	Sand	Clayey Gravel	Silty Gravel	Gravel	Fill	Other - Write in Comments	Lt grey	Md grey	Dk grey	Brn grey	Pale Brown	Greyish brown	Yellowish Brown	Dk Yellowish Orange	Reddish Brown	Mottled	other - write in comments	Wet	Moist	Low	Dry	V-soft	Soft	Firm	Stiff	V- Stiff	Hard	Friable	High	Medium	Low	None	Coarse	Medium	Fine	Well sorted	Moderatley well sorted	Poorly Sorted	Loose	Co-Hesive	Odour	Visual - Write in Comments	PID	COMMENTS
0											X											X		X				X								X													Natural topsoil. schist (hard/friable), trace organic matter.
0.05											X			X								X										X					X												Quartzite silver mica grain.
8.5											X					X									X			X				X	X				X												Sand Alluvial material. low moisture content Perched aquifer.
9.2											X							X								X							X				X												Quartzite. Yellowish/brown. Friable.
11.5											X							X					X										X				X												" " Wet W/S.
↓																																																	
14.																																																		

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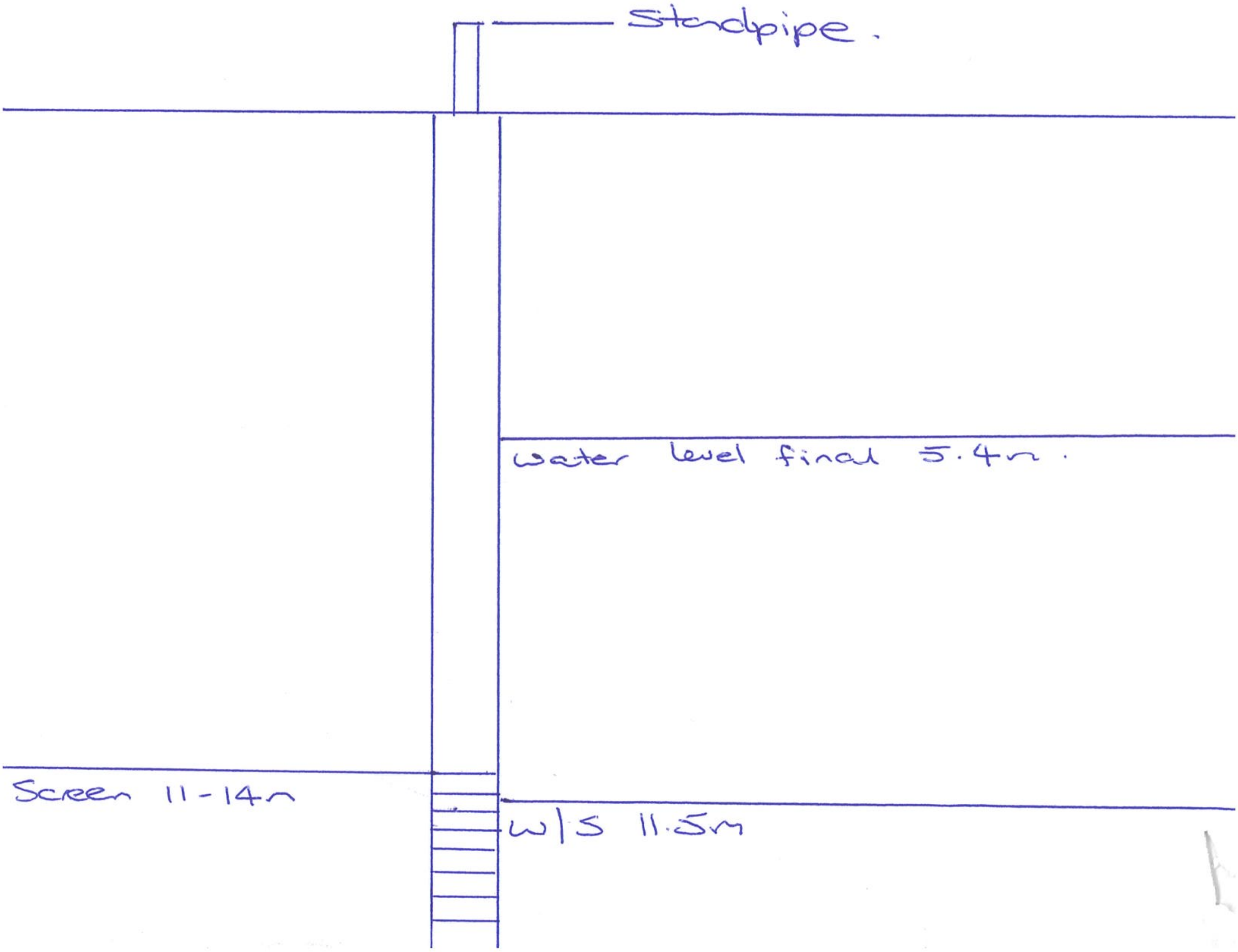
CO4/4

Key notes

WS observed @ 11.5.
GW under pressure - water level final 5.4m.
Screen installed 0.5 above W/S to target water bearing zone.

Sampling notes

Deploy H/S and tug twice @ 11.5 - 14m to open in order to target water bearing zone.

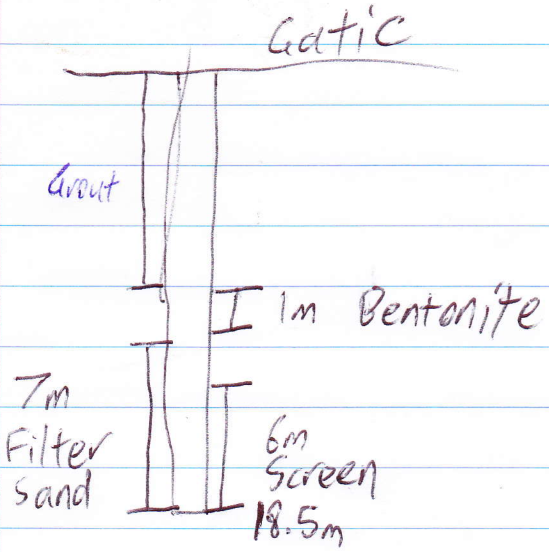


Weather: overcast
Wind: N 10km/h
Ground Condition: Dry (small amounts of frost in surrounding area)

GW02

found with 4m of water, bailed down to 0.5m and left to test for potential recharge

0.65m
small amount of recharge (150 mm), installed 6m screen on 18.5m well as unclear where fracture is located



DC08
5pm 9/6/20

35.050730° S
138.951116° E

photos taken

shallow, free flowing

DC08, QA01 sediment & water
QA01A water only

~~No WQM~~
WQM to be sampled ex-situ 12/6/20 before handing over to Envirolab

DC08 WQM taken 12/06/2020
Temp 2.7°C
pH 7.64
DO(ppm) 17.95
EC(spc) 1411
Redox 170.4mV

Groundwater Gauging Sheet

Client:	**WL Meter Type: Dip / Fox / Int.Fce / Gge**
Project:	**Date:**
Job No.:	**Time:**
Location:	**Sampler:**

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
GW01	–	1.141	–	Bore depth: 15.462. Gatic 2/2 bolts. well cap secure
GW06	–	6.862	–	bore depth 10.248 Standpipe. well cap secure.
KAN23	–	19.734	–	Gatic Casing - 150mm. No well cap
GW02	–	14.348	–	Gatic 2/2 bolts. well cap secure Bore depth 18,036
GW05	–	4.232	–	Bore depth 7,930 Gatic 2/2 bolts. well cap secure
H15	–	12.069	–	Gatic screw on, secure Bore depth 28.897
C04a	–	4.270	–	Stand pipe Bore depth 14.970
GW03	–	9.480	–	Stand pipe Bore depth 22.428
GW04	–	17.992	–	Stand Pipe Bore depth 25.004
GW07	–	11.136	–	Gatic 2/2 bolts, cap secure Well depth 23.111
Hawthorn				unable to measure, approx depth from surrounding area is 25m -no supporting Water Connect information
KAN26	–	11.81	–	Gatic, 150mm. No well cap. Well-Depth in excess of 31m (length of IP)

Hydrasleeve Sampling Record

Project number:		**Sampler initials**	
Client:		**PM initials**	
Site location:			

Well ID	GW01	**Depth to Groundwater (mBTOC)**	1.141
Date	15-6-20	**Depth to top of sampler (mBTOC)**	14.0m.
QC sample	QA20 + QA20A.	**Well depth (mBTOC)**	15.462.

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	6.49	14.4	8926 (spc)	38.2	2.45

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☑ N ☐	clear / pale brown, low turbidity, no sediment load; no odor / sheen.

Well ID	GW06	**Depth to Groundwater (mBTOC)**	6.862
Date	15-6-20	**Depth to top of sampler (mBTOC)**	
QC sample	N/A.	**Well depth (mBTOC)**	10.248

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

Time	**pH**	**Temp (C)**	**EC (uS/cm)**	**Redox (mV)**	**DO (mg/L)**
11:00	8.06	16.1	5,778 (spc)	28.6	1.80.

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☑ N ☐	Clear / pale brown. low / medium turbidity no sediment load. no odor / sheen

Well ID	KAN23	**Depth to Groundwater (mBTOC)**	19.734
Date	15-6-20	**Depth to top of sampler (mBTOC)**	
QC sample	–	**Well depth (mBTOC)**	25.501

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

Time	**pH**	**Temp (C)**	**EC (uS/cm)**	**Redox (mV)**	**DO (mg/L)**
	10.22	16.4	3494 (spc)	-219.9	1.46

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☑ N ☐	casing - 150mm. No well cap. Clear. low turbidity. fine sands in the bottom of the H/S; H2S / iron sulpide odour. No sheen.

Hydrasleeve Sampling Record

Project number:		**Sampler initials**	
Client:		**PM initials**	
Site location:			

Well ID	GW02	**Depth to Groundwater (mBTOC)**	14.348
Date	15/6/20	**Depth to top of sampler (mBTOC)**	18.036
QC sample	NA	**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	11.66	14.8	20641 (spc)	-72.9	1.42

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	Clear/Pale Brown, low turbidity, no sediment load, no sheen/odour

Well ID	GW05	**Depth to Groundwater (mBTOC)**	4.232
Date	15/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	—	**Well depth (mBTOC)**	7.930

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	11.09	15.2	744 (spc)	-38.8	3.59

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	Grey, medium turbidity, medium sediment load, no sheen/odour (schist from well drilling)

Well ID	H15	**Depth to Groundwater (mBTOC)**	
Date	16/6/20	**Depth to top of sampler (mBTOC)**	
QC sample		**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	12.67	15.5	~~-169.4~~		3.42

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	Clear/Grey-brown, 812 -169.4 low turbidity, no sediment load, no sheen/odour

Hydrasleeve Sampling Record

Project number:		**Sampler initials**	
Client:		**PM initials**	
Site location:			

Well ID	C04a	**Depth to Groundwater (mBTOC)**	4.270
Date	16/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	–	**Well depth (mBTOC)**	14.970

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	11.54	17.1	2476(spc)	-170.1	2.45

	Comments (odour, colour, turbidity,sheen)
LNAPL Check Y ☐ N ☐	Yellow-Brown, medium turbidity, low sediment load (clay), no odour/sheen

Well ID	GW03	**Depth to Groundwater (mBTOC)**	
Date	16/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	–	**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	9.85	16.1	7104(spc)	40.8	5.05

	Comments (odour, colour, turbidity,sheen)
LNAPL Check Y ☐ N ☐	clear/pale brown, low turbidity, no sediment load, no sheen/odour

Well ID	GW04	**Depth to Groundwater (mBTOC)**	
Date	16/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	–	**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	11.26	15.9	6887	-135.1	3.83

	Comments (odour, colour, turbidity,sheen)
LNAPL Check Y ☐ N ☐	Clear/brown, low to medium turbidity, low sediment load (schist dust), no sheen/odour

		initials	
Client:		**PM initials**	
Site location:			

Well ID	GW07	**Depth to Groundwater (mBTOC)**	
Date	16/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	–	**Well depth (mBTOC)**	

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)					
Time	**pH**	**Temp (C)**	**EC (uS/cm)**	**Redox (mV)**	**DO (mg/L)**
	11.46	16.7	1262	-192.5	4.80
Comments (odour, colour, turbidity,sheen)					
LNAPL Check **Y** ☐ **N** ☐	~~[illegible]~~ pale grey, low to medium turbidity, no sediment load, no odour/sheen				

↓ location tested on 19/6/20 - see field notes

Well ID	Hawthorn 1	**Depth to Groundwater (mBTOC)**	–
Date	~~16/6/20~~	**Depth to top of sampler (mBTOC)**	
QC sample	~~QA 21, QA21A~~	**Well depth (mBTOC)**	~~≈ 25m~~

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)					
Time	**pH**	**Temp (C)**	**EC (uS/cm)**	**Redox (mV)**	**DO (mg/L)**
	~~11.58~~	~~13.5~~	~~5399(spc)~~	~~-117.7~~	~~8.37~~
Comments (odour, colour, turbidity,sheen)					
LNAPL Check **Y** ☐ **N** ☐					

Well ID	KAN26	**Depth to Groundwater (mBTOC)**	
Date	19/6/20	**Depth to top of sampler (mBTOC)**	
QC sample		**Well depth (mBTOC)**	

In situ downhole parameters (collect post sampling – ensure parameters have stabilised)					
Time	**pH**	**Temp (C)**	**EC (uS/cm)**	**Redox (mV)**	**DO (mg/L)**
	8.81	15.9	1202 (spc)	-195.9	6.54
Comments (odour, colour, turbidity,sheen)					
LNAPL Check **Y** ☐ **N** ☐	Clear, low turbidity, low sediment load, no odour/sheen				

Hydrasleeve Sampling Record

Project number:		**Sampler initials**	
Client:		**PM initials**	
Site location:			

Well ID	Hawthorn 1 * sample1	**Depth to Groundwater (mBTOC)**	
Date	19/6/20	**Depth to top of sampler (mBTOC)**	
QC sample		**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	9.41	16.8°C	~~4.68~~ 5564 (spc)	-178.2	6.80

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	

Well ID	Hawthorn 1 * sample2	**Depth to Groundwater (mBTOC)**	
Date	19/6/20	**Depth to top of sampler (mBTOC)**	
QC sample		**Well depth (mBTOC)**	

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	9.69	17.4	5552 (spc)	-216.4	4.94

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	

Well ID	Hawthorn 1 * sample3	**Depth to Groundwater (mBTOC)**	–
Date	19/6/20	**Depth to top of sampler (mBTOC)**	
QC sample	QA21, QA21A	**Well depth (mBTOC)**	≈ 25m

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

Time	pH	Temp (C)	EC (uS/cm)	Redox (mV)	DO (mg/L)
	9.67	17.4	5560 (spc)	-192.8	5.72

Comments (odour, colour, turbidity,sheen)

LNAPL Check Y ☐ N ☐	clear, low turbidity, low sediment load, no odour/sheen

Field notes

Job ID : 12516828

Date : 15-6-20

Weather : overcast. SW <10 kmph. 12°C.
Ground conditions : Wet

GHD Staff : Joel Chance
Sean Sparrow

Notes:

Rinsate : RB05 (collected from ip) @ 10:15 AM after gauging GW01.

Tripblank : collected @ GW01 (on the fire training ground).

203 Peggy Buxton Rd - spent 4.5 hrs (11.00 - 15.30) searching for wells, only located 1 of 4 (KAN23) - team of two, one with metal detector

Date: 16-6-20

weather: cloudy. W < 10 kmph 8°C
ground conditions. wet

Sampled: GW03, GW04, H15, C04a

19/6/20 Weather 11°C partly cloudy
Ground: dry

Sean Sparrow

Hawthorn 1 WQM-1 16.8°C 6.80 ppm DO
5564 SPC 4.68 µs/cm
9.41 pH -178.2 mV

unable to measure well depth, region usually has wells down to ≈ 25m

WQM-2 17.4°C 4.94 ppm DO
5552 SPC 4.74 µs/cm
9.69 pH -216.4 mV

Rinsate sample taken off of WQM

WQM-3 17.4°C 5.72 ppm DO
5560 SPC 4.75 µs/cm
9.67 pH -192.8 mV

clear, low turb, low sediment load, no odour/sheen

Samples: Hawthorn 1, QA21, QA21A, TB06, RB06

RB taken from WQM

203 Peggy Buxton

KAN27 & KAN28 unable to be located

KAN26 found under 5-10mm of top soil
- Sample: KAN26
- WQM 15.9°C 6.54 ppm DO
  1202 SPC 0.98 µs/cm
  8.81 pH -195.9 mV
- SWL 11.811m
- Well Depth - in excess of 31m (length of IP)
- Comments: Clear, low turbidity, low sediment load, no odour/sheen

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 9/06/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB03	1700							
DC08	1700	(54H) 313095 m E 6119496 m S	2.7	7.64	1411	17.95	170.4	Creek shallow and flowing freely, access requested & obtained to access road reserve (95 Smyth Rd, Dawesley). Sediment sample collected. Due to impromptu visit to property, did not have WQM on hand and had to test the samples ex-situ before handing them to the lab (12/06/2020).
QA20								Intra-lab duplicate sample of DC08 (sediment and water)
QA20A								Inter-lab triplicate sample of DC08 (water only)

Date: 15/06/2020 – 16/06/2020

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB04								
RB04								
GW01	1000 15/6	(54H) 312081 m E 6124663 m S	14.4	6.49	8926	2.45	38.2	Northern boundary of CFS State Training Centre (on-site).
QA20								Intra-lab duplicate sample of GW01
QA20A								Inter-lab triplicate sample of GW01
GW06	1100 15/6	(54H) 312419 m E 6122351 m S	16.1	8.06	5778	1.80	28.6	Road easement between properties, permission requested and received to access location through private property.
KAN23	1200 15/6	(54H) 311384 m E 6124376 m S	16.4	10.22	3494	1.46	-219.9	Private property, Informed Consent and permission to access site received, samples include PFAS, pH, TDS and

								Metals. Site includes four groundwater monitoring wells installed with gatics, which are all suspected to be covered by top soil, KAN26 found on 19/06/2020, remaining two wells (KAN27 & KAN28) were not able to be located by GHD staff or surveyor that was contracted to survey wells.
GW02	1600 15/6	(54H) 312744 m E 6124668 m S	14.8	11.66	20641	1.42	-72.9	Roadside neighbouring DEM Brukunga WTP.
GW05	1700 15/6	(54H) 312205 m E 6123128 m S	15.2	11.09	744	3.59	-38.8	Roadside of Pyrites Rd, north of Dawesley Creek bridge.
H15	0900 16/6	(54H) 312475 m E 6123588 m S	15.5	12.67	812	3.42	-169.4	Private property, Informed Consent and permission to access site received, samples include PFAS, pH, TDS and Metals.
C04a	1200 16/6	(54H) 312286 m E 6123985 m S	17.1	11.54	2476	2.45	-170.1	Private property, Informed Consent and permission to access site received, samples include PFAS, pH, TDS and Metals.
GW03	1300 16/6	(54H) 312959 m E 6124496 m S	16.1	9.85	7104	5.05	40.8	DEM Brukunga WTP land, east of sludge drying ponds.
GW04	1400 16/6	(54H) 312784 m E 6124214 m S	15.9	11.26	6887	3.83	-135.1	DEM Brukunga WTP land, south of sludge drying ponds.
GW07	1500 16/6	(54H) 312230 m E 6122568 m S	16.7	11.46	1262	4.80	-192.5	Roadside of Pyrites Rd, south of Dawesley Creek bridge.

Date: 19/06/2020

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
RB05								
TB05								
Hawthorn1	0800	(54H) 312850 m E 6121034 m S	16.8	9.41	5564	6.80	-178.2	Grab sample from bore well, took 3 consecutive WQM readings to ensure water column had stabilised before taking samples. Private property, samples included PFAS, pH, TDS and Metals.
			17.4	9.69	5552	4.94	-216.4	
			17.4	9.67	5560	5.72	-192.8	
QA21								Intra-lab duplicate sample of Hawthorn1
QA21A								Inter-lab triplicate sample of Hawthorn1
KAN26	1500	(54H) 310962 m E 6124446 m S	15.9	8.81	1202	6.54	-195.9	Private property, Informed Consent and permission to access site received, samples include PFAS, pH, TDS and Metals.

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 8/07/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB07								
RB07								Rinsate sample taken from WQM between DC14 and DC15
DC09	0857	(54H) 315233 m E 6116776 m S	8.3	7.28	2456	9.78	119.1	Creek flowing freely, access requested & obtained to access road reserve (483 Ironstone Range Rd, Petwood). Sediment sample collected.
QA25								Intra-lab duplicate of DC09
QA25A								Inter-lab duplicate of DC09
DC10	0935	(54H) 315127 m E 6116269 m S	8.2	7.46	2404	9.99	124.9	Creek flowing freely, access requested & obtained to access road reserve (483 Ironstone Range Rd, Petwood). Sediment sample collected.
DC11	1012	(54H) 314936 m E 6115772 m S	9.3	7.61	2411	10	145.1	Creek flowing freely, access requested & obtained to access road reserve (483 Ironstone Range Rd, Petwood). Sediment sample collected.
DC13	1130	(54H) 316439 m E 6114554 m S	10.6	7.74	1960	6.67	119.5	Creek flowing freely, access requested & obtained to access road reserve (573 Back Callington Rd, Petwood). Sediment sample collected.
DC14	1720	(54H) 316496 m E 6113997 m S	10.2	8.31	1982	9.31	198.7	Creek flowing freely, sediment sample collected.
DC15	1640	(54H) 316722 m E 6112626 m S	10.6	8.23	1658	10.91	179.6	Creek flowing freely, sediment sample collected.

Sample ID	GPS	Comment
WW01	(54H) 312196 m E 6124226 m S	Sample collected from tailings dam seepage that was pooling beneath the far eastern wall.
WW02	(54H) 312180 m E 6124254 m S	Sample collected from tailings dam seepage that was collecting beneath the far eastern wall and being transferred to the collection pond via the 'V-notch'.
QA26		Intra-lab duplicate of WW02
QA26A		Inter-lab duplicate of WW02
WW03	(54H) 311780 m E 6123746 m S	Sample collected from seepage from southern rock stockpile via via small one-way dead end track.
WW04	(54H) 311683.28 m E 6123852.36 m S	Sample collected from seepage along roadside near top of South Hill Rd (on mine site).
WW05	(54H) 311645 m E 6124748 m S	Sample collected from northern pit accessible via West Hill Rd (on mine site), most northern edge of pit area.
WW06	(54H) 311638 m E 6124732 m S	Sample collected from northern pit accessible via West Hill Rd (on mine site), near WW05 eastern facing rather than south facing.
WW07	(54H) 311591 m E 6124242 m S	Sample collected from southern pit accessible via West Hill Rd (on mine site), western corner nearest to the sledge stockpile deposition zone.

Surface water and sediment

~~Purging~~ and Sampling Record

~~Bore ID:~~ DC 09 DC 10

Job Information

Client: CFS
Project: 12516268
Proj. No.: PFAS Assessment
Sampler: SS
Date: 08-07-20
Round ....

Sampling Information

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

Bore Information

SWL(mbTOC): .... m   Logic Check: ....
Screen: From:............to.......... m   Stick Up: .... m
NAPL Check: ....   Bore Diam.: .... mm
Ref.datum: ....   Well Cap Secure? ....
Bore Depth: .... m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (~~mS~~ µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
8.57	DC09	8.3	7.28	2456	9.78	119.1	photos ✓	QA25, QA25A	DC 09 Lat 35.074951 °S } Spyglass
9.35	DC10	8.2	7.46	2404	9.99	124.9		2×250mL water bottles	Long 138.973375 °E } app
	DC10	S	35° 04'	45.9"	E 138°	58' 20.0"	photos ✓	1× Large sediment jar	(other side of fence where car is parked)
10.12	DC11	9.3	7.61	2411	10.00	145.1		2×250mL water	photos taken
	DC11	Lat	35.083862 °S		Long 138.	970016 °E	photos ✓	1× jar sediment	access to creek by jumping the fence
11.30	DC13	10.6	7.74	1960	6.67	119.5			
	DC13	Lat	35°05'42.	4" Long	138°59'10.	4"	photos	2×250mL w	DC09 Sampling location at creek
16.40	DC15	10.6	8.23	1658	10.91	179.6		1× jar sedim	S 35° 04' 29.5" } etrex 20 GPS
	DC15	Lat	35°00'09.	1" Long	138°56'	09.3"	photos	2×250mL	E 138° 58' 24.6" } GARMIN
17.20	DC14	10.2	8.31	1982	9.31	198.7		1× jar	
	DC14	Lat	35°06'	00.5"	Long 138°	59' 12.2"	photos	2×250mL	Surface water & sediment sample
								1× jar	

Field QA Checks:

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

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

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

QA25, QA25A @ DC09   Surface water & sediment (3 plastic jars)
↳ 6 Large plastic bottles

Purge Volumes

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

*Double for gravel pack

relabeled to WW--

SS01 - Seepage Lat 35°00.'25.8"
Long 138°56'30.8"

SS02 - Lat 35°00' 24.9" (QA26, QA26A)
Long 138° 56' 30.2"

SS03 - Lat 35°00'41.1"
Long 138°56'14.0"

SS04 - Lat 35° 00' 37.1"
Long 138° 56' 09.6"

SS05 - Lat 35° 00'08.5"
- Long 138°56'09.5"

SS06 - Lat 35° 00'09.0"
Long 138° 56'09.2"

SS07 - Lat 35°00'09.1"
Long 138° 56' 09.3"

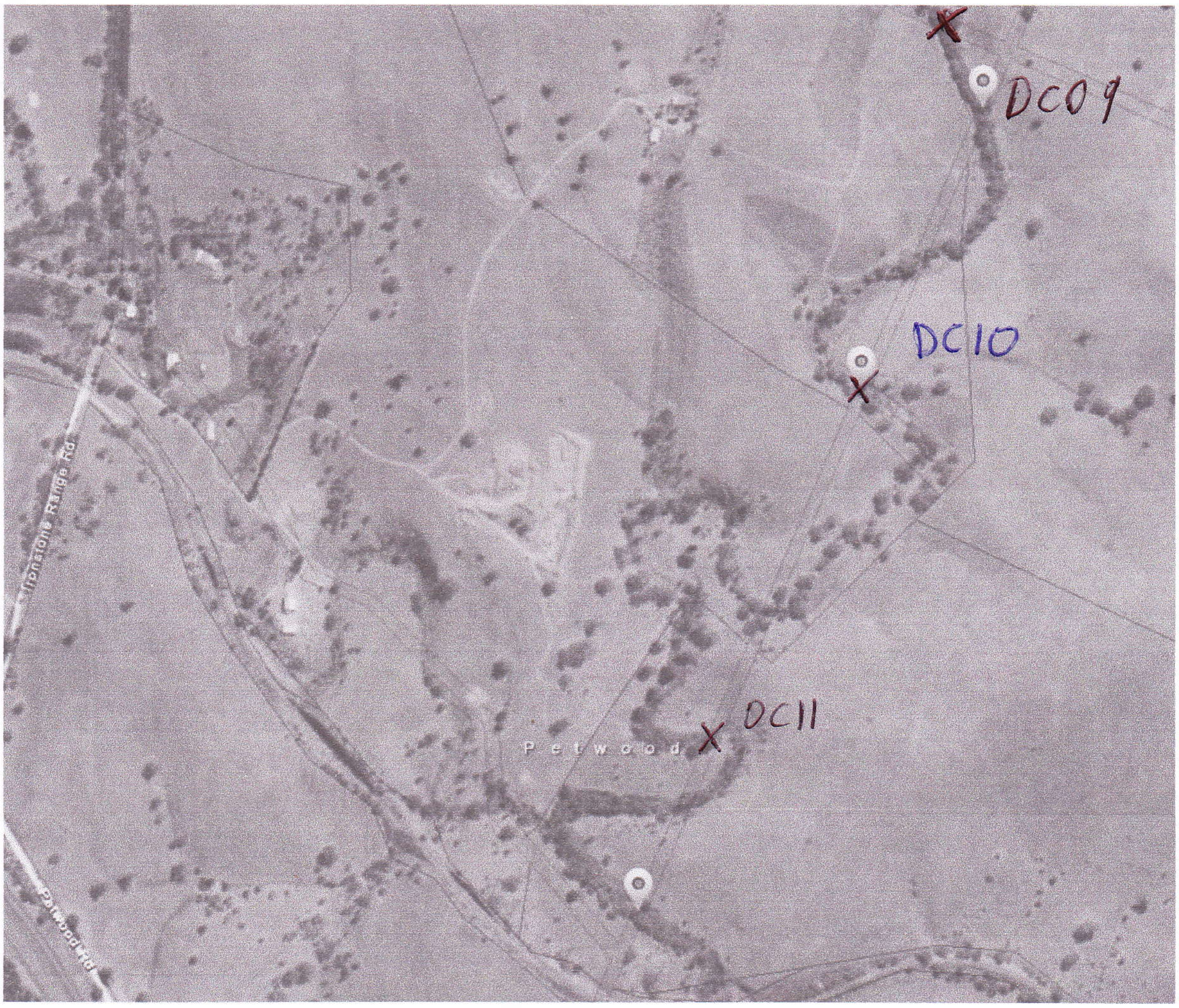


Figure: Map of proposed surface water sampling locations DC09, DC10 and DC11 in road reserve (public land), Petwood SA.

Location ID	Location	Soil Description
SS01, SS08, SS09	Surface sample on northern bench	Sandy Silt, no plasticity, orange brown, fine to medium grained sand
SS02	Spoil from groundwater bore	Sandy Silt, no plasticity, orange brown, fine to medium grained sand
SS03-SS07, SS09-SS17, SS21, SS22	Stockpiles on northern bench	Silty Sand, fine to medium grained sand, orange brown, no plasticity
SS18-SS20	Material beneath black lining of waste rock piles in northern bench	Sandy Silt, no plasticity, orange brown, fine to medium grained sand
SS23-SS30	Stockpiles in southern area of mine site	Sandy Silt, no plasticity, orange brown, fine to medium grained sand
SS10-SS15	Emergency Sludge overall area	Sandy Silt, no plasticity, orange brown, fine to medium grained sand
SS15-SS20	Sludge drying ponds	Sandy Silt, no plasticity, orange brown, fine to medium grained sand

GHD

~~Purging and~~ Sampling Record

Surface water & Sediment

Bore ID: Dawesley Creek Mount Barker Creek

Job Information	Sampling Information	Bore Information
Client: CFS	**Purge Method:**	**SWL(mbTOC):** m **Logic Check:**
Project: PFAS investigation	**Sample Method:** Grab samples	**Screen: From:** to m **Stick Up:** m
Proj. No.: 12516828	**WQ Meter Type:** YSI PRO	**NAPL Check:** **Bore Diam.:** mm
Sampler: SS / VB	**Flow Cell:** Y / N **Pump Depth:** m	**Ref.datum:** **Well Cap Secure?**
Date: 23-07-20	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** 4 m
Round	**Field Filtered? Y / N** (filter vessel, disposable filter/syringe)	

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
8.55	MBC02	9.2	7.88	1735	12.15 (106%)	189.9	QA28,	QA28A	Rocky Creekbed little to no sediment; org. film on rocks
	coordinates	GPS	54 H 03	12906	61 12917	Spyglass: 35.	109193°S	138.947032E	Access via rock hopping; elevation 186.2m
	DC16	9.3	7.41	2202	8.91	231.2			Samples: MBC02, QA28, QA28A, MBC02S, QA28S, QA28AS
10.30	GPS	54H	31707	3	6112095	fence	running	east/west	Access via
		creek	slow/	free moving,	clear,	brown	sediment		met with EPA free
11:50	DC17	10.0	7.54	2166	6.97 (63.5%)	237.2	DC17,	DC17S	DO reading ~~not~~ stabilising slowly; Ck clear, slow moving
	GPS	54H	317241	6111604	Spyglass	35.121805°S;	138.994348°E	dark	brown sediment, water plants, reed, wide open channel
12:20	MBC01	11.6	8.04	1966	10.89 (99.5%)	233.9	Samples:	MBC01,	MBC01S silty sandy sediment; clear water w/ low-medium
	GPS 54H	031	7303	6111067	Spyglass	35.126680°S	138.994971°E	90m elevation	3m wide open channel, free flowing, turbity
13.30	NC01	12.4	8.45	1342	10.55	224.2			Clear, abundant brown sediment
	GPS 54H	3144	13	6115969					shallow slow moving wide
14.00	NC02	11.1	8-03	1187	10.36	229.3			Clear, rocky bed, gravelly brown sediment
	GPS 54H	31393	8	6116433					pipe appears to come from stormwater
14:50	BR01	16.2	9.21	2975	12.88	219.8			
	GPS	320512		6110487					Stagnant, no flow, gravelly pale sand, small amt algae

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / N

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

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

TB07 & RB07 collected between MBC02 & DC16, RB07 taken from WQM

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

*Double for gravel pack

Purging and Sampling Record

Page 2

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	SWL (m)	(..........)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
15.30	DC19	10.7	7.73	1407	9.03	215.2			QC27, QC27A, QC27S, QC27AS
	GPS 54H	319936	6106588						Clear, appeared to go under/around
									culvert
16.10	DC18	11.1	7.82	1917	6.88	222.7			wide, deep channel <10m, slow
	GPS 54H	320396	6109715						moving, brown sediment, med turb
16.45	BR02	11.5	8.06	6820	5.47	236.4			(water only) shotcrete edges,
	GPS 54H		320978		6111247				boulders line bed, abundant reeds
									but stagnant, slow movement
17.20	DC-VP02	10.7	7.96	1340	9.98	182.2			fast free-flowing, clear, brown
	GPS 54H		312181		6126818				sediment, area was burnt during
									Cuddlee Creek bushfire
17.40	DC-VP01	10.3	7.96	1301	8.78	188.1			slow moving, clear, black sediment,
	GPS 54H		312387		6126369				strong methane odour, area was
									burnt during Cuddlee Creek
									bushfire

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 23/07/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB07								
RB07								Rinsate sample taken from WQM between MBC02 and DC16
DC16 / DC16S	1030	(54H) 317073 m E 6112095 m S	9.3	7.41	2202	8.91	231.2	Shallow, slow but freely moving, clear, brown sediment
DC17 / DC17S	1150	(54H) 317241 m E 6111604 m S	10.0	7.54	2166	6.97	237.2	Clear, slow moving, dark brown sediment, abundant water plants in centre beneath surface, abundant reeds on banks, wide open channel
DC18 / DC18S	1610	(54H) 317073 m E 6112095 m S	11.1	7.82	1917	6.88	222.7	Wide, deep channel, <10 m, slow moving, brown sediment, medium turbidity
DC19 / DC19S	1530	(54H) 319936 m E 6106588 m S	10.7	7.73	1407	9.03	215.2	Clear, appeared to go under / around culvert (erosion / non-constructed pathway)
QC27								Intra-lab duplicate of DC19S
QC27A								Inter-lab duplicate of DC19S
QC27S								Intra-lab duplicate of DC19S
QC27AS								Inter-lab duplicate of DC19S
DC-UP01 / DC-UP01S	1720	(54H) 312181 m E 6126818 m S	10.7	7.96	1340	9.98	182.2	Fast free-slowing, clear, brown sediment, area was burnt during the Cudlee Creek bushfire
DC-UP02 / DC-UP02S	1740	(54H) 317073 m E 6112095 m S	10.3	7.96	8.78	1301	188.1	Slow moving, clear, black sediment, strong methane odour, area was burnt during the Cudlee Creek bushfire

MBC01 / MBC01S	1220	(54H) 317303 m E 6111067 m S	11.6	8.04	1966	10.89	233.9	Silty sandy sediment, clear water with medium turbidity, 3 m wide open channel, free flowing
MBC02 / MBC02S	0855	(54H) 312906 m E 6112917 m S	9.2	7.88	1735	12.15	189.9	Rocky creek bed little to no sediment, organic film on rocks
QC28								Intra-lab duplicate of MBC02
QC28A								Inter-lab duplicate of MBC02
QC28S								Intra-lab duplicate of MBC02S
QC28AS								Inter-lab duplicate of MBC02S
NC01 / NC01S	1330	(54H) 314413 m E 6115969 m S	12.4	8.45	1342	10.55	224.2	Clear, abundant brown sediment, shallow slow moving
NC02 / NC02S	1400	(54H) 313938 m E 6116433 m S	11.1	8.03	1187	10.36	229.3	Clear, rocky bed, gravelly brown sediment, pipe appears to be potentially stormwater (may be constructed creek diversion under culvert)
BR01 / BR01S	1450	(54H) 320512 m E 6110487 m S	16.2	9.21	2975	12.88	219.8	Stagnant with obvious signs of algae, no flow, gravelly pale sand, water is discoloured pale yellow
BR02	1645	(54H) 320978 m E 6111247 m S	11.5	8.06	6820	5.47	236.4	Shotcrete edges, boulders line creek bed, abundant reeds but stagnant water with large amount of algae, slow movement (water only)

	PARCEL IDENTIFIER	TITLE	PROPERTY HOUSE	PROPERTY ST NAME	PROPERTY ST TYPE	PROPERTY SUBURB	Complete Survey	Left Survey
1	F252765AL701	CT6195/402	LOT701	BREMER RANGE	RD	ST IVES		
2	D66427AL21	CT5936/419	LOT21	SAMUELS	RD	CALLINGTON		
3	D66427AL21	CT5936/419	LOT21	SAMUELS	RD	CALLINGTON		
4	D75224AL57	CT6008/594	106	FARLEY	RD	RED CREEK		✓ NH
5	D75224AL57	CT6008/594	106	FARLEY	RD	RED CREEK		
6	F160689AL50	CT5663/235	LOT50	ECLAIR MINE	RD	ST IVES		
7	F160689AL50	CT5663/235	LOT50	ECLAIR MINE	RD	ST IVES		
8	D66427AL22	CT5936/420	LOT22	SAMUELS	RD	CALLINGTON		
9	D66427AL22	CT5936/420	LOT22	SAMUELS	RD	CALLINGTON		
10	H170600SE62	CR5745/685	LOT62	BREMER RANGE	RD	ST IVES		✓ no residence
11	H170600SE63	CR5745/686	LOT62	BREMER RANGE	RD	ST IVES		
12	F252765AL702	CT6195/402	LOT702	BREMER RANGE	RD	ST IVES		
13	D57447AL3	CT5860/146	430C	CALLINGTON	RD	SALEM	✓	~~✓~~ ~~NH~~
14	F178299AL100	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		✓ no residence need to email co-owner
15	F178299AL94	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
16	F178299AL96	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
17	F178299AL109	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
18	F178299AL106	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
19	F178299AL108	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
20	F178299AL104	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
21	F178299AL97	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
22	F178299AL95	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
23	F178299AL107	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
24	F178299AL105	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
25	F178299AL103	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
26	F178299AL93	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
27	F178299AL98	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
28	F178299AL102	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
29	F178299AL99	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
30	F178299AL101	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
31	F178299AL92	CT5347/363	LOT34	BREMER RANGE	RD	ST IVES		
32	F161070AL35	CT5347/362	LOT34	BREMER RANGE	RD	ST IVES		
33	F161070QP36	CT5347/362	LOT34	BREMER RANGE	RD	ST IVES		
34	F161070QP37	CT5347/362	LOT34	BREMER RANGE	RD	ST IVES		
35	F161070AL34	CT5347/362	LOT34	BREMER RANGE	RD	ST IVES		
36	D66427AL21	CT5936/419	LOT21	SAMUELS	RD	CALLINGTON		✓ NH
37	D66427AL21	CT5936/419	LOT21	SAMUELS	RD	CALLINGTON		

(informed consent)
sampled

38	D111170AL120	CT6168/953	430D	CALLINGTON	RD	SALEM	✓		
39	D111170AL121	CT6168/954	430D	CALLINGTON	RD	SALEM			
40	F212200AL179	CT5695/306	LOT178	BREMER RANGE	RD	ST IVES		–	Quarry
41	F212200AL178	CT5695/306	LOT178	BREMER RANGE	RD	ST IVES			
42	D57447AL4	CT5860/147	430B	CALLINGTON	RD	SALEM	✓		
43	F160689AL50	CT5663/235	LOT50	ECLAIR MINE	RD	ST IVES		✓	no residence
44	F160689AL50	CT5663/235	LOT50	ECLAIR MINE	RD	ST IVES			
45	D57447AL5	CT5860/148	430A	CALLINGTON	RD	SALEM		✓	NH
46	D43067QP15	CT5288/87	LOT14	ECLAIR MINE	RD	ST IVES			
47	D43067QP15	CT5288/87	LOT14	ECLAIR MINE	RD	ST IVES			
48	D43067QP14	CT5288/87	LOT14	ECLAIR MINE	RD	ST IVES			
49	D43067QP14	CT5288/87	LOT14	ECLAIR MINE	RD	ST IVES			
50	D75224AL55	CT6008/592	170	WILLIAMS HILL	RD	RED CREEK		✓	NH no residence
51	D75224AL55	CT6008/592	170	WILLIAMS HILL	RD	RED CREEK			
52	F16278AL209	CR5924/969	LOT209	BREMER RANGE	RD	ST IVES			
53	H170600SE64	CR5745/687	LOT64	BREMER RANGE	RD	ST IVES			
54	D75224AL56	CT6008/593	LOT56	WILLIAMS HILL	RD	SALEM			
55	D75224AL56	CT6008/593	LOT56	WILLIAMS HILL	RD	SALEM			
56	D112337QP70	CT6176/63	LOT70	SAMUELS	RD	CALLINGTON			
57	D112337QP71	CT6176/63	LOT70	SAMUELS	RD	CALLINGTON			
58	H170600SE503	CT5714/468	LOT503	SAMUELS	RD	CALLINGTON			
59	D43067QP15	CT5288/87	LOT15	ECLAIR MINE	RD	ST IVES			
60	D43067QP15	CT5288/87	LOT15	ECLAIR MINE	RD	ST IVES			
61	H170600SE60	CR5745/683	LOT60	ECLAIR MINE	RD	ST IVES			
62	H170600SE61	CR5745/684	LOT60	ECLAIR MINE	RD	ST IVES			
63	D94872AL100	CT6152/250	470	CALLINGTON	RD	SALEM	✓		
64	D94872AL101	CT6152/251	LOT101	CALLINGTON	RD	SALEM			

470A Callington Rd, Salem ✓ NH

Purging and Sampling Record Mount Barker Creek

Bore ID: ....

Job Information	***Sampling Information***	***Bore Information***
Client: CFS	**Purge Method:** N/A	**SWL(mbTOC):** .... m **Logic Check:** ....
Project: PFAS investigation Stage 2	**Sample Method:** Grab	**Screen: From:**........**to**........ m **Stick Up:** .... m
Proj. No.: 12516828	**WQ Meter Type:** YSI Professional	**NAPL Check:**........ **Bore Diam.:** .... mm
Sampler: Sean Sparrow	**Flow Cell:** Y [✓ N] **Pump Depth:** N/A m	**Ref.datum:** .... **Well Cap Secure?**........
Date: 10-08-2020	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** .... m
Round	**Field Filtered? Y / N** (filter vessel, disposable filter/syringe)	

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
10:24	DC17	8,9	8,04	1297	8,78 (76%)	-159,8			DC17, QC29, QC29A → Water
	Spyglass: 35,138830°S, 139,023543°E; 0285613; 6157305								DC17 S, QC29S, QC29AS → Sediment
	~10m wide open channel, free flowing, moving rel quickly, ~~[illegible]~~								clear to pale brown, low turbidity
	reeds along bank Mt Barker Ck @ 430D Callington Rd, Salem								(Conservation Property)

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 10/08/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB08								
RB08								Rinsate sample taken from WQM after sampling DC17A
DC17A / DC17AS	1024	(54H) 319938 m E 6109773 m S	8.9	8.04	1297	8.78	-159.8	Clear to pale brown, low turbidity, wide and deep channel, slow but free flowing
QC29								Intra-lab duplicate of DC17A
QC29A								Inter-lab duplicate of DC17A
QC29S								Intra-lab duplicate of DC17AS
QC29AS								Inter-lab duplicate of DC17AS

Purging and Sampling Record

Bore ID: 6627-5944

Job Information

Client:
Project: 12516828
Proj. No.:
Sampler: SS
Date: 17/8
Round

Sampling Information

Purge Method: pumped bore
Sample Method:
WQ Meter Type:
Flow Cell: Y / N   Pump Depth: m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): - m
Screen: From: to m
NAPL Check:
Ref.datum:
Bore Depth: 28.35 water connect m
Logic Check:
Stick Up: m
Bore Diam.: mm
Well Cap Secure?

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (SPC)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
9.17		15.4	7.01	4611	4.13	114.0			Clear, strong methane odour
9.20		17.5	6.55	4529	~~6.70~~ 1.24	6.7			Clear, medium methane odour
9.23		17.9	6.47	4535	1.09	-11.4			Clear, slight methane odour
9.26		18.0	6.49	4546	3.00	-16.1			Clear, no odour
9.29		18.0	6.44	4545	1.09	-18.1			Clear, no odour
9.33		18.1	6.47	4549	2.24	-21.4			Clear, no odour
*	Samples taken		6627-5944,	QC30,	QC30A				
									GPS 312289
									54H 6122864

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

~~Purging and Sampling Record~~ Surface Water Sampling

Bore ID: ....

Job Information	Sampling Information	Bore Information
Client:	**Purge Method:**............	**SWL(mbTOC):** .... m **Logic Check:** ....
Project: 12516828	**Sample Method:**............	**Screen: From:**............**to**........... m **Stick Up:** .... m
Proj. No.:	**WQ Meter Type:**............	**NAPL Check:**.................................. **Bore Diam.:** .... mm
Sampler: Sean Sparrow	**Flow Cell:** Y / N **Pump Depth:**..........m	**Ref.datum:** .... **Well Cap Secure?**.............
Date: 17-8-20	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** .... m
Round	**Field Filtered? Y / N** (filter vessel, disposable filter/syringe)	

Time (...........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (SPC)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
9.50 DC02A		10.2	7.63	2843	8.97	35.5			QC30S, QC30AS
DC02AS		GPS	54H	312375		6122802			Clear, free flowing, narrow/rocky bed

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / N

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

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

Purge Volumes

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

*Double for gravel pack

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 17/08/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
TB09								
RB09								Rinsate sample taken from WQM between 6627-5944 and DC02A
6627-5944	0917	(54H) 312289 m E 6122864 m S	15.4	7.01	4611	4.13	114.0	Grab sample from bore well, took 6 consecutive WQM readings to ensure water column had stabilised before taking samples. 294 Pyrites Road, Brukunga, Informed Consent received and accompanied by property owner.
	0920		17.5	6.55	4529	1.24	6.7	
	0923		17.9	6.47	4535	1.09	-11.4	
	0926		18.1	6.49	4546	3.00	-16.1	
	0929		18.0	6.44	4545	1.09	-18.1	
	0933		18.1	6.47	4549	2.24	-21.4	
QC30								Intra-lab duplicate sample of 6627-5944
QC30A								Inter-lab triplicate sample of 6627-5944
DC02A / DC02AS	0950	(54H) 312375 m E 6122802 m S	10.2	7.63	2843	8.97	35.5	Private property, Informed Consent and permission to access site received.
QC30S								Intra-lab duplicate sample of DC02AS
QC30AS								Inter-lab triplicate sample of DC02AS

Surface water
~~Purging and~~ Sampling Record

Bore ID: ....

Job Information

Client: ....
Project: 12516828.........................
Proj. No.: ....
Sampler: SS.....................................
Date: 11/9.......................................
Round ....

Sampling Information

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

Bore Information

SWL(mbTOC): .... m Logic Check: ....
Screen: From:...........to.......... m Stick Up: .... m
NAPL Check:.................................. Bore Diam.: .... mm
Ref.datum: .... Well Cap Secure?............
Bore Depth: .... m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..............)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
10.01	BR03_1C	14.7	7.68	6213	9.40	-65.5			all samples, wide channel, <20m,
	QC31, QC31A	[illegible]	139.0345	29	35.124690				red-brown, no odour, low turb,
10.14	BR03_1B	14.8	7.80	6265	11.43	-100.1			no sed load
		139.04	0925		35.116878				
10.20	BR03_1A	14.8	7.84	6283	8.29	-73.1			
		139.04	0990		35.116574				
11.03	BR02-1C	12.5	7.47	5457	9.24	-156.8			all samples, clear, slow moving water,
		139.04	0977		35.116582				shotcrete edges and bed, no odour,
11.10	BR02_1B	12.8	7.47	5503	5.63	-180.9			low turb, no sed load
		139.035	335		35.125710				
11.20	BR02_1A	13.6	7.57	5642	8.42	-137.4			
		139.035	429		35.125667				

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

Surface water ~~Purging and~~ Sampling Record

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	SWL (m)	(..........)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
12.33	MBC02-1A	15.8	7.76	1224	11.10	-133.6			All samples, clear/brown, fast flowing
	QC32, QC32A		139.035514		35.125383				shallow, low turb, no sed load,
12.42	MBC02-1B	15.8	7.80	1225	11.19	-125.7			slight methane odour, branching &
~~12.42~~		138.947043			35.109155				rocky
12.51	MBC02-1C	15.3	7.64	1209	11.59	-120.8			
		138.947061			35.109052				
14.20	MBC01_1C	16.7	7.77	1474	10.47	-87.1			All samples, clear, abundant brown
		138.947254			35.109208				sediment, salty (sea) water odour,
14.28	MBC01_1B	16.7	7.86	1472	10.40	-76.1			free flowing, narrow channel, algae
		138.994941			35.126707				
14.38	MBC01_1A	16.8	7.92	1474	9.46	-68.7			MBC01-1C, single large fish
		138.994896			35.126728				(red fin?) visible in water

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

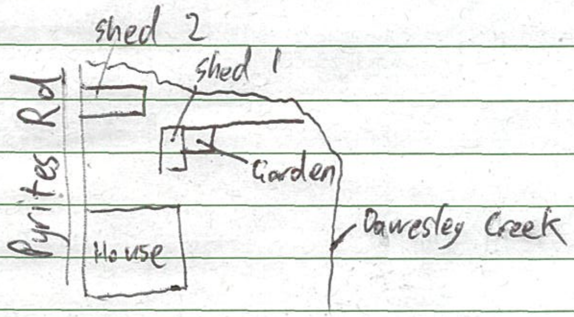
Sampler: Sean Sparrow **Date: 11/09/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
FB10								
RB10								Rinsate sample taken from WQM between BR03_1A and BR02_1C
BR03_1C	1001	(54H) 321475 m E 6112242 m S	14.7	7.68	6213	9.40	-65.5	Wide channel, red-brown, no odour, low turbidity, no sediment load
QC31								Intra-lab duplicate of BR03_1C
QC31A								Inter-lab duplicate of BR03_1C
BR03_1B	1014	(54H) 321476 m E 6112253 m S	14.8	7.80	6265	11.43	-100.1	Wide channel, red-brown, no odour, low turbidity, no sediment load
BR03_1A	1020	(54H) 321477 m E 6112272 m S	14.8	7.84	6283	8.29	-73.1	Wide channel, red-brown, no odour, low turbidity, no sediment load
BR02_1C	1103	(54H) 320983 m E 6111249 m S	12.5	7.47	5457	9.24	-156.8	Clear, slow moving water, shotcrete edges and creek bed, no odour, low turbidity, no sediment load
BR02_1B	1110	(54H) 320987 m E 6111260 m S	12.8	7.47	5503	5.63	-180.9	Clear, slow moving water, shotcrete edges and creek bed, no odour, low turbidity, no sediment load
BR02_1A	1120	(54H) 320992 m E 6111278 m S	13.6	7.57	5642	8.42	-137.4	Clear, slow moving water, shotcrete edges and creek bed, no odour, low turbidity, no sediment load
MBC02_1A	1233	(54H) 312894 m E 6112932 m S	15.8	7.76	1224	11.10	-133.6	Clear/brown, fast flowing, shallow, low turbidity, no sediment load, slight methane odour, branching & rocky
QC32								Intra-lab duplicate of MBC02_1A
QC32A								Inter-lab duplicate of MBC02_1A

MBC02_1B	1242	(54H) 312903 m E 6112923 m S	15.8	7.80	1225	11.19	-125.7	Clear/brown, fast flowing, shallow, low turbidity, no sediment load, slight methane odour, branching & rocky
MBC02_1C	1251	(54H) 312913 m E 6112920 m S	15.3	7.64	1209	11.59	-120.8	Clear/brown, fast flowing, shallow, low turbidity, no sediment load, slight methane odour, branching & rocky
MBC01_1C	1420	(54H) 317308 m E 6111068 m S	16.7	7.77	1474	10.47	-87.1	Clear, abundant brown sediment, salty (sea)water odour, free flowing, narrow channel, algae Single large fish (red fin? Approximately 20 cm long) spotted in water, moving and behaving normally
MBC01_1B	1428	(54H) 317297 m E 6111059 m S	16.7	7.86	1472	10.40	-76.1	Clear, abundant brown sediment, salty (sea)water odour, free flowing, narrow channel, algae
MBC01_1A	1438	(54H) 317288 m E 6111051 m S	16.8	7.92	1474	9.46	-68.7	Clear, abundant brown sediment, salty (sea)water odour, free flowing, narrow channel, algae

17/9/2020

Soil Sampling Garden
Jackson's Property
296 Pyrites Rd, Brukunga



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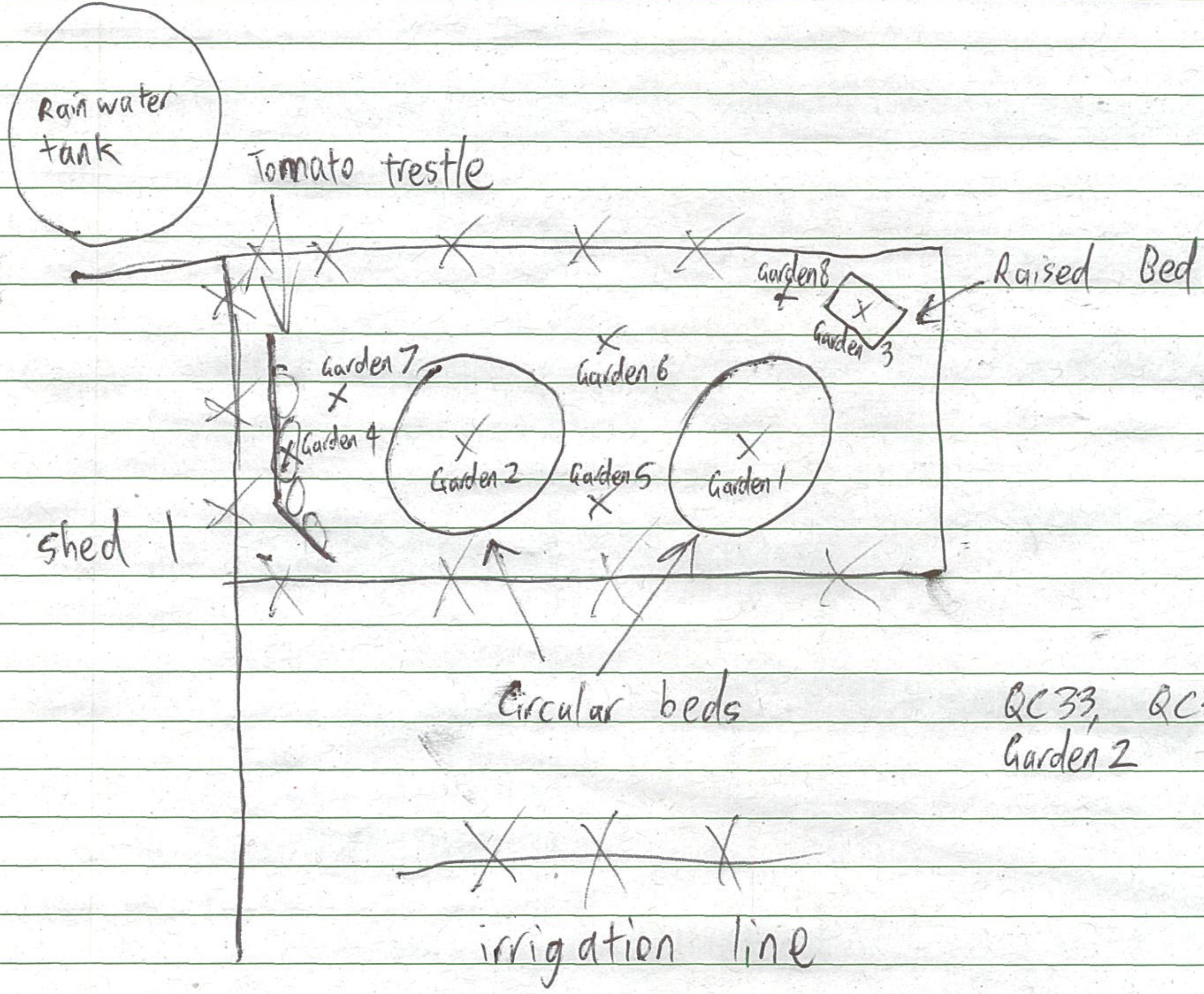

QC33, QC33A
Garden 2

Purging and Sampling Record

Bore ID: 6627-5944

Job Information

Client: ....
Project: 12516828
Proj. No.: ....
Sampler: SS
Date: 17/9
Round ....

Sampling Information

Purge Method: pumped bore
Sample Method: ....
WQ Meter Type: ....
Flow Cell: Y / N   Pump Depth: ....m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): – m   Logic Check: ....
Screen: From: .... to .... m   Stick Up: .... m
NAPL Check: ....   Bore Diam.: .... mm
Ref.datum: ....   Well Cap Secure? ....
Bore Depth: 28.35 water connect m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (....C......)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
9.16		17.3	6.47	2514	4.22	-38.6			Clear, slight methane odour
9.21		17.9	6.34	3906	2.10	-26.3			Clear, no odour
9.25		17.9	6.40	3789	2.32	-33.4			Clear, no odour
9.29		18.0	6.40	3676	1.20	-39.7			Clear, no odour
9.33		18.2	6.42	3674	1.47	-40.0			Clear, no odour
9.35		18.1	6.43	3677	2.14	-40.3			Clear, no odour
	sample taken	6627-	5944B,	QC34,	QC34A				

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

Surface water ~~Purging and~~ Sampling Record

Bore ID: ....

Job Information

Client: ....
Project: 12516828
Proj. No.: ....
Sampler: SS
Date: 17/9
Round ....

Sampling Information

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

Bore Information

SWL(mbTOC): .... m   Logic Check: ....
Screen: From:............to........... m   Stick Up: .... m
NAPL Check:...................................   Bore Diam.: .... mm
Ref.datum: ....   Well Cap Secure?.............
Bore Depth: .... m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..............)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
15.30	BR03_2A	16.9	8.75	9402	8.21	71.5			all samples, clear/brown, <20m channel
	QC36/A	54H	321475	6112267					slow moving, low turb, no sed load
15.49	BR03_2B	17.2	8.65	9953	8.86	76.0			
		54H	321477	6112255					
15.55	BR03_2C	19.0	8.47	15330	2.03	73.9			
		54H	321474	6112240					
16.15	BR02_2C	13.6	8.01	6923	4.97	-50.4			all samples, clear, stagnant,
		54H	320985	6111247					algae, small spots of oil sheen,
16.22	BR02-2B	13.7	7.87	8844	1.10	-46.1			low turb, no sed load,
		54H	320982	6111256					shotcrete edges and bed
16.27	BR02-2A	13.8	8.08	7002	3.87	-9.8			
		54H	320998	6411285					

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

Surface water ~~Purging and~~ Sampling Record

Bore ID: ....

Job Information	*Sampling Information*	*Bore Information*
Client:	Purge Method:............	SWL(mbTOC): .... m Logic Check: ....
Project: 12516828	Sample Method:............	Screen: From:............to.......... m Stick Up: .... m
Proj. No.:	WQ Meter Type:............	NAPL Check:................................ Bore Diam.: .... mm
Sampler: SS	Flow Cell: Y / N Pump Depth:..........m	Ref.datum: .... Well Cap Secure?............
Date: 17/9	WLevel Meter Type: Dip / Fox / Int.Fce / Gge	Bore Depth: .... m
Round	Field Filtered? Y / N (filter vessel, disposable filter/syringe)	

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..............)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
11.12	MBC02_2A	14.1	8.07	1150	9.30	126.3			all samples, clear, free flowing, rocky,
		54H	312869	6112919					shallow channel, low turb, no sed load
11.22	MBC02-2B	14.7	8.14	1150	9.71	115.4			
		54H	312902	6112919					
11.38	MBC02.2C	14.1	8.06	1150	7.83	110.5			
		54H	312914	6112913					
13.52	MBC01.2A	15.5	8.29	1546	8.42	107.7			all samples, clear, free flowing,
	QC35/A	54H	317287	6111054					wide channel, low turb, no sed load
14.02	MBC01.2B	15.5	8.30	1511	10.30	98.1			
		54H	317301	6111064					at least 8 fish spotted
14.13	MBC01.2C	15.6	8.34	1548	7.84	15.5			from MBC01_2C
		54H	317308	6111068					

Field QA Checks:

Air bubbles in vials? Y / N   Any violent reactions? Y / N

Decontamination as per GHD procedure? Y / N

Was sampling equipment pre-cleaned? Y / N

COC updated? Y / N

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

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

Purge Volumes

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

*Double for gravel pack

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 17/09/2020**

Sample ID	GPS (UTM)	Comment
FB11		
RB11		Rinsate sample taken from WQM between 6627-5944 and DC02A
Garden1	(54H) 312296 m E 6122978 m S	Soil sample from disused vegetable garden, sample analysed
Garden2		Soil sample from disused vegetable garden, sample analysed
QC33		Intra-lab duplicate sample of Garden2
QC33A		Inter-lab duplicate sample of Garden2
Garden3		Soil sample from disused vegetable garden, sample analysed
Garden4		Soil sample from disused vegetable garden, sample analysed
Garden5		Soil sample from disused vegetable garden, sample on hold
Garden6		Soil sample from disused vegetable garden, sample on hold
Garden7		Soil sample from disused vegetable garden, sample on hold
Garden8		Soil sample from disused vegetable garden, sample on hold

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
6627-5944_B	0916	(54H) 312289 m E 6122864 m S	17.3	6.47	2514	4.22	-38.6	Grab sample from bore well, took 6 consecutive WQM readings to ensure water column had stabilised before taking samples. 294 Pyrites Road, Brukunga, Informed Consent received and accompanied by property owner.
	0921		17.9	6.34	3906	2.10	-26.3	
	0925		17.9	6.40	3789	2.32	-33.4	
	0929		18.0	6.40	3676	1.20	-39.7	
	0933		18.2	6.42	3674	1.47	-40.0	
	0935		18.1	6.43	3677	2.14	-40.3	
QC34								Intra-lab duplicate sample of 6627-5944_B
QC34A								Inter-lab triplicate sample of 6627-5944_B

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
MBC02_2A	1112	(54H) 312869 m E 6112919 m S	14.1	8.07	1150	9.30	126.3	All samples, clear, free flowing, rocky, shallow channel, low turbidity, no sediment load
MBC02_2B	1122	(54H) 3112902 m E 6112919 m S	14.7	8.14	1150	9.71	115.4	
MBC02_2C	1138	(54H) 312914 m E 6112913 m S	14.1	8.06	1150	7.83	110.5	
MBC01_2A	1352	(54H) 317287 m E 6111054 m S	15.5	8.29	1546	8.42	107.7	All samples, clear, free flowing, wide channel, low turbidity, no sediment load At least 8 fish spotted from MBC01_2C
MBC01_2B	1402	(54H) 317301 m E 6111064 m S	15.5	8.80	1511	10.30	98.1	
MBC01_2C	1413	(54H) 317308 m E 6111068 m S	15.6	8.34	1548	7.84	15.5	
QC35								Intra-lab duplicate sample of 6627-5944_B
QC35A								Inter-lab triplicate sample of 6627-5944_B
BR03_2A	1530	(54H) 321475 m E 6112267 m S	16.9	8.75	9402	8.21	71.5	All samples, clear/brown, <20 m channel, slow moving, low turbidity, no sediment load
BR03_2B	1549	(54H) 321477 m E 6112255 m S	17.2	8.65	9953	8.86	76.0	
BR03_2C	1555	(54H) 321474 m E 6112240 m S	19.0	8.47	15330	2.03	73.9	
QC36								Intra-lab duplicate sample of BR03_2A
QC36A								Inter-lab triplicate sample of BR03_2A

BR02_2C	1615	(54H) 320985 m E 6111247 m S	13.6	8.01	6923	4.97	-50.4	All samples, clear, stagnant, algae, small spots of oil sheen, low turbidity, no sediment load, shotcrete edges and creek bed
BR02_2B	1622	(54H) 320982 m E 6111256 m S	13.7	7.87	8844	1.10	-46.1	
BR02_2A	1627	(54H) 320998 m E 6111285 m S	13.8	8.08	7002	3.87	-9.8	

Purging and Sampling Record

Bore ID: 6627-11131

Job Information

Client: ....
Project: 12516828
Proj. No.: ....
Sampler: SS
Date: 24/9
Round ....

Sampling Information

Purge Method: pumped bore
Sample Method: ....
WQ Meter Type: ....
Flow Cell: Y / N   Pump Depth: ....m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): — m   Logic Check: ....
Screen: From:............to........... m   Stick Up: .... m
NAPL Check: ....   Bore Diam.: .... mm
Ref.datum: ....   Well Cap Secure? ....
Bore Depth: .... m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..............)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
8.47	5	18.6	7.20	3588	5.81	-66.5			GPS 3115087
8.51	10	18.9	7.11	3594	6.08	-64.3			54H 6116419
8.54	20	18.8	7.06	3589	5.91	-61.1			
8.59	30	18.8	7.04	3586	5.60	-60.4			
9.04	40	18.9	7.05	3582	5.82	-63.2			
	45	18.7	7.04	3570	6.80	-66.4			

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 24/09/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (us/cm)	DO (mg/L)	Redox (mV)	Comment
FB12								
RB12								Rinsate sample taken from WQM following sampling from 6627-11131
6627-11131	0847	(54H) 315087 m E 6116419 m S	18.6	7.20	3588	5.81	-66.5	Grab sample from bore well, took 6 consecutive WQM readings to ensure water column had stabilised before taking samples. 483 Ironstone Range Road, Petwood, Informed Consent received and accompanied by property owner.
	0851		18.9	7.11	3594	6.08	-64.3	
	0854		18.8	7.06	3589	5.91	-61.1	
	0859		18.8	7.04	3586	5.60	-60.4	
	0904		18.9	7.05	3582	5.82	-63.2	
	0906		18.7	7.04	3570	6.80	-66.4	
QC30								Intra-lab duplicate sample of 6627-11131
QC30A								Inter-lab triplicate sample of 6627-11131

~~Purging~~ and Sampling Record

Bore ID: ....

Job Information

Client: 12516 828
Project: ....
Proj. No.: ....
Sampler: Sean Sparrow
Date: 28/10
Round ....

Sampling Information

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

Bore Information

SWL(mbTOC): .... m Logic Check: ....
Screen: From:...........to.......... m Stick Up: .... m
NAPL Check:................................ Bore Diam.: .... mm
Ref.datum: .... Well Cap Secure?............
Bore Depth: .... m

Time (..........)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (..............)	Dis.Oxygen (..............)	Ox-Red Pt. (± mV)	SWL (m TOC)	(..............)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
8.50	Tank 1	15.0	7.46	188.1	2.99	85.0			Clear, no odour, low turb, no sed load,
		54H	311944		6124469				slight foaming/bubbles
9.10	Tank 2	15.2	7.57	169.7	5.59	90.8			Clear, no odour, low turb, no sed load,
		54H	311944		6124467				very slight foaming/bubbles
9.30	Tank 3	15.1	7.56	156.6	8.07	110.2			Clear, no odour, low turb, no sed load,
		54H	311944		6124458				slight foaming/bubbles
9.45	Tank 4	15.5	7.92	203.2	7.39	117.2			Clear, no odour, low turb, no sed load,
		54H	311939		6124448				very slight foaming/bubbles
10.10	Tank 5	16.1	7.97	256.9	8.44	119.2		QC38/QC38A	Clear, no odour, low turb, no sed load,
		54H	311939		6124437				no visible foaming/bubbles
10.30	Tank 6	17.1	7.86	217.6	6.80	109.2		FB13/RB13	Clear, no odour, low turb, no sed load,
		54H	311948		6124422				very slight foaming/bubbles
10.50	Tank 7	18.2	7.77	214.2	7.23	106.3			Clear, no odour, low turb, no sed load,
		54H	311949		6124414				very slight foaming/bubbles

Field QA Checks:

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

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

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

Purge Volumes

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

*Double for gravel pack

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 28/10/2020**

Sample ID	Time	GPS (UTM)	Temp (^{O}C)	pH	EC (µs/cm)	DO (mg/L)	Redox (mV)	Comment
FB13								
RB13								Rinsate sample taken from WQM between Tank6 and Tank7
Tank1	0850	(54H) 311944 m E 6124469 m S	15.0	7.46	188.1	2.99	85.0	Clear, no odour, low turbidity, no sediment load, slight foaming/bubbles
Tank2	0910	(54H) 311944 m E 6124467 m S	15.2	7.57	169.7	5.59	90.8	Clear, no odour, low turbidity, no sediment load, very slight foaming/bubbles
Tank3	0930	(54H) 311944 m E 6124458 m S	15.1	7.56	156.6	8.07	110.2	Clear, no odour, low turbidity, no sediment load, slight foaming/bubbles
Tank4	0945	(54H) 311939 m E 6124448 m S	15.5	7.92	203.2	7.39	117.2	Clear, no odour, low turbidity, no sediment load, very slight foaming/bubbles
Tank5	1010	(54H) 311939 m E 6124437 m S	16.1	7.97	256.9	8.44	119.2	Clear, no odour, low turbidity, no sediment load, no visible foaming/bubbles
QC38								Intra-lab duplicate of Tank5
QC38A								Inter-lab duplicate of Tank5
Tank6	1030	(54H) 311948 m E 6124422 m S	17.1	7.86	217.6	6.80	109.2	Clear, no odour, low turbidity, no sediment load, very slight foaming/bubbles
Tank7	1050	(54H) 311949 m E 6124414 m S	18.2	7.77	214.2	7.23	106.3	Clear, no odour, low turbidity, no sediment load, very slight foaming/bubbles

Sampling Record Sheet **Client: CFS** **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow

(Water)

Sample ID	Date	Temp (^OC)	pH	EC µ/cm)	DO (mg/L)	Redox (mV)	Comment
FB01	17/11/2020						
RB01	17/11/2020						Rinsate sample taken from 100 mm Concrete Core bit after drilling HPA5
RB02	18/11/2020						Rinsate sample taken from 150 mm Concrete Core bit after drilling 12516828/Tank7/03
W1	17/11/2020						Grab sample of DI water being used to lubricate Concrete Core bit while drilling on Hot Pad A
W2	18/11/2020	26.3	8.36	407.3	5.08	-116.9	Grab sample of mains water from hose being used to lubricate Concrete Core bit while drilling in Tank 7
FD01	18/11/2020						Intra-laboratory duplicate of W2
FS01	18/11/2020						Secondary intra-laboratory duplicate of W2
W3	24/11/2020	24.2	8.52	354.0	5.78	-110.3	Grab sample of mains water from hose being used to lubricate Concrete Core bit while drilling Tanks 1 and 4
FD02	24/11/2020						Intra-laboratory duplicate of W3
FS02	24/11/2020						Secondary intra-laboratory duplicate of W3
FB02	24/11/2020						
RB03	24/11/2020						Rinsate sample taken from 150 mm Concrete Core bit after drilling 12516828/Tank1/3

(Hot Pad)

Sample ID	Date	GPS (UTM)	Comment
HPA1	17/11/2020	(54H) 311955 m E 6124470 m S	Concrete core sample taken from Hot Pad A
HPA2	17/11/2020	(54H) 311967 m E 6124474 m S	Concrete core sample taken from Hot Pad A
HPA3	17/11/2020	(54H) 311976 m E 6124468 m S	Concrete core sample taken from Hot Pad A
HPA4	17/11/2020	(54H) 311974 m E 6124457 m S	Concrete core sample taken from Hot Pad A
HPA5	17/11/2020	(54H) 311969 m E 6124454 m S	Concrete core sample taken from Hot Pad A
HPB1	24/11/2020	(54H) 311966 m E 6124486 m S	Concrete core sample taken from Hot Pad B
HPB/QA	24/11/2020		Intra-laboratorya duplicate of HPB1
HPB2	24/11/2020	(54H) 311980 m E 6124491 m S	Concrete core sample taken from Hot Pad B
HPB3	24/11/2020	(54H) 311985 m E 6124514 m S	Concrete core sample taken from Hot Pad B
HPB4	24/11/2020	(54H) 311970 m E 6124510 m S	Concrete core sample taken from Hot Pad B
HPB5	24/11/2020	(54H) 311963 m E 6124517 m S	Concrete core sample taken from Hot Pad B

(Tank concrete cores)

Sample ID	Date	GPS (UTM)	Comment
12516828/Tank7/01a	18/11/2020	(54H) 311960 m E 6124409 m S	Concrete core sample taken from Tank7 (cut to be 1/2)
12516828/Tank7/01b			Concrete core sample taken from Tank7 (cut to be 1/8)
12516828/Tank7/01c			Concrete core sample taken from Tank7 (cut to be 1/8, treated by Xypex)
12516828/QAa			Intra-laboratory duplicate of 12516828/Tank7/01a (cut to be 1/8)
12516828/QAb			Intra-laboratory duplicate of 12516828/Tank7/01b (cut to be 1/8)
12516828/Tank7/02a	18/11/2020	(54H) 311954 m E 6124414 m S	Concrete core sample taken from Tank7 (cut to be 1/2)
12516828/Tank7/02b			Concrete core sample taken from Tank7 (cut to be 1/4)
12516828/Tank7/02c			Concrete core sample taken from Tank7 (cut to be 1/4, treated by Xypex)
12516828/Tank7/03a	18/11/2020	(54H) 311950 m E 6124407 m S	Concrete core sample taken from Tank7 (cut to be 1/2)
12516828/Tank7/03b			Concrete core sample taken from Tank7 (cut to be 1/4)
12516828/Tank7/03c			Concrete core sample taken from Tank7 (cut to be 1/4, treated by Xypex)
12516828/Tank4/01a	24/11/2020	(54H) 311940 m E 6124447 m S	Concrete core sample taken from Tank4 (cut to be 1/2)
12516828/Tank4/01b			Concrete core sample taken from Tank4 (cut to be 1/4)
12516828/Tank4/01c			Concrete core sample taken from Tank4 (cut to be 1/4, treated by Xypex)
12516828/Tank4/02a	24/11/2020	(54H) 311943 m E 6124453 m S	Concrete core sample taken from Tank4 (cut to be 1/2)
12516828/Tank4/02b			Concrete core sample taken from Tank4 (cut to be 1/4)
12516828/Tank4/02c			Concrete core sample taken from Tank4 (cut to be 1/4, treated by Xypex)
12516828/Tank4/03a	24/11/2020	(54H) 311948 m E 6124448 m S	Concrete core sample taken from Tank4 (cut to be 1/2)
12516828/Tank4/03b			Concrete core sample taken from Tank4 (cut to be 1/4)
12516828/Tank4/03c			Concrete core sample taken from Tank4 (cut to be 1/4, treated by Xypex)

Sample ID	Date	GPS (UTM)	Comment
12516828/Tank1/01a	24/11/2020	(54H) 311944 m E 6124474 m S	Concrete core sample taken from Tank1 (cut to be 1/2)
12516828/Tank1/01b			Concrete core sample taken from Tank1 (cut to be 1/4)
12516828/Tank1/01c			Concrete core sample taken from Tank1 (cut to be 1/4, treated by Xypex)
12516828/Tank1/02a	24/11/2020	(54H) 311947 m E 6124472 m S	Concrete core sample taken from Tank1 (cut to be 1/2)
12516828/Tank1/02b			Concrete core sample taken from Tank1 (cut to be 1/4)
12516828/Tank1/02c			Concrete core sample taken from Tank1 (cut to be 1/4, treated by Xypex)
12516828/Tank1/03a	24/11/2020	(54H) 311943 m E 6124470 m S	Concrete core sample taken from Tank1 (cut to be 1/2)
12516828/Tank1/03b			Concrete core sample taken from Tank1 (cut to be 1/4)
12516828/Tank1/03c			Concrete core sample taken from Tank1 (cut to be 1/4, treated by Xypex)

Groundwater Gauging Sheet

Client: CFS	**WL Meter Type:** Dip / Fox / Int.Fce / Gge
Project: Brukunga STC	**Date:** 23/02/2021
Job No.: 12516828	**Time:**
Location: Brukunga investigation area	**Sampler:** Sean Sparrow

Location / Bore ID	Stick up (m)	SWL (mbTOC)	Thickness of NAPL (mm)	Comment
KAN26			8.646	
KAN23			17.320	
KAN12			1.404	
H01			2.768	
H02			1.627	
GW01			0.755	
KAN41		~~[illegible]~~	13.891	
KAN51			14.530	- broken well cap/top of casing
KAN45		~~[illegible]~~	6.576	
GW03		~~8.975~~	9.048	
BH22			2.446	
H03			4.902	
H12			2.044	
H04a			2.018	
H04b			0.819	
H05			2.186	
H11				- unable to locate gauged C02 as it was similair distance from creek
H06a			1.662	
H06b			1.543	
C04a			4.243	
~~[illegible]~~				
KAN52			17.185	
BH15		~~[illegible]~~	8.532	
C02			1.345	replacement of H11

Project: 12516828 CFS Brukunga STC
Date: 23/02/2021
Sampler: Sean Sparrow

South of Pond 4 pH 2.65 EC 11973

South of CFS pH 2.85 EC 6175

Creek_6 pH 2.88 EC 5687

Creek_5 pH 2.97 EC 6401

Creek_4 pH 3.18 EC 9179

North of CFS pH 2.88 EC 9529

North of Diversion pH 7.49 EC 1841

Sampling Record Sheet

Client: CFS **Project: CFS Brukunga State Training Centre** **Project No: 12516828**

Sampler: Sean Sparrow **Date: 23/02/2021**

Well ID	SWL	Comments
KAN26	8.646	
KAN23	17.320	
KAN12	1.404	
H01	2.768	
H02	1.627	
GW01	0.755	
KAN41	13.891	
KAN51	14.530	Had a broken well cap/ top of casing, survey data for this well may not be accurate, however was covered by detachable gatic to prevent debris falling into the well
KAN45	6.576	
GW03	9.048	
BH22	2.446	
H03	4.902	
H12	2.044	
H04a	2.018	
H04b	0.819	
H05	2.186	
H11	-	Unable to locate well (possibly labelled with different ID that did not appear on our maps), gauged C02 instead as it was a similar distance from/ parallel to the creek from H11
C02	1.345	Replacement for H11
H06a	1.662	
H06b	1.543	
C04a	4.243	
KAN52	17.185	
BH15	8.532	

Location description	pH	EC
North of Diversion Drain	7.49	1841
North of CFS Site	2.88	9529
Creek_4	3.18	9179
Creek_5	2.97	6401
Creek_6	2.88	5687
South of CFS Site	2.85	6175
South of Pond 4	2.65	11973

Appendix J – Calibration Certificates

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30m)
Serial No. 4038

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	8.4V
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

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

Calibrated by: Joseph Tomas

Calibration date: 11-Jun-20

Next calibration due: 10-Aug-20

KENNARDS HIRE

EQUIPMENT CERTIFICATION REPORT

PGN9003842-9003846 - INTERFACE METER

Plant Number: 235243 **Serial Number:** 268006

Probe Length: 60m

ITEM	TEST	PASS	COMMENTS
Battery	Compartment / Capacity	☑ 8.4v	9v
Probe	Clean / Operation	☑	
Earth Lead	Check if equipped	☑	
Tape Check	Cleaned / Checked for cuts	☑	
Function test	At surface level	☑	

Checked By: Wilma Fouché Date: 18/2/21 Signed:

Accessories List:

Interface Meter	Tape Guide	Decon 90 Solution
Brush	Spare 9v Battery	Transport Box

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Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **14D101793**

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
2. pH 7.00		pH 7.00		330737	pH 7.00
3. pH 4.00		pH 4.00		330734	pH 3.99
4. mV		236.0mV		333082/329762	243.46 mV
5. EC		2.76mS		329027	2.76mS
6. D.O		0.00ppm		10465	0
7. Temp		18.6		MultiTherm	15.7

Calibrated by: **Giovanni Pambuan**

Calibration date: **5/05/2020**

Next calibration due: **4/06/2020**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J104323

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0 ppm		10465	0 ppm
2. Conductivity		2760uS		329027	2760uS
3. pH7		pH 7.00		330737	pH 7.00
4. pH4		pH 4.00		330734	pH 4.00
5. ORP mV		231mV		333082/329762	235.32 mV
7. Temp °C		20.5		Multimeter	19.4

Calibrated by: Giovanni Pambuan

Calibration date: 15-May-20

Next calibration due: 11-Nov-20

11/06/2020

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 14D101793

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
2. pH 7.00		pH 7.00		330737	pH 7.00
3. pH 4.00		pH 4.00		330734	pH 3.99
4. mV		236.0mV		333082/329762	237.96mV
5. EC		2.76mS		329027	2.76mS
6. D.O		0.00ppm		10465	0
7. Temp		18.6		MultiTherm	18.2

Calibrated by: Giovanni Pambuan

Calibration date: 11/06/2020

Next calibration due: 11/07/2020

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 12C101136

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

Certificate of Calibration

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

Diffusion mode Aspirated mode

Sensor	**Serial no**	**Standard Solutions**	**Certified**	**Solution Bottle Number**	**Instrument Reading**
1. pH 7.00		pH 7.00		330737	pH 6.99
2. pH 4.00		pH 4.00		330734	pH 3.99
3. mV		231mV		333082/329762	243.02 mV
4. EC		2.760 mS		329027	2.760 mS
6. D.O		0 ppm		10465	0.0ppm
7. Temp		21.3		MultiTherm	15.9

Calibrated by: Giovanni Pambuan

Calibration date: 7/07/2020

Multi Parameter Water Meter

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 11C100758

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 6.69
2. pH 4.00		pH 4.00		330734	pH 4.02
3. mV		231mV		333082/329762	228.5 mV
4. EC		2.76 mS		329027	2.76mS
6. D.O		0 ppm		10465	0ppm
7. Temp		27		MultiThem	22.5

Calibrated by: Giovanni Pambuan

Calibration date: 7-Aug-20

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 11C100758

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 6.69
2. pH 4.00		pH 4.00		330734	pH 4.02
3. mV		231mV		333082/329762	228.5 mV
4. EC		2.76 mS		329027	2.76mS
6. D.O		0 ppm		10465	0ppm
7. Temp		27		MultiThem	22.5

Calibrated by: Giovanni Pambuan

Calibration date: 7-Aug-20

Multi Parameter Water Meter

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Instrument **YSI Quatro Pro Plus**
Serial No. **12C101136**

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

Certificate of Calibration

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

Diffusion mode Aspirated mode

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 7.00
2. pH 4.00		pH 4.00		330734	pH 4.08
3. mV		231mV		333082/329762	247.7 mV
4. EC		2.760 mS		329027	2.154mS
6. D.O		0 ppm		10640	0.0ppm
7. Temp		21.3		MultiTherm	13.9

Calibrated by: **Jamie Duggan**

Calibration date: **13/08/2020**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J104308

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			new 1m cable and 4 sensors 27/03/2020

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0 ppm		123302	0 ppm
2. Conductivity		2760uS		329027	2760uS
3. pH7		pH 7.00		330737	pH 6.94
4. pH4		pH 4.00		330734	pH 3.89
5. ORP mV		235.1mV		329762/333082	242.10 mV
7. Temp °C		19.3		Multimeter	17.3

Calibrated by: Jamie Duggan

Calibration date: 16-Sep-20

Next calibration due: 15-Mar-21

Gas Detection Air Sampling & Monitoring Environmental & Water Quality Monitoring
airmet
Air-Met Scientific Pty Ltd
ABN 73 006 849 949
Ph 1300 137 067

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 09K101344

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions		Instrument Reading
Temp		20		19
pH7		pH 7	330737	pH 7.00
pH4		pH 4	330734	pH 4.13
EC		2760µS/cm	329027	2760µS/cm
ORP (mV)		231mV	333082/329762	236.00mV
DO Zero		Sodium sulfite	*10465*	0.0%

Calibrated by: **Jamie Duggan**

Calibration date: **27-Oct-20**

Next calibration due: **25-Apr-21**

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: YSIPP6P
Serial Number: 13B101199 (Display)
14J100123 (Sonde)

Equipment Check

	Enclosed	Returned	Comment
YSI Pro Plus Display	☑	☐	
YSI Quatro Sonde	☑	☐	
- YSI 1001 pH Probe *(LN: 12J)*	☑	☐	
- YSI 1002 ORP Probe *(LN: 12G)*	☑	☐	
- YSI 5560 Cond/Temp Probe *(LN: 13L)*	☑	☐	
- YSI Polarographic DO Sensor *(LN: 14E)*	☑	☐	
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	1011 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	☑ 242 mV at 22°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

David McGraw 22/10/20

Equipment Specialist
ECO Environmental

KENNARDS
HIRE

EQUIPMENT CERTIFICATION REPORT

PGN9003871 WATER QUALITY METER – MULTIFUNCTION (YSI PRO PLUS)

Plant Number: 1077348 **Serial Number:** 20L101814

SENSOR	CONCENTRATION	SPAN 1	SPAN 2	TRACEABILITY	PASS
pH	pH 7.00 / pH 4.00	7.00 pH	4.00 pH	330737 341027	☑
Conductivity	12.88 mS/cm	12.88 mS/cm	—	343265	☑
Dissolved Oxygen	Sodium Sulphite / Air	0.0% in Sodium Sulphite	% Saturation in Air	10465	☑
ORP	240mV @ 20°C	240mV	—	337308 338782	☑

Battery Status 100 %	Temperature 25,8°C
Electrodes Cleaned and Checked	

Note: Calibration solution traceability information is available upon request.

Checked By: Wilma Fouché Date: 18/ 3/ 21 Signed:

Accessories List:

User's Manual	pH Sensor	Conductivity/ Temp Sensor
Dissolved Oxygen Sensor	Redox (ORP) Sensor	Flow Cell
User Guide	Stainless Steel Restrictor	Spare Batteries
Calibration Cup		

Appendix K – Laboratory Reports and Chain of Custody Documentation

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
☎ 02 9910 6200 | ✉ sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt, Myaree, WA 6154
☎ 08 9317 2505 | ✉ lab@mpl.com.au

Melbourne Lab - Envirolab Services
~~25 Research Drive, Croydon South, VIC 3136~~
☎ 03 9763 2500 | ✉ melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
☎ 08 7087 6800 | ✉ adelaide@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
☎ 07 3266 9532 | ✉ brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
☎ 08 8967 1201 | ✉ darwin@envirolab.com.au

Client: GHD
Contact Person: Robert Webb
Project Mgr: Dilara Valiff
Sampler: Robert Webb
Address: 211 Victoria Square, Adelaide SA 5000
Phone:
Mob: 468764489
Email: Robert.Webb2@ghd.com
Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. : 19SA002
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or Information	Depth	Date sampled	Type of sample	PFAS Short Suite (water)	PFAS Short Suite (sediment)														Provide as much information about the sample as you can
1	SS01		8/05/2020	soil	1															
2	SS02		8/05/2020	soil	1															
3	SS03		8/05/2020	soil	1															
4	SS04		8/05/2020	soil	1															
5	SS05		8/05/2020	soil	1															
6	SS06		8/05/2020	soil	1															
7	SS07		8/05/2020	soil	1															
8	SS08		8/05/2020	soil	1															
9	SS09		8/05/2020	soil	1															
10	SS10		8/05/2020	soil	1															
11	SS11		8/05/2020	soil	1															
12	SS12		8/05/2020	soil	1															
13	SS13		8/05/2020	soil	1															
14	SS14		8/05/2020	soil	1															
15	SS15		8/05/2020	soil	1															
16	SS16		8/05/2020	soil	1															

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 243030
Date Received: 13.5.20
Time Received: 12.45
Received by:
Temp: [✓ Cool]/Ambient
Cooling: [✓ Ice/Icepack]
Security: [✓ Intact]/Broken/None

243030 CN

17	SS17		8/05/2020	soil	1															
18	SS18		8/05/2020	soil	1															
19	SS19		8/05/2020	soil	1															
20	SS20		8/05/2020	soil	1															
21	SS21		8/05/2020	soil	1															
22	SS22		8/05/2020	soil	1															
23	SS23		8/05/2020	soil	1															
24	SS24		8/05/2020	soil	1															
25	SS25		8/05/2020	soil	1															
26	SS26		8/05/2020	soil	1															
27	SS27		8/05/2020	soil	1															
28	SS28		8/05/2020	soil	1															
29	SS29		8/05/2020	soil	1															
30	SS30		8/05/2020	soil	1															
31	WB01		6/05/2020	water	1															
32	FXB01 7.		7/05/2020	water	1															
33	FX01		7/05/2020	water	1															
34	FX02		7/05/2020	water	1															
35	FX03		7/05/2020	water	1															
36	FX04		7/05/2020	water	1															
37	FX05		7/05/2020	water	1															
38	FX06		7/05/2020		1															
39	FX07		7/05/2020		1															
40	DC02		8/05/2020	water, sed	1	~~sed~~														
41	DC03		8/05/2020	water, sediment	1	(153 sediment)														
42	DC04		8/05/2020	water, sediment	1	(154 sediment)														
152 soil. / 43 water.	DC05		8/05/2020	water, sediment	1	(155 sediment)														
44	QC11		8/05/2020	waterS	1															
—	QC11a		8/05/2020	water	1															Please forward to ALS
45	QC12		8/05/2020	sediment	1															
—	QC12a		8/05/2020	sediment	1															Please forward to ALS
46 / 47	DC07		8/05/2020	water, sediment	1															
48	RB01		6/05/2020	water	1															
49	RB02		6/05/2020	water	1															
50	RB03		7/05/2020	water	1															
51	RB04		7/05/2020	water	1															
52	RB05		8/05/2020	water	1															
53	RB06		8/05/2020	water	1															

243030 ar

54	FB01		6/05/2020	water	1															
55	FB02		7/05/2020	water	1															
56	FB03		8/05/2020	water	1															
57	TB01		6/05/2020	water	1															
58	TB02		7/05/2020	water	1															
59	SW03_0-0.2		6/05/2020	soil	1															
60	SW03_0,5-0.7		6/05/2020	soil																
61	SW03_1.5-1.7		6/05/2020	soil	1															
62	SW03_4.8-4.9		6/05/2020	soil																
63	SW04_0-0.2		6/05/2020	soil																
64	SW04_1.0-1.3		6/05/2020	soil	1															
65	QC04		6/05/2020	soil	1															
–	QC04a		6/05/2020	soil	1															Please forward to ALS
66	SW04_2.0-2.1		6/05/2020	soil	1															
67	SW04_3.85_3.9		6/05/2020	soil																
68	SW04_4.5-4.6		6/05/2020	soil	1															
69	SW05_0-0,2		6/05/2020	soil	1															
70	SW05_1.0-1.1		6/05/2020	soil	1															
71	SW05_2.0-2.2		6/05/2020	soil																
72	SW05_3.4-3.6		6/05/2020	soil																
73	SW06_0.5-0.7		6/05/2020	soil																
74	SW06_4.1-4.2		6/05/2020	soil	1															
75	SW06_4.3-4.4		6/05/2020	soil	1															
76	SW07_0.2-0.3		7/05/2020	soil	1															
77	SW07_1.0-1.2		7/05/2020	soil																
78	SW07_2.5-2.8		7/05/2020	soil	1															
79	QC06		7/05/2020	soil	1															
–	QC06a		7/05/2020	soil	1															Please forward to ALS
80	SW07_4.2-4.3		7/05/2020	soil																
81	SW08_0.5-0.6		7/05/2020	soil	1															
82	SW08_2.3-2.4		7/05/2020	soil	1															
83	SW08_4.0-4.1		7/05/2020	soil																
84	SW08_4.95-5		7/05/2020	soil																
85	SW09_0.1-0.2		7/05/2020	soil	1															
NR	SW09_1.6-1.8 - ?		7/05/2020	soil	1															
86	SW09_2.0-2.2		7/05/2020	soil																
87	SW09_4.0-4.2		7/05/2020	soil																
88	SW09_5.5-5.7		7/05/2020	soil	1															
89	SW01_0.1-0.3		7/05/2020	soil	1															
90	SW01_1.9-2.0		7/05/2020	soil	1															

243030

91	SW01_3.3-3.6		7/05/2020	soil																
92	QC07		7/05/2020	soil																
—	QC07a		7/05/2020	soil																Please forward to ALS
93	SW02_0.1-0.3		7/05/2020	soil	1															
94	SW02_0.9-1.1		7/05/2020	soil	1															
95	SW02_1.4-1.5		7/05/2020	soil																
96	SW10_0-0.2		7/05/2020	soil																
97	SW10_0.8-0.9		7/05/2020	soil	1															
98	SW10_1.5-1.7		7/05/2020	soil	1															
99	SW10_2.7-2.8		7/05/2020	soil																
100	SW11_0-0.1		7/05/2020	soil	1															
101	SW11_0.4-0.5		7/05/2020	soil																
102	SW11_1.3-1.5		7/05/2020	soil																
103	SW11_2.0-2.3		7/05/2020	soil	1															
104	QC08		7/05/2020	soil	1															
—	QC08a		7/05/2020	soil	1															Please forward to ALS
105	SW11_3.0-3.2		7/05/2020	soil																
106	SW12		7/05/2020	soil	1															
107	SW13		7/05/2020	soil	1															
108	SW14		7/05/2020	soil	1															
109	SW15		7/05/2020	soil	1															
110	SW16		7/05/2020	soil	1															
111	SW17		7/05/2020	soil	1															
112	SW18		7/05/2020	soil	1															
113	SW19		7/05/2020	soil	1															
NR	SW20		7/05/2020	soil	1															
114	SB01_0-0.2	( )	6/05/2020	soil	1															
115	SB01_0.2-0.4	(0.4 - 0.6)	6/05/2020	soil	1															
116	SB01_0.9-1.1	(0.8 - 1.0)	6/05/2020	soil																
NR	SB01_1.7-1.9		6/05/2020	soil																
NR	SB01_2.3-2.8		6/05/2020	soil																
NR	SB01_3.0-3.2		6/05/2020	soil																
117	SB02_0.1-0.3		6/05/2020	soil																
117	SB02_0.1-0.3		6/05/2020	soil	1															
118	QC02		6/05/2020	soil	1															
—	QC02a		6/05/2020	soil	1															Please forward to ALS
119	SB02_0.6-0.8		6/05/2020	soil	1															
120	SB02_0.8-0.95		6/05/2020	soil																
121	SB03_0-0.2	(0.1 - 0.2)	6/05/2020	soil	1															
122	SB03_0.4-0.6		6/05/2020	soil	1															

243030 cm

123	SB03_0.9-1.1		6/05/2020	soil	1															
124	SB03_1.7-1.9		6/05/2020	soil																
125	SB03_2.3-2.8		6/05/2020	soil																
126	SB03_3-3.2		6/05/2020	soil																
127	SB04_0-0.2		6/05/2020	soil	1															
128	QC05		6/05/2020	soil	1															
—	QC05a		6/05/2020	soil	1															Please forward to ALS
129	SB05_0.1-0.2		6/05/2020	soil	1															
130	SB05_0.3-0.4		6/05/2020	soil	1															
131	SB05_0.8-1.0		6/05/2020	soil	1															
132	QC01		6/05/2020	soil																
—	QC01a		6/05/2020	soil																Please forward to ALS
133	SB05_1.7-1.9		6/05/2020	soil																
134	SB05_3.1-3.3		6/05/2020	soil																
135	SB06_Concrete		6/05/2020	concrete	1															
136	SB08_Concrete		6/05/2020	concrete	1															
137	SB05-Concrete	X2	6/05/2020	concrete	1															
— NR	SB02-Concrete		6/05/2020	concrete	1															
138	SB06_0.23-0.4		6/05/2020	soil	1															
139	SB06_0.4-0.6		6/05/2020	soil	1															
140	SB06_1.0-1.2		6/05/2020	soil	1															
141	SB06_1.9-2.1		6/05/2020	soil																
142	SB07_0-0.2		6/05/2020	soil	1															
143 ~~139~~	QC03		6/05/2020	soil	1															
—	QC03a		6/05/2020	soil	1															Please forward to ALS
144	SB07_0.4-0.6		6/05/2020	soil	1															
145	SB08_02-0.4	(0.1-0.3)	6/05/2020	soil	1															
146	SB08_0.4-0.6	(0.3-0.5)	6/05/2020	soil	1															
147 / 148	Creek_5		8/05/2020	water, sediment	1															
149 / 150	Creek_6		8/05/2020	water, sediment	1															
151	QC13		8/05/2020	water	1															
152	QC13a		8/05/2020	water	1															
NR	QC14		8/05/2020	sediment	1															
NR	QC14a		8/05/2020	sediment	1															
NR	Creek_4		8/05/2020	water, sediment	1															

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (C GHD	**Received by (Company):**	***Lab Use Only***	
Print Name: Robert Webb	**Print Name:**	**Job number:**	**Cooling: Ice / Ice pack / None**
Date & Time: RW	**Date & Time:**	**Temperature:**	**Security seal: Intact / Broken / None**
Signature: 11/05/2020	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**	

156. SW5-0.3
157. SW6 1.2.
158. SSO
159. QC10 water
160. QC10A water.

161. water unlabelled.

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
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CERTIFICATE OF ANALYSIS 243030

Client Details

Client	GHD Pty Ltd
Attention	Robert Webb
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	121 soil, 31 water, 7 sediment, 4 concrete
Date samples received	13/05/2020
Date completed instructions received	13/05/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	25/05/2020
Date of Issue	25/05/2020

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Results Approved By
Fiona Tan, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

NATA
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COMPETENCE

PFAS in Soils Short

Our Reference		243030-1	243030-2	243030-3	243030-4	243030-5
Your Reference	UNITS	SS01	SS02	SS03	SS04	SS05
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.2	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.2	<0.1	0.1	<0.1	0.4
Perfluorooctanoic acid PFOA	µg/kg	<0.2	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.2	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.4	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	99	94	100	100	105
Surrogate $^{13}C_2$ *PFOA*	%	91	88	90	91	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	89	91	140	105
Extracted ISTD $^{13}C_4$ *PFOS*	%	81	101	97	132	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	82	90	94	132	94
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	87	87	93	148	100
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	100	100	105	100	87
Total Positive PFHxS & PFOS	µg/kg	0.4	<0.1	0.1	<0.1	0.4
Total Positive PFOS & PFOA	µg/kg	0.2	<0.1	0.1	<0.1	0.4
Total Positive PFAS	µg/kg	0.4	<0.1	0.1	<0.1	0.4

PFAS in Soils Short

Our Reference		243030-6	243030-7	243030-8	243030-9	243030-10
Your Reference	UNITS	SS06	SS07	SS08	SS09	SS10
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	0.2	<0.1	2.3	2.2
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	0.2	0.9
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	86	102	87	88	99
Surrogate $^{13}C_2$ *PFOA*	%	94	80	87	90	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	90	86	76	74	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	98	87	79	70	85
Extracted ISTD $^{13}C_4$ *PFOA*	%	82	88	74	68	85
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	96	100	93	74	93
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	87	80	67	67	67
Total Positive PFHxS & PFOS	µg/kg	<0.1	0.2	<0.1	2.3	2.4
Total Positive PFOS & PFOA	µg/kg	<0.1	0.2	<0.1	2.4	3.1
Total Positive PFAS	µg/kg	<0.1	0.2	<0.1	2.4	3.4

PFAS in Soils Short						
Our Reference	UNITS	243030-11	243030-12	243030-13	243030-14	243030-15
Your Reference		SS11	SS12	SS13	SS14	SS15
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	0.7
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	3.6	0.3	0.2	65
Perfluorooctanoic acid PFOA	µg/kg	<0.1	0.8	<0.1	0.1	5.6
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	96	84	88	93	109
Surrogate $^{13}C_2$ *PFOA*	%	81	82	82	89	87
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	79	69	71	67
Extracted ISTD $^{13}C_4$ *PFOS*	%	85	79	81	70	66
Extracted ISTD $^{13}C_4$ *PFOA*	%	85	76	71	65	65
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	96	85	74	74	70
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	67	67	73	53	60
Total Positive PFHxS & PFOS	µg/kg	<0.1	3.6	0.3	0.2	66
Total Positive PFOS & PFOA	µg/kg	<0.1	4.4	0.3	0.3	71
Total Positive PFAS	µg/kg	<0.1	4.4	0.3	0.3	71

PFAS in Soils Short						
Our Reference	UNITS	243030-16	243030-17	243030-18	243030-19	243030-20
Your Reference		SS16	SS17	SS18	SS19	SS20
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.2	0.3	<0.2	<0.2	<0.2
Perfluorooctanesulfonic acid PFOS	µg/kg	18	36	0.3	<0.2	0.4
Perfluorooctanoic acid PFOA	µg/kg	1.3	2.2	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.1	<0.1	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.2	<0.2	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	96	93	97	97	101
Surrogate $^{13}C_2$ *PFOA*	%	87	83	89	90	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	64	57	57	52	71
Extracted ISTD $^{13}C_4$ *PFOS*	%	64	57	62	55	74
Extracted ISTD $^{13}C_4$ *PFOA*	%	65	56	59	50	71
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	67	63	70	56	78
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	67	53	53	47	60
Total Positive PFHxS & PFOS	µg/kg	18	36	0.3	<0.2	0.4
Total Positive PFOS & PFOA	µg/kg	19	38	0.3	<0.2	0.4
Total Positive PFAS	µg/kg	19	39	0.3	<0.2	0.4

PFAS in Soils Short						
Our Reference		243030-21	243030-22	243030-23	243030-24	243030-25
Your Reference	UNITS	SS21	SS22	SS23	SS24	SS25
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	1.9	0.5	0.3	0.3	0.2
Perfluorooctanoic acid PFOA	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.1
6:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.1
8:2 FTS	µg/kg	<0.4	<0.4	<0.4	<0.4	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	91	87	91	92	97
Surrogate $^{13}C_2$ *PFOA*	%	90	93	83	87	87
Extracted ISTD $^{18}O_2$ *PFHxS*	%	95	90	86	102	102
Extracted ISTD $^{13}C_4$ *PFOS*	%	94	85	89	104	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	94	82	97	100	94
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	93	85	119	111	107
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	93	73	80	73	87
Total Positive PFHxS & PFOS	µg/kg	1.9	0.5	0.3	0.3	0.2
Total Positive PFOS & PFOA	µg/kg	1.9	0.5	0.3	0.3	0.2
Total Positive PFAS	µg/kg	1.9	0.5	0.3	0.3	0.2

PFAS in Soils Short						
Our Reference		243030-26	243030-27	243030-28	243030-29	243030-30
Your Reference	UNITS	SS26	SS27	SS28	SS29	SS30
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	0.4	<0.2	<0.2	<0.2
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	18	<0.2	0.8	0.2
Perfluorooctanoic acid PFOA	µg/kg	<0.1	0.1	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.1	<0.1	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.2	<0.2	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	103	92	99	101	94
Surrogate $^{13}C_2$ *PFOA*	%	89	88	84	87	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	105	136	102	112	105
Extracted ISTD $^{13}C_4$ *PFOS*	%	106	134	98	104	106
Extracted ISTD $^{13}C_4$ *PFOA*	%	103	129	97	106	106
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	115	141	111	104	100
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	87	113	87	87	107
Total Positive PFHxS & PFOS	µg/kg	<0.1	18	<0.2	0.8	0.2
Total Positive PFOS & PFOA	µg/kg	<0.1	18	<0.2	0.8	0.2
Total Positive PFAS	µg/kg	<0.1	19	<0.2	0.8	0.2

PFAS in Soils Short						
Our Reference	UNITS	243030-44	243030-47	243030-59	243030-61	243030-64
Your Reference		QC11	DC07	SW03_0-0.2	SW03_1.5-1.7	SW04_1.0-1.3
Date Sampled		08/05/2020	08/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	sediment	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.2	0.7	0.4	0.2	0.6
Perfluorooctanesulfonic acid PFOS	µg/kg	3.5	27	0.6	0.4	1.1
Perfluorooctanoic acid PFOA	µg/kg	<0.2	0.8	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	95	98	107	96	95
Surrogate $^{13}C_2$ *PFOA*	%	90	85	85	86	82
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	93	95	81	98
Extracted ISTD $^{13}C_4$ *PFOS*	%	94	87	81	81	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	85	79	88	76	88
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	89	59	93	74	89
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	67	100	87	73	73
Total Positive PFHxS & PFOS	µg/kg	3.5	28	1.1	0.6	1.7
Total Positive PFOS & PFOA	µg/kg	3.5	28	0.6	0.4	1.1
Total Positive PFAS	µg/kg	3.5	29	1.1	0.6	1.7

PFAS in Soils Short						
Our Reference		243030-65	243030-66	243030-68	243030-69	243030-70
Your Reference	UNITS	QC04	SW04_2.0-2.1	SW04_4.5-4.6	SW05_0-0.2	SW05_1.0-1.1
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.4	0.3	<0.2	0.4	0.5
Perfluorooctanesulfonic acid PFOS	µg/kg	0.6	0.8	0.4	0.6	0.5
Perfluorooctanoic acid PFOA	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	104	94	102	97	99
Surrogate $^{13}C_2$ *PFOA*	%	86	91	91	95	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	90	88	86	66
Extracted ISTD $^{13}C_4$ *PFOS*	%	85	83	79	83	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	79	85	76	70
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	89	81	93	70	74
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	73	60	67	60	86
Total Positive PFHxS & PFOS	µg/kg	1.0	1.2	0.4	0.9	1.1
Total Positive PFOS & PFOA	µg/kg	0.6	0.8	0.4	0.6	0.5
Total Positive PFAS	µg/kg	1.0	1.2	0.4	0.9	1.1

PFAS in Soils Short						
Our Reference		243030-74	243030-75	243030-76	243030-78	243030-79
Your Reference	UNITS	SW06_4.1-4.2	SW06_4.3-4.4	SW07_0.2-0.3	SW07_2.5-2.8	QC06
Date Sampled		06/05/2020	06/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.3	<0.1	<0.2	0.4	0.4
Perfluorooctanesulfonic acid PFOS	µg/kg	0.8	<0.1	0.3	1.1	1.1
Perfluorooctanoic acid PFOA	µg/kg	<0.2	<0.1	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.2	<0.1	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.4	<0.2	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	96	102	94	99	104
Surrogate $^{13}C_2$ *PFOA*	%	87	79	85	92	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%	65	90	69	66	71
Extracted ISTD $^{13}C_4$ *PFOS*	%	75	98	79	73	76
Extracted ISTD $^{13}C_4$ *PFOA*	%	66	99	71	65	70
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	59	95	78	61	66
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	72	124	90	63	72
Total Positive PFHxS & PFOS	µg/kg	1.0	<0.1	0.3	1.5	1.6
Total Positive PFOS & PFOA	µg/kg	0.8	<0.1	0.3	1.1	1.1
Total Positive PFAS	µg/kg	1.0	<0.1	0.3	1.5	1.6

PFAS in Soils Short

Our Reference		243030-81	243030-82	243030-85	243030-88	243030-89
Your Reference	UNITS	SW08_0.5-0.6	SW08_2.3-2.4	SW09_0.1-0.2	SW09_5.5-5.7	SW01_0.1-0.3
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.4	<0.2	0.9	<0.1	0.3
Perfluorooctanesulfonic acid PFOS	µg/kg	1.0	<0.2	1.6	0.3	0.6
Perfluorooctanoic acid PFOA	µg/kg	<0.2	<0.2	<0.2	<0.1	<0.2
6:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.1	<0.2
8:2 FTS	µg/kg	<0.4	<0.4	<0.4	<0.2	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	96	100	98	97	92
Surrogate $^{13}C_2$ *PFOA*	%	94	92	89	90	100
Extracted ISTD $^{18}O_2$ *PFHxS*	%	71	64	72	82	74
Extracted ISTD $^{13}C_4$ *PFOS*	%	79	69	80	87	86
Extracted ISTD $^{13}C_4$ *PFOA*	%	69	64	73	86	72
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	80	61	81	109	85
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	85	67	90	112	91
Total Positive PFHxS & PFOS	µg/kg	1.4	<0.2	2.5	0.3	0.9
Total Positive PFOS & PFOA	µg/kg	1.0	<0.2	1.6	0.3	0.6
Total Positive PFAS	µg/kg	1.4	<0.2	2.5	0.3	0.9

PFAS in Soils Short						
Our Reference		243030-90	243030-93	243030-94	243030-97	243030-98
Your Reference	UNITS	SW01_1.9-2.0	SW02_0.1-0.3	SW02_0.9-1.1	SW10_0.8-0.9	SW10_1.5-1.7
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.3	0.3	0.5	3.9	0.7
Perfluorooctanesulfonic acid PFOS	µg/kg	0.3	0.5	0.7	1.2	<0.2
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.2	<0.2	0.4	<0.2
6:2 FTS	µg/kg	<0.1	<0.2	<0.2	<0.1	<0.2
8:2 FTS	µg/kg	<0.2	<0.4	<0.4	<0.2	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	97	94	97	98	98
Surrogate $^{13}C_2$ *PFOA*	%	92	91	85	87	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%	77	74	68	78	67
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	85	79	90	77
Extracted ISTD $^{13}C_4$ *PFOA*	%	83	76	74	87	77
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	99	75	69	94	80
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	100	97	83	112	95
Total Positive PFHxS & PFOS	µg/kg	0.6	0.9	1.2	5.1	0.7
Total Positive PFOS & PFOA	µg/kg	0.3	0.5	0.7	1.7	<0.2
Total Positive PFAS	µg/kg	0.6	0.9	1.2	5.5	0.7

PFAS in Soils Short						
Our Reference	UNITS	243030-100	243030-103	243030-104	243030-106	243030-107
Your Reference		SW11_0-0.1	SW11_2.0-2.3	QC08	SW12	SW13
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.6	0.3	0.6	<0.2	1.6
Perfluorooctanesulfonic acid PFOS	µg/kg	1.2	<0.2	0.4	1.2	5.0
Perfluorooctanoic acid PFOA	µg/kg	0.1	<0.2	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.1	<0.2	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.2	<0.4	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	95	91	97	90	100
Surrogate $^{13}C_2$ *PFOA*	%	90	85	94	86	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	82	68	62	73	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	94	82	67	86	89
Extracted ISTD $^{13}C_4$ *PFOA*	%	87	77	64	77	84
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	104	84	68	86	75
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	115	95	72	92	96
Total Positive PFHxS & PFOS	µg/kg	1.8	0.3	1	1.2	6.6
Total Positive PFOS & PFOA	µg/kg	1.3	<0.2	0.4	1.2	5.0
Total Positive PFAS	µg/kg	1.9	0.3	1	1.2	6.6

PFAS in Soils Short						
Our Reference		243030-108	243030-109	243030-110	243030-111	243030-112
Your Reference	UNITS	SW14	SW15	SW16	SW17	SW18
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.3	1.8	0.5	1.0	0.5
Perfluorooctanesulfonic acid PFOS	µg/kg	2.1	29	2.6	1.3	0.8
Perfluorooctanoic acid PFOA	µg/kg	0.2	0.3	<0.2	<0.2	<0.2
6:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
8:2 FTS	µg/kg	<0.4	0.4	<0.4	<0.4	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	89	94	93	97	96
Surrogate $^{13}C_2$ *PFOA*	%	82	83	86	88	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%	82	74	80	82	87
Extracted ISTD $^{13}C_4$ *PFOS*	%	93	83	91	91	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	86	80	83	86	86
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	81	78	73	78	83
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	73	81	79	84	89
Total Positive PFHxS & PFOS	µg/kg	2.4	31	3.1	2.4	1.3
Total Positive PFOS & PFOA	µg/kg	2.3	29	2.6	1.3	0.8
Total Positive PFAS	µg/kg	2.6	31	3.1	2.4	1.3

PFAS in Soils Short						
Our Reference	UNITS	243030-113	243030-114	243030-115	243030-117	243030-118
Your Reference		SW19	SB01_0-0.2	SB01_0.2-0.4	SB02_0.1-0.3	QC02
Date Sampled		07/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.2	210	210	0.4	0.3
Perfluorooctanesulfonic acid PFOS	µg/kg	0.5	1,400	1,300	1.9	1.1
Perfluorooctanoic acid PFOA	µg/kg	<0.2	27	30	<0.1	<0.1
6:2 FTS	µg/kg	<0.2	0.3	0.6	<0.1	<0.1
8:2 FTS	µg/kg	<0.4	0.6	1	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	97	80	107	95	91
Surrogate $^{13}C_2$ *PFOA*	%	85	89	93	90	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	84	78	81	108	100
Extracted ISTD $^{13}C_4$ *PFOS*	%	91	78	78	109	106
Extracted ISTD $^{13}C_4$ *PFOA*	%	84	90	96	111	101
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	70	#	#	114	95
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	70	#	#	138	110
Total Positive PFHxS & PFOS	µg/kg	0.5	1,600	1,500	2.3	1.4
Total Positive PFOS & PFOA	µg/kg	0.5	1,400	1,300	1.9	1.1
Total Positive PFAS	µg/kg	0.5	1,600	1,500	2.3	1.4

PFAS in Soils Short						
Our Reference	UNITS	243030-119	243030-121	243030-122	243030-123	243030-127
Your Reference		SB02_0.6-0.8	SB03_0-0.2	SB03_0.4-0.6	SB03_0.9-1.1	SB04_0-0.2
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	20/05/2020	21/05/2020	20/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	21/05/2020	20/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.6	130	2.3	<0.1	4.3
Perfluorooctanesulfonic acid PFOS	µg/kg	3.0	130	3.6	0.1	19
Perfluorooctanoic acid PFOA	µg/kg	<0.2	14	0.3	<0.1	2.0
6:2 FTS	µg/kg	<0.2	2.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.4	2.6	<0.2	<0.2	2.9
Surrogate $^{13}C_8$ *PFOS*	%	95	96	94	94	99
Surrogate $^{13}C_2$ *PFOA*	%	90	93	89	84	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	92	90	102	98	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	95	113	104	110	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	86	95	117	105	98
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	74	#	150	109	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	85	#	#	122	148
Total Positive PFHxS & PFOS	µg/kg	3.6	260	5.9	0.1	24
Total Positive PFOS & PFOA	µg/kg	3.0	140	3.9	0.1	21
Total Positive PFAS	µg/kg	3.6	280	6.2	0.1	29

PFAS in Soils Short						
Our Reference	UNITS	243030-128	243030-129	243030-130	243030-131	243030-135
Your Reference		QC05	SB05_0.1-0.2	SB05_0.3-0.4	SB05_0.8-1.0	SB06_Concrete
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	concrete
Date prepared	-	20/05/2020	20/05/2020	21/05/2020	20/05/2020	20/05/2020
Date analysed	-	20/05/2020	20/05/2020	21/05/2020	20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	2.6	1.7	2.7	15	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	13	27	250	0.5	<0.1
Perfluorooctanoic acid PFOA	µg/kg	1.2	0.3	1.4	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	0.2	0.6	<0.1	<0.1
8:2 FTS	µg/kg	1	5.9	1	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	93	93	82	93	93
Surrogate $^{13}C_2$ *PFOA*	%	83	83	86	87	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%	103	90	100	100	69
Extracted ISTD $^{13}C_4$ *PFOS*	%	106	100	110	103	81
Extracted ISTD $^{13}C_4$ *PFOA*	%	118	106	88	116	63
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	#	104	#	143	39
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	138	#	148	50
Total Positive PFHxS & PFOS	µg/kg	15	29	250	15	<0.1
Total Positive PFOS & PFOA	µg/kg	14	27	250	0.5	<0.1
Total Positive PFAS	µg/kg	18	35	260	15	<0.1

PFAS in Soils Short						
Our Reference		243030-136	243030-137	243030-138	243030-139	243030-140
Your Reference	UNITS	SB08_Concrete	SB05_Concrete	SB06_0.23-0.4	SB06_0.4-0.6	SB06_1.0-1.2
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		concrete	concrete	soil	soil	soil
Date prepared	-	20/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Date analysed	-	20/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	200	<0.1	0.3	0.5
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	1,200	0.9	25	26
Perfluorooctanoic acid PFOA	µg/kg	<0.1	16	<0.1	<0.1	0.2
6:2 FTS	µg/kg	<0.1	8.9	<0.1	0.1	<0.1
8:2 FTS	µg/kg	<0.2	7.9	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	90	128	93	94	92
Surrogate $^{13}C_2$ *PFOA*	%	90	90	83	87	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	84	78	83	80	81
Extracted ISTD $^{13}C_4$ *PFOS*	%	92	92	106	103	104
Extracted ISTD $^{13}C_4$ *PFOA*	%	78	81	87	85	85
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	66	106	80	72	76
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	68	195	98	97	97
Total Positive PFHxS & PFOS	µg/kg	<0.1	1,400	0.9	26	26
Total Positive PFOS & PFOA	µg/kg	<0.1	1,200	0.9	25	26
Total Positive PFAS	µg/kg	<0.1	1,400	0.9	26	27

Client Reference: 12516828

PFAS in Soils Short						
Our Reference		243030-142	243030-143	243030-144	243030-145	243030-146
Your Reference	UNITS	SB07_0-0.2	QC03	SB07_0.4-0.6	SB08_0.2-0.4	SB08_0.4-0.6
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Date analysed	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	15	18	19	6.5	4.8
Perfluorooctanesulfonic acid PFOS	µg/kg	140	170	740	33	0.8
Perfluorooctanoic acid PFOA	µg/kg	2.6	3.3	2.9	0.9	0.2
6:2 FTS	µg/kg	<0.1	<0.1	0.2	<0.1	0.1
8:2 FTS	µg/kg	0.4	0.4	0.5	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	104	98	125	102	96
Surrogate $^{13}C_2$ *PFOA*	%	82	82	80	82	81
Extracted ISTD $^{18}O_2$ *PFHxS*	%	79	83	84	84	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	114	114	114	121	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	88	90	87	88
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	87	92	91	89	86
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	114	122	105	117	109
Total Positive PFHxS & PFOS	µg/kg	150	190	760	39	5.7
Total Positive PFOS & PFOA	µg/kg	140	170	740	34	1.0
Total Positive PFAS	µg/kg	160	190	760	40	6.0

Client Reference: 12516828

PFAS in Soils Short						
Our Reference		243030-148	243030-150	243030-151	243030-152	243030-153
Your Reference	UNITS	Creek 5	Creek 6	QC13	QC13a	DC03
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		sediment	sediment	water	water	sediment
Date prepared	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Date analysed	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	160	49	55	39	3.0
Perfluorooctanesulfonic acid PFOS	µg/kg	810	160	290	500	58
Perfluorooctanoic acid PFOA	µg/kg	32	3.2	5.1	5.5	1.6
6:2 FTS	µg/kg	<0.5	<0.2	<0.2	<0.2	1
8:2 FTS	µg/kg	<1	<0.4	<0.4	<0.4	<1
Surrogate $^{13}C_8$ *PFOS*	%	106	110	106	112	96
Surrogate $^{13}C_2$ *PFOA*	%	97	82	84	81	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	105	73	71	67	65
Extracted ISTD $^{13}C_4$ *PFOS*	%	97	116	111	110	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	86	73	70	66	68
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	147	76	87	67	74
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	120	69	85	60	90
Total Positive PFHxS & PFOS	µg/kg	970	210	340	540	61
Total Positive PFOS & PFOA	µg/kg	840	160	300	510	60
Total Positive PFAS	µg/kg	1,000	210	350	540	64

PFAS in Soils Short					
Our Reference		243030-154	243030-155	243030-162	243030-163
Your Reference	UNITS	DC04	DC05	SB02_Concrete	Creek 4
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		sediment	sediment	concrete	sediment
Date prepared	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Date analysed	-	21/05/2020	21/05/2020	21/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	1.4	0.3	0.2	4.6
Perfluorooctanesulfonic acid PFOS	µg/kg	44	7.0	0.2	33
Perfluorooctanoic acid PFOA	µg/kg	0.9	<0.2	<0.1	0.6
6:2 FTS	µg/kg	<0.5	<0.2	<0.1	<0.2
8:2 FTS	µg/kg	<1	<0.4	<0.2	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	98	99	97	92
Surrogate $^{13}C_2$ *PFOA*	%	82	81	101	81
Extracted ISTD $^{18}O_2$ *PFHxS*	%	66	76	82	69
Extracted ISTD $^{13}C_4$ *PFOS*	%	60	78	103	79
Extracted ISTD $^{13}C_4$ *PFOA*	%	62	77	97	74
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	63	77	90	83
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	71	94	101	94
Total Positive PFHxS & PFOS	µg/kg	45	7.3	0.3	38
Total Positive PFOS & PFOA	µg/kg	45	7.0	0.2	34
Total Positive PFAS	µg/kg	46	7.3	0.3	38

Moisture						
Our Reference		243030-1	243030-2	243030-3	243030-4	243030-5
Your Reference	UNITS	SS01	SS02	SS03	SS04	SS05
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	50	18	12	19	13

Moisture						
Our Reference		243030-6	243030-7	243030-8	243030-9	243030-10
Your Reference	UNITS	SS06	SS07	SS08	SS09	SS10
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	19	11	12	20	13

Moisture						
Our Reference		243030-11	243030-12	243030-13	243030-14	243030-15
Your Reference	UNITS	SS11	SS12	SS13	SS14	SS15
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	18	18	18	17	16

Moisture						
Our Reference		243030-16	243030-17	243030-18	243030-19	243030-20
Your Reference	UNITS	SS16	SS17	SS18	SS19	SS20
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	23	19	39	51	38

Moisture						
Our Reference		243030-21	243030-22	243030-23	243030-24	243030-25
Your Reference	UNITS	SS21	SS22	SS23	SS24	SS25
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	43	34	36	42	13

Moisture						
Our Reference		243030-26	243030-27	243030-28	243030-29	243030-30
Your Reference	UNITS	SS26	SS27	SS28	SS29	SS30
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	14	9.7	38	45	42

Moisture						
Our Reference		243030-44	243030-47	243030-59	243030-61	243030-64
Your Reference	UNITS	QC11	DC07	SW03_0-0.2	SW03_1.5-1.7	SW04_1.0-1.3
Date Sampled		08/05/2020	08/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	sediment	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	40	63	44	41	44

Moisture						
Our Reference		243030-65	243030-66	243030-68	243030-69	243030-70
Your Reference	UNITS	QC04	SW04_2.0-2.1	SW04_4.5-4.6	SW05_0-0.2	SW05_1.0-1.1
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	40	44	50	48	52

Moisture						
Our Reference		243030-74	243030-75	243030-76	243030-78	243030-79
Your Reference	UNITS	SW06_4.1-4.2	SW06_4.3-4.4	SW07_0.2-0.3	SW07_2.5-2.8	QC06
Date Sampled		06/05/2020	06/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	40	13	41	39	36

Moisture						
Our Reference		243030-81	243030-82	243030-85	243030-88	243030-89
Your Reference	UNITS	SW08_0.5-0.6	SW08_2.3-2.4	SW09_0.1-0.2	SW09_5.5-5.7	SW01_0.1-0.3
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	50	58	44	13	36

Moisture						
Our Reference		243030-90	243030-93	243030-94	243030-97	243030-98
Your Reference	UNITS	SW01_1.9-2.0	SW02_0.1-0.3	SW02_0.9-1.1	SW10_0.8-0.9	SW10_1.5-1.7
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	20	32	38	24	54

Moisture						
Our Reference		243030-100	243030-103	243030-104	243030-106	243030-107
Your Reference	UNITS	SW11_0-0.1	SW11_2.0-2.3	QC08	SW12	SW13
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	16	50	65	30	41

Moisture						
Our Reference		243030-108	243030-109	243030-110	243030-111	243030-112
Your Reference	UNITS	SW14	SW15	SW16	SW17	SW18
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	32	58	42	36	33

Moisture						
Our Reference		243030-113	243030-114	243030-115	243030-117	243030-118
Your Reference	UNITS	SW19	SB01_0-0.2	SB01_0.2-0.4	SB02_0.1-0.3	QC02
Date Sampled		07/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	40	11	16	6.3	6.3

Moisture						
Our Reference		243030-119	243030-121	243030-122	243030-123	243030-127
Your Reference	UNITS	SB02_0.6-0.8	SB03_0-0.2	SB03_0.4-0.6	SB03_0.9-1.1	SB04_0-0.2
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	44	4.0	11	12	14

Moisture						
Our Reference		243030-128	243030-129	243030-130	243030-131	243030-138
Your Reference	UNITS	QC05	SB05_0.1-0.2	SB05_0.3-0.4	SB05_0.8-1.0	SB06_0.23-0.4
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	14	12	15	11	9.3

Moisture						
Our Reference		243030-139	243030-140	243030-142	243030-143	243030-144
Your Reference	UNITS	SB06_0.4-0.6	SB06_1.0-1.2	SB07_0-0.2	QC03	SB07_0.4-0.6
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	20/05/2020
Moisture	%	13	11	16	16	9.0

Moisture						
Our Reference		243030-145	243030-146	243030-148	243030-150	243030-151
Your Reference	UNITS	SB08_0.2-0.4	SB08_0.4-0.6	Creek 5	Creek 6	QC13
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		soil	soil	sediment	sediment	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	21/05/2020
Date analysed	-	20/05/2020	20/05/2020	20/05/2020	20/05/2020	22/05/2020
Moisture	%	11	6.4	73	45	42

Moisture						
Our Reference		243030-152	243030-153	243030-154	243030-155	243030-163
Your Reference	UNITS	QC13a	DC03	DC04	DC05	Creek 4
Date Sampled		06/05/2020	06/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		water	sediment	sediment	sediment	sediment
Date prepared	-	21/05/2020	19/05/2020	19/05/2020	19/05/2020	21/05/2020
Date analysed	-	22/05/2020	20/05/2020	20/05/2020	20/05/2020	22/05/2020
Moisture	%	44	77	69	31	55

PFAS in Waters Short						
Our Reference	UNITS	243030-31	243030-32	243030-33	243030-34	243030-35
Your Reference		WB01	FXB01	FX01	FX02	FX03
Date Sampled		06/05/2020	07/05/2020	07/05/2020	07/05/2020	07/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	0.01	0.01	0.02
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	0.01	0.03	0.04
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	0.01	<0.01	0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	104	100	103	104	95
Surrogate $^{13}C_2$ *PFOA*	%	91	92	94	92	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	87	86	86	88
Extracted ISTD $^{13}C_4$ *PFOS*	%	90	89	91	86	91
Extracted ISTD $^{13}C_4$ *PFOA*	%	102	101	102	99	100
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	138	136	149	154	152
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	98	96	102	101	96
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	0.03	0.05	0.06
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	0.03	0.03	0.05
Total Positive PFAS	µg/L	<0.01	<0.01	0.04	0.05	0.07

PFAS in Waters Short						
Our Reference		243030-36	243030-37	243030-38	243030-39	243030-40
Your Reference	UNITS	FX04	FX05	FX06	FX07	DC02
Date Sampled		07/05/2020	07/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	0.02	<0.01	<0.01	0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	0.06	0.02	0.01	0.03
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	97	104	102	106	103
Surrogate $^{13}C_2$ *PFOA*	%	94	92	93	94	91
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	86	88	85	85
Extracted ISTD $^{13}C_4$ *PFOS*	%	90	89	89	89	88
Extracted ISTD $^{13}C_4$ *PFOA*	%	99	99	101	97	100
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	146	152	143	138	137
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	97	98	94	94	91
Total Positive PFHxS & PFOS	µg/L	0.01	0.08	0.02	0.01	0.04
Total Positive PFOA & PFOS	µg/L	0.01	0.06	0.02	0.01	0.03
Total Positive PFAS	µg/L	0.01	0.08	0.02	0.01	0.04

PFAS in Waters Short						
Our Reference		243030-41	243030-42	243030-43	243030-45	243030-46
Your Reference	UNITS	DC03	DC04	DC05	QC12	DC07
Date Sampled		08/05/2020	08/05/2020	08/05/2020	08/05/2020	08/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	21/05/2020	19/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	21/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.02	0.02	0.04	2.1	0.05
Perfluorooctanesulfonic acid PFOS	µg/L	0.05	0.06	0.09	0.64	0.09
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	0.14	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	101	106	104	97	96
Surrogate $^{13}C_2$ *PFOA*	%	91	94	87	90	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%	88	87	84	93	87
Extracted ISTD $^{13}C_4$ *PFOS*	%	92	86	86	100	93
Extracted ISTD $^{13}C_4$ *PFOA*	%	103	102	105	94	99
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	149	142	138	91	137
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	95	95	89	84	93
Total Positive PFHxS & PFOS	µg/L	0.07	0.08	0.13	2.7	0.14
Total Positive PFOA & PFOS	µg/L	0.05	0.06	0.09	0.78	0.09
Total Positive PFAS	µg/L	0.07	0.08	0.13	2.9	0.14

PFAS in Waters Short						
Our Reference	UNITS	243030-48	243030-49	243030-50	243030-51	243030-52
Your Reference		RB01	RB02	RB03	RB04	RB05
Date Sampled		06/05/2020	06/05/2020	07/05/2020	07/05/2020	08/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	108	99	98	103	106
Surrogate $^{13}C_2$ *PFOA*	%	90	89	89	92	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	86	84	92	83	85
Extracted ISTD $^{13}C_4$ *PFOS*	%	86	93	98	96	92
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	98	105	99	101
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	140	133	144	129	132
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	91	95	99	94	88
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFAS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01

PFAS in Waters Short

Our Reference	UNITS	243030-53	243030-54	243030-55	243030-56	243030-57
Your Reference		RB06	FB01	FB02	FB03	TB01
Date Sampled		08/05/2020	06/05/2020	07/05/2020	08/05/2020	06/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	19/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	μg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	112	97	101	100	109
Surrogate $^{13}C_2$ *PFOA*	%	97	101	100	107	101
Extracted ISTD $^{18}O_2$ *PFHxS*	%	84	94	95	94	92
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	96	93	91	76
Extracted ISTD $^{13}C_4$ *PFOA*	%	96	98	102	98	102
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	129	128	131	130	136
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	91	81	84	82	57
Total Positive PFHxS & PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFAS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01

PFAS in Waters Short

Our Reference		243030-58	243030-147	243030-149	243030-161
Your Reference	UNITS	TB02	Creek 5	Creek 6	Creek 4
Date Sampled		07/05/2020	06/05/2020	06/05/2020	06/05/2020
Type of sample		water	water	water	water
Date prepared	-	19/05/2020	19/05/2020	19/05/2020	21/05/2020
Date analysed	-	19/05/2020	19/05/2020	19/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	2.2	2.0	0.17
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	0.94	0.66	0.12
Perfluorooctanoic acid PFOA	µg/L	<0.01	0.23	0.14	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*	%	105	107	104	100
Surrogate $^{13}C_2$ *PFOA*	%	99	105	99	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	93	91	100
Extracted ISTD $^{13}C_4$ *PFOS*	%	80	78	80	103
Extracted ISTD $^{13}C_4$ *PFOA*	%	101	100	98	95
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	131	133	122	90
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	58	75	73	94
Total Positive PFHxS & PFOS	µg/L	<0.01	3.1	2.6	0.29
Total Positive PFOA & PFOS	µg/L	<0.01	1.2	0.80	0.13
Total Positive PFAS	µg/L	<0.01	3.4	2.8	0.30

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	243030-2
Date prepared	-			20/05/2020	1	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Date analysed	-			20/05/2020	1	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	1	0.2	0.3	40	111	102
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	1	0.2	0.4	67	107	99
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	1	<0.2	<0.2	0	108	103
6:2 FTS	µg/kg	0.1	Org-029	<0.1	1	<0.2	<0.2	0	104	97
8:2 FTS	µg/kg	0.2	Org-029	<0.2	1	<0.4	<0.4	0	106	92
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	95	1	99	89	11	96	94
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	84	1	91	92	1	90	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	89	1	83	79	5	88	89
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	106	1	81	89	9	100	100
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	91	1	82	81	1	87	90
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	80	1	87	84	4	79	96
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	103	1	100	90	11	92	114

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	243030-22
Date prepared	-			[NT]	11	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Date analysed	-			[NT]	11	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	11	<0.1	<0.1	0	117	113
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	11	<0.1	<0.1	0	101	104
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	11	<0.1	<0.1	0	99	103
6:2 FTS	µg/kg	0.1	Org-029	[NT]	11	<0.1	<0.1	0	102	105
8:2 FTS	µg/kg	0.2	Org-029	[NT]	11	<0.2	<0.2	0	104	100
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	11	96	94	2	93	99
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	11	81	82	1	82	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	11	93	86	8	99	88
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	11	85	85	0	112	89
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	11	85	79	7	112	88

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	243030-22
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	11	96	89	8	112	89
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	11	67	60	11	157	73

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	243030-74
Date prepared	-			[NT]	21	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Date analysed	-			[NT]	21	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	21	<0.2	<0.2	0	106	114
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	21	1.9	1.5	24	104	108
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	21	<0.2	<0.2	0	97	101
6:2 FTS	µg/kg	0.1	Org-029	[NT]	21	<0.2	<0.2	0	91	101
8:2 FTS	µg/kg	0.2	Org-029	[NT]	21	<0.4	<0.4	0	99	96
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	21	91	98	7	100	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	21	90	91	1	90	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	21	95	102	7	84	62
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	21	94	91	3	97	72
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	21	94	94	0	92	62
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	21	93	93	0	90	60
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	21	93	93	0	98	67

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	243030-108
Date prepared	-			[NT]	44	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Date analysed	-			[NT]	44	20/05/2020	20/05/2020		20/05/2020	20/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	44	<0.2	<0.2	0	97	116
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	44	3.5	3.0	15	109	107
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	44	<0.2	<0.2	0	103	101
6:2 FTS	µg/kg	0.1	Org-029	[NT]	44	<0.2	<0.2	0	97	103
8:2 FTS	µg/kg	0.2	Org-029	[NT]	44	<0.4	<0.4	0	88	98
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	44	95	101	6	104	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	44	90	84	7	91	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	44	93	95	2	102	86
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	44	94	87	8	102	92
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	44	85	88	3	104	85
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	44	89	85	5	113	74
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	44	67	67	0	152	90

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	243030-138
Date prepared	-			[NT]	70	20/05/2020	20/05/2020		21/05/2020	21/05/2020
Date analysed	-			[NT]	70	20/05/2020	20/05/2020		21/05/2020	21/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	70	0.5	0.6	18	111	113
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	70	0.5	0.5	0	103	106
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	70	<0.2	<0.2	0	101	101
6:2 FTS	µg/kg	0.1	Org-029	[NT]	70	<0.2	<0.2	0	96	97
8:2 FTS	µg/kg	0.2	Org-029	[NT]	70	<0.4	<0.4	0	82	95
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	70	99	96	3	92	95
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	70	88	83	6	85	84
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	70	66	66	0	117	84
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	70	73	76	4	119	103
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	70	70	71	1	118	86

Client Reference: 12516828

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	243030-138
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	[NT]	70	74	78	5	133	78
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	[NT]	70	86	76	12	120	96

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	89	20/05/2020	20/05/2020		[NT]	[NT]
Date analysed	-			[NT]	89	20/05/2020	20/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	89	0.3	<0.2	40	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	89	0.6	0.5	18	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	89	<0.2	<0.2	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	89	<0.2	<0.2	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	89	<0.4	<0.4	0	[NT]	[NT]
Surrogate $^{13}C_8$ PFOS	%		Org-029	[NT]	89	92	103	11	[NT]	[NT]
Surrogate $^{13}C_2$ PFOA	%		Org-029	[NT]	89	100	88	13	[NT]	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	[NT]	89	74	73	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	[NT]	89	86	83	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	[NT]	89	72	77	7	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	[NT]	89	85	80	6	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	[NT]	89	91	91	0	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	107	20/05/2020	20/05/2020		[NT]	[NT]
Date analysed	-			[NT]	107	20/05/2020	20/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	107	1.6	1.8	12	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	107	5.0	5.7	13	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	107	<0.2	0.2	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	107	<0.2	<0.2	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	107	<0.4	<0.4	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	107	100	100	0	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	107	85	86	1	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	107	83	81	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	107	89	89	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	107	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	107	75	81	8	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	107	96	110	14	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	119	20/05/2020	20/05/2020		[NT]	[NT]
Date analysed	-			[NT]	119	20/05/2020	20/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	119	0.6	0.6	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	119	3.0	2.7	11	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	119	<0.2	<0.2	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	119	<0.2	<0.2	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	119	<0.4	<0.4	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	119	95	92	3	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	119	90	88	2	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	119	92	95	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	119	95	99	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	119	86	89	3	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils 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]	119	74	77	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	119	85	81	5	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	136	20/05/2020	20/05/2020		[NT]	[NT]
Date analysed	-			[NT]	136	20/05/2020	20/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	136	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	136	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	136	<0.1	<0.1	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	136	<0.1	<0.1	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	136	<0.2	<0.2	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	136	90	91	1	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	136	90	88	2	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	136	84	87	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	136	92	92	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	136	78	78	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	136	66	59	11	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	136	68	62	9	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	148	21/05/2020	21/05/2020		[NT]	[NT]
Date analysed	-			[NT]	148	21/05/2020	21/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	148	160	190	17	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	148	810	980	19	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	148	32	30	6	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	148	<0.5	<0.5	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	148	<1	<1	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	148	106	104	2	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	148	97	100	3	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	148	105	105	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	148	97	95	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	148	86	84	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	148	147	137	7	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	148	120	84	35	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	243030-32
Date prepared	-			21/05/2020	31	19/05/2020	19/05/2020		21/05/2020	19/05/2020
Date analysed	-			21/05/2020	31	19/05/2020	19/05/2020		21/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	31	<0.01	<0.01	0	108	109
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	31	<0.01	<0.01	0	109	112
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	31	<0.01	<0.01	0	111	106
6:2 FTS	µg/L	0.01	Org-029	<0.01	31	<0.01	<0.01	0	100	105
8:2 FTS	µg/L	0.02	Org-029	<0.02	31	<0.02	<0.02	0	95	92
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	99	31	104	105	1	108	108
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	97	31	91	90	1	93	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	90	31	87	91	4	87	86
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	85	31	90	91	1	88	85
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	73	31	102	104	2	98	98
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	75	31	138	141	2	134	128
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	60	31	98	94	4	100	96

QUALITY CONTROL: PFAS in Waters Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	243030-55
Date prepared	-			[NT]	41	19/05/2020	19/05/2020		21/05/2020	19/05/2020
Date analysed	-			[NT]	41	19/05/2020	19/05/2020		21/05/2020	19/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	41	0.02	0.02	0	92	102
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	41	0.05	0.05	0	103	101
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	41	<0.01	<0.01	0	98	99
6:2 FTS	µg/L	0.01	Org-029	[NT]	41	<0.01	<0.01	0	88	102
8:2 FTS	µg/L	0.02	Org-029	[NT]	41	<0.02	<0.02	0	91	99
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	41	101	100	1	100	96
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	41	91	89	2	99	103
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	41	88	84	5	90	90
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	41	92	88	4	86	90
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	41	103	100	3	72	94

QUALITY CONTROL: PFAS in Waters Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	243030-55
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	41	149	138	8	78	120
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	41	95	89	7	70	81

QUALITY CONTROL: PFAS in Waters Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	54	19/05/2020	19/05/2020		[NT]	[NT]
Date analysed	-			[NT]	54	19/05/2020	19/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	54	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	54	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	54	<0.01	<0.01	0	[NT]	[NT]
6:2 FTS	µg/L	0.01	Org-029	[NT]	54	<0.01	<0.01	0	[NT]	[NT]
8:2 FTS	µg/L	0.02	Org-029	[NT]	54	<0.02	<0.02	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	54	97	98	1	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	54	101	106	5	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	54	94	94	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	54	96	92	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	54	98	96	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	54	128	130	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	54	81	89	9	[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.

Report Comments

The PQL has been raised due to the high moisture content in sample/s, resulting in a high dilution factor.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Begin forwarded message:

From: Dilara Valiff <Dilara.Valiff@ghd.com>
Date: 20 June 2020 at 9:00:58 am ACST
To: Envirolab Adelaide <adelaide@envirolab.com.au>
Cc: Alex Stenta <astenta@envirolab.com.au>
Subject: Brukunga CFS PFAS analysis request

243030 - A
Due: 29/6/20

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Alex
Could you please dearchive and test for PFAS short suite the following samples from the batch for the attached report 243371:

- Water samples DC06A and DC06B
- Soil samples SB01_0.9-1.1. - 116

Kind regards

Dilara Valiff
Senior Environmental Consultant

GHD
Proudly employee owned
T: +61 8111 6572 | M: +61 420 959 236 | E: dilara.valiff@ghd.com
Level 4 211 Victoria Square Adelaide SA 5000 | www.ghd.com

Connect

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 243030-A

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	121 soil, 31 water, 7 sediment, 4 concrete
Date samples received	13/05/2020
Date completed instructions received	20/06/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	29/06/2020
Date of Issue	26/06/2020

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

Results Approved By
Fiona Tan, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

PFAS in Soils Short		
Our Reference		243030-A-116
Your Reference	UNITS	SB01_0.9-1.1
Date Sampled		06/05/2020
Type of sample		soil
Date prepared	-	23/06/2020
Date analysed	-	23/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	62
Perfluorooctanesulfonic acid PFOS	µg/kg	2,100
Perfluorooctanoic acid PFOA	µg/kg	14
6:2 FTS	µg/kg	0.4
8:2 FTS	µg/kg	21
Surrogate $^{13}C_8$ *PFOS*	%	101
Surrogate $^{13}C_2$ *PFOA*	%	110
Extracted ISTD $^{18}O_2$ *PFHxS*	%	100
Extracted ISTD $^{13}C_4$ *PFOS*	%	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	84
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	122
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	157
Total Positive PFHxS & PFOS	µg/kg	2,100
Total Positive PFOS & PFOA	µg/kg	2,100
Total Positive PFAS	µg/kg	2,200

Moisture		
Our Reference		243030-A-116
Your Reference	UNITS	SB01_0.9-1.1
Date Sampled		06/05/2020
Type of sample		soil
Date prepared	-	24/06/2020
Date analysed	-	25/06/2020
Moisture	%	33

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	243030-A-116
Date prepared	-			23/06/2020	116	23/06/2020	23/06/2020		23/06/2020	23/06/2020
Date analysed	-			23/06/2020	116	23/06/2020	23/06/2020		23/06/2020	23/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	116	62	58	7	100	##
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	116	2100	2200	5	103	##
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	116	14	13	7	99	58
6:2 FTS	µg/kg	0.1	Org-029	<0.1	116	0.4	0.4	0	94	102
8:2 FTS	µg/kg	0.2	Org-029	<0.2	116	21	25	17	107	69
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	116	101	110	9	98	##
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	102	116	110	104	6	105	110
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	108	116	100	101	1	107	89
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	100	116	94	92	2	95	36
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	104	116	84	87	4	97	83
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	122	116	122	113	8	119	110
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	143	116	157	136	14	129	135

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.

Report Comments

PFAS in Soil:
Percent recovery is not possible to report due to the high concentration of the analytes in the sample/s. However an acceptable recovery was obtained for the LCS.
Percent recovery for PFOA is outside of global acceptance criteria (60%-140%) due to the high concentration of the analytes in the sample/s causing interference. However an acceptable recovery was obtained for the LCS.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Jessica Hie

From: Alex Stenta
Sent: Monday, 13 July 2020 12:23 PM
To: Phalak Inthakesone; Fiona Tan; Samplereceipt Distribution Sydney
Subject: FW: Additional Sample Testing

243030-B
Due: 20/7/20
Std TAT.

Hi Guys,

Please see additional testing request for PFAS samples below:

Kind Regards,

Alex Stenta | BD Manager SA | Envirolab Group

Celebrating 15 years of **Great Science. Great Service.**
7a The Parade Norwood SA 5067
T 08 7087 6800 **F** 08 8362 1776 **M** 0406 350 706
E astenta@envirolab.com.au | **W** www.envirolab.com.au

View reduced sampling bottle provision for PFAS in water | **COVID-19 Update**

Please note that all samples submitted to the Envirolab Group laboratories will be analysed under the Envirolab Group Terms and Conditions. The Terms and Conditions are accessible by clicking this link

From: Mei Lyn Herbertt <MeiLyn.Herbertt@ghd.com>
Sent: Monday, 13 July 2020 11:47 AM
To: Alex Stenta <astenta@envirolab.com.au>
Cc: Dilara Valiff <Dilara.Valiff@ghd.com>
Subject: Additional Sample Testing

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Alex!

PFAS_short.

Hope you're doing well!

For the CFS job 12516828 can we get leechate testing for the following sludge samples:

15 - SS15
17 - SS17
27 - SS27
64 - SW04_1.0-1.3
85 - SW09_0.1-0.2
107 - SW13

Thanks so much for your help! ☺

Kind Regards

Mei Lyn Herbertt
BSc(Adv), BSc(Hons)
Environmental Scientist

GHD
Proudly employee owned
T: +61 8 8111 6789 | M: +61 448 416 733 | V: 336789 | meilyn.herbertt@ghd.com
Level 4 211 Victoria Square Adelaide SA 5000 Australia | http://www.ghd.com/

Connect

Water | Energy & Resources | Environment | Property & Buildings | Transportation

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 243030-B

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	121 soil, 31 water, 7 sediment, 4 concrete
Date samples received	13/05/2020
Date completed instructions received	13/07/2020

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	20/07/2020
Date of Issue	17/07/2020

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

Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in TCLP Short

Our Reference		243030-B-15	243030-B-17	243030-B-27	243030-B-64	243030-B-85
Your Reference	UNITS	SS15	SS17	SS27	SW04_1.0-1.3	SW09_0.1-0.2
Date Sampled		08/05/2020	08/05/2020	08/05/2020	06/05/2020	07/05/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/07/2020	15/07/2020	15/07/2020	15/07/2020	15/07/2020
Date analysed	-	15/07/2020	15/07/2020	15/07/2020	15/07/2020	15/07/2020
pH of soil for fluid# determ.	pH units	6.0	7.1	3.9	8.3	8.3
pH of soil TCLP (after HCl)	pH units	1.7	1.8	1.6	4.2	4.3
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	5.0	5.1	4.9	6.2	6.2
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.03	0.01	<0.01	0.01	0.02
Perfluorooctanesulfonic acid PFOS	µg/L	0.59	0.32	0.29	0.02	0.02
Perfluorooctanoic acid PFOA	µg/L	0.21	0.09	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	103	92	102	94	103
Surrogate $^{13}C_2$ *PFOA*	%	97	102	101	95	101
Extracted ISTD $^{18}O_2$ *PFHxS*	%	97	100	95	95	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	99	104	100	103	95
Extracted ISTD $^{13}C_4$ *PFOA*	%	104	105	100	102	103
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	110	109	104	105	103
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	120	121	123	127	114
Total Positive PFHxS & PFOS	µg/L	0.61	0.33	0.29	0.03	0.04
Total Positive PFOS & PFOA	µg/L	0.80	0.41	0.29	0.02	0.02
Total Positive PFAS	µg/L	0.82	0.42	0.29	0.03	0.04

PFAS in TCLP Short		
Our Reference	UNITS	243030-B-107
Your Reference		SW13
Date Sampled		07/05/2020
Type of sample		soil
Date prepared	-	15/07/2020
Date analysed	-	15/07/2020
pH of soil for fluid# determ.	pH units	8.2
pH of soil TCLP (after HCl)	pH units	2.7
Extraction fluid used	-	1
pH of final Leachate	pH units	6.2
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.05
Perfluorooctanesulfonic acid PFOS	µg/L	0.08
Perfluorooctanoic acid PFOA	µg/L	<0.01
6:2 FTS	µg/L	<0.01
8:2 FTS	µg/L	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	99
Surrogate $^{13}C_2$ *PFOA*	%	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	103
Extracted ISTD $^{13}C_4$ *PFOS*	%	99
Extracted ISTD $^{13}C_4$ *PFOA*	%	99
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	109
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	133
Total Positive PFHxS & PFOS	µg/L	0.13
Total Positive PFOS & PFOA	µg/L	0.08
Total Positive PFAS	µg/L	0.13

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 TCLP Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	243030-B-17
Date prepared	-			15/07/2020	15	15/07/2020	15/07/2020		15/07/2020	15/07/2020
Date analysed	-			15/07/2020	15	15/07/2020	15/07/2020		15/07/2020	15/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	15	0.03	0.02	40	101	102
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	15	0.59	0.47	23	101	104
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	15	0.21	0.18	15	105	106
6:2 FTS	µg/L	0.01	Org-029	<0.01	15	<0.01	<0.01	0	111	112
8:2 FTS	µg/L	0.02	Org-029	<0.02	15	<0.02	<0.02	0	107	101
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	97	15	103	100	3	102	98
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	15	97	103	6	103	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	95	15	97	98	1	95	98
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	92	15	99	104	5	101	100
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	98	15	104	102	2	98	101
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	98	15	110	117	6	97	100
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	119	15	120	120	0	108	110

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.

ENVIROLAB GROUP ENVIROLAB SERVICES mpl

CHAIN OF CUSTODY FORM - Client

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C. McKenzie 18/5/20 1045

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ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
☎ 02 9910 6200 | ✉ sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt, Myaree, WA 6154
☎ 08 9317 2505 | ✉ lab@mpl.com.au

Melbourne Lab - Envirolab Services
25 Research Drive, Croydon South, VIC 3136
☎ 03 9763 2500 | ✉ melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
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☎ 08 7087 6800 | ✉ adelaide@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
☎ 07 3266 9532 | ✉ brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
☎ 08 8967 1201 | ✉ darwin@envirolab.com.au

Client: GHD
Contact Person: Robert Webb
Project Mgr: Dilara Valiff
Sampler: Robert Webb
Address: 211 Victoria Square, Adelaide SA 5000
Phone:
Mob: 468764489
Email: Robert.Webb2@ghd.com
Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. : 19SA002
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite (water)	PFAS Short Suite (sediment)														Provide as much information about the sample as you can
1	SS01		8/05/2020	soil	1															
2	SS02		8/05/2020	soil	1															
3	SS03		8/05/2020	soil	1															
4	SS04		8/05/2020	soil	1															
5	SS05		8/05/2020	soil	1															
6	SS06		8/05/2020	soil	1															
7	SS07		8/05/2020	soil	1															
8	SS08		8/05/2020	soil	1															
9	SS09		8/05/2020	soil	1															
10	SS10		8/05/2020	soil	1															
11	SS11		8/05/2020	soil	1															
12	SS12		8/05/2020	soil	1															
13	SS13		8/05/2020	soil	1															
14	SS14		8/05/2020	soil	1															
15	SS15		8/05/2020	soil	1															
16	SS16		8/05/2020	soil	1															

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 243039
Date Received:
Time Received:
Received by:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Environmental Divisio
Sydney
Work Order Reference
ES201698

Telephone : +61-2-8784 8555

Form 302_V006

Issue date: 7 October 2019

18/5/20 116

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17	SS17		8/05/2020	soil	1		
18	SS18		8/05/2020	soil	1		
19	SS19		8/05/2020	soil	1		
20	SS20		8/05/2020	soil	1		
21	SS21		8/05/2020	soil	1		
22	SS22		8/05/2020	soil	1		
23	SS23		8/05/2020	soil	1		
24	SS24		8/05/2020	soil	1		
25	SS25		8/05/2020	soil	1		
26	SS26		8/05/2020	soil	1		
27	SS27		8/05/2020	soil	1		
28	SS28		8/05/2020	soil	1		
29	SS29		8/05/2020	soil	1		
30	SS30		8/05/2020	soil	1		
31	WB01		6/05/2020	water	1		
32	FXB01 7		7/05/2020	water	1		
33	FX01		7/05/2020	water	1		
34	FX02		7/05/2020	water	1		
35	FX03		7/05/2020	water	1		
36	FX04		7/05/2020	water	1		
37	FX05		7/05/2020	water	1		
38	FX06		7/05/2020	[illegible]	1		
39	FX07		7/05/2020	[illegible]	1		
40	DC02		8/05/2020	water, sed	1	spot	
41	DC03		8/05/2020	water, sediment	1	(153 sediment)	
42	DC04		8/05/2020	water, sediment	1	(154 sediment)	
/43 water.	DC05		8/05/2020	water, sediment	1	(155 sediment)	
44	QC11		8/05/2020	~~water~~S	1		
① —	QC11a		8/05/2020	water	1		Please forward to ALS
45	QC12		8/05/2020	sediment	1		
② —	QC12a		8/05/2020	sediment	1		Please forward to ALS
46/47	DC07		8/05/2020	water, sediment	1		
48	RB01		6/05/2020	water	1		
49	RB02		6/05/2020	water	1		
50	RB03		7/05/2020	water	1		
51	RB04		7/05/2020	water	1		
52	RB05		8/05/2020	water	1		
53	RB06		8/05/2020	water	1		

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18/5/20
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[illegible]

54	FB01		6/05/2020	water	1															
55	FB02		7/05/2020	water	1															
56	FB03		8/05/2020	water	1															
57	TB01		6/05/2020	water	1															
58	TB02		7/05/2020	water	1															
59	SW03_0-0.2		6/05/2020	soil	1															
60	SW03_0.5-0.7		6/05/2020	soil																
61	SW03_1.5-1.7		6/05/2020	soil	1															
62	SW03_4.8-4.9		6/05/2020	soil																
63	SW04_0-0.2		6/05/2020	soil																
64	SW04_1.0-1.3		6/05/2020	soil	1															
65	QC04		6/05/2020	soil	1															
③ —	QC04a		6/05/2020	soil	1															Please forward to ALS
66	SW04_2.0-2.1		6/05/2020	soil	1															
67	SW04_3.85_3.9		6/05/2020	soil																
68	SW04_4.5-4.6		6/05/2020	soil	1															
69	SW05_0-0.2		6/05/2020	soil	1															
70	SW05_1.0-1.1		6/05/2020	soil	1															
71	SW05_2.0-2.2		6/05/2020	soil																
72	SW05_3.4-3.6		6/05/2020	soil																
73	SW06_0.5-0.7		6/05/2020	soil																
74	SW06_4.1-4.2		6/05/2020	soil	1															
75	SW06_4.3-4.4		6/05/2020	soil	1															
76	SW07_0.2-0.3		7/05/2020	soil	1															
77	SW07_1.0-1.2		7/05/2020	soil																
78	SW07_2.5-2.8		7/05/2020	soil	1															
79	QC06		7/05/2020	soil	1															
④ —	QC06a		7/05/2020	soil	1															Please forward to ALS
80	SW07_4.2-4.3		7/05/2020	soil																
81	SW08_0.5-0.6		7/05/2020	soil	1															
82	SW08_2.3-2.4		7/05/2020	soil	1															
83	SW08_4.0-4.1		7/05/2020	soil																
84	SW08_4.95-5		7/05/2020	soil																
85	SW09_0.1-0.2		7/05/2020	soil	1															
[illegible]	SW09_1.6-1.8 ?		7/05/2020	soil	1															
86	SW09_2.0-2.2		7/05/2020	soil																
87	SW09_4.0-4.2		7/05/2020	soil																
88	SW09_5.5-5.7		7/05/2020	soil	1															
89	SW01_0.1-0.3		7/05/2020	soil	1															
90	SW01_1.9-2.0		7/05/2020	soil	1															

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C.mullen
18/5/20 1045

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91	SW01_3.3-3.6		7/05/2020	soil																
92	QC07		7/05/2020	soil																
⑤ —	QC07a		7/05/2020	soil																Please forward to ALS
93	SW02_0.1-0.3		7/05/2020	soil	1															
94	SW02_0.9-1.1		7/05/2020	soil	1															
95	SW02_1.4-1.5		7/05/2020	soil																
96	SW10_0-0.2		7/05/2020	soil																
97	SW10_0.8-0.9		7/05/2020	soil	1															
98	SW10_1.5-1.7		7/05/2020	soil	1															
99	SW10_2.7-2.8		7/05/2020	soil																
100	SW11_0-0.1		7/05/2020	soil	1															
101	SW11_0.4-0.5		7/05/2020	soil																
102	SW11_1.3-1.5		7/05/2020	soil																
103	SW11_2.0-2.3		7/05/2020	soil	1															
104	QC08		7/05/2020	soil	1															
⑥ —	QC08a		7/05/2020	soil	1															Please forward to ALS
105	SW11_3.0-3.2		7/05/2020	soil																
106	SW12		7/05/2020	soil	1															
107	SW13		7/05/2020	soil	1															
108	SW14		7/05/2020	soil	1															
109	SW15		7/05/2020	soil	1															
110	SW16		7/05/2020	soil	1															
111	SW17		7/05/2020	soil	1															
112	SW18		7/05/2020	soil	1															
113	SW19		7/05/2020	soil	1															
NR	SW20		7/05/2020	soil	1															
114	SB01_0-0.2		6/05/2020	soil	1															
115	SB01_0.2-0.4	(0.4 - 0.6)	6/05/2020	soil	1															
116	SB01_0.9-1.1	(0.8 - 1.0)	6/05/2020	soil																
NR	SB01_1.7-1.9		6/05/2020	soil																
NR	SB01_2.3-2.8		6/05/2020	soil																
NR	SB01_3.0-3.2		6/05/2020	soil																
117	SB02_0.1-0.3		6/05/2020	soil																
117	SB02_0.1-0.3		6/05/2020	soil	1															
118	QC02		6/05/2020	soil	1															
⑦ —	QC02a		6/05/2020	soil	1															Please forward to ALS
119	SB02_0.6-0.8		6/05/2020	soil	1															
120	SB02_0.8-0.95		6/05/2020	soil																
121	SB03_0-0.2	(0.1 - 0.2)	6/05/2020	soil	1															
122	SB03_0.4-0.6		6/05/2020	soil	1															

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Sydney
C. McLena
18/5/20 1045

243050 am

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123	SB03_0.9-1.1		6/05/2020	soil	1															
124	SB03_1.7-1.9		6/05/2020	soil																
125	SB03_2.3-2.8		6/05/2020	soil																
126	SB03_3-3.2		6/05/2020	soil																
127	SB04_0-0.2		6/05/2020	soil	1															
128	QC05		6/05/2020	soil	1															
⑧ —	QC05a		6/05/2020	soil	1															Please forward to ALS
129	SB05_0.1-0.2		6/05/2020	soil	1															
130	SB05_0.3-0.4		6/05/2020	soil	1															
131	SB05_0.8-1.0		6/05/2020	soil	1															
132	QC01		6/05/2020	soil																
⑨ —	QC01a		6/05/2020	soil																Please forward to ALS
133	SB05_1.7-1.9		6/05/2020	soil																
134	SB05_3.1-3.3		6/05/2020	soil																
135	SB06_Concrete		6/05/2020	concrete	1															
136	SB08_Concrete		6/05/2020	concrete	1															
137	SB05-Concrete x2		6/05/2020	concrete	1															
NR	SB02-Concrete		6/05/2020	concrete	1															
138	SB06_0.23-0.4		6/05/2020	soil	1															
139	SB06_0.4-0.6		6/05/2020	soil	1															
140	SB06_1.0-1.2		6/05/2020	soil	1															
141	SB06_1.9-2.1		6/05/2020	soil																
142	SB07_0-0.2		6/05/2020	soil	1															
143	QC03		6/05/2020	soil	1															
⑩ —	QC03a		6/05/2020	soil	1															Please forward to ALS
144	SB07_0.4-0.6		6/05/2020	soil	1															
145	SB08_02-0.4	(0.1-0.3)	6/05/2020	soil	1															
146	SB08_0.4-0.6	(0.3-0.5)	6/05/2020	soil	1															
147 | 148	Creek_5		8/05/2020	water, sediment	1															
149 | 150	Creek_6		8/05/2020	water, sediment	1															
151	QC13		8/05/2020	water	1															
152	QC13a		8/05/2020	water	1															
NR	QC14		8/05/2020	sediment	1															
NR	QC14a		8/05/2020	sediment	1															
NR	Creek_4		8/05/2020	water, sediment	1															

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (C GHD	**Received by (Company):**	***Lab Use Only***	
Print Name: Robert Webb	**Print Name:**	**Job number:**	**Cooling: Ice / Ice pack / None**
Date & Time: RW	**Date & Time:**	**Temperature:**	**Security seal: Intact / Broken / None**
Signature: 11/05/2020	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**	

156. SW5-0.3
157. SW6 1.2.
158. SSO
159. QC10 water
160. QC10A water.

161. water unlabelled.

Rec'
18/5/20 11.6°
1500

Form 302_V006

Issue date: 7 October 2019

CERTIFICATE OF ANALYSIS

Work Order : **ES2016983**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : +61 08 8111 6600
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : Robert Webb
Site :
Quote number : EN/005/19
No. of samples received : 10
No. of samples analysed : 8

Page : 1 of 6
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 18-May-2020 15:00
Date Analysis Commenced : 21-May-2020
Issue Date : 25-May-2020 12:31

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

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

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

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

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

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS 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: **SEDIMENT** (Matrix: **SOIL**)			*Client sample ID*	**QC11a**	**QC04a**	**QC06a**	**QC08a**	**QC02a**
			Client sampling date / time	08-May-2020 00:00	06-May-2020 00:00	07-May-2020 00:00	07-May-2020 00:00	06-May-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2016983-001**	**ES2016983-003**	**ES2016983-004**	**ES2016983-006**	**ES2016983-007**
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**31.4**	**47.0**	**36.5**	**60.2**	**5.9**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	**0.0004**	**0.0006**	<0.0002	**0.0002**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0043**	**0.0007**	**0.0013**	<0.0002	**0.0013**
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	**0.0002**	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0043**	**0.0011**	**0.0019**	<0.0002	**0.0015**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0043**	**0.0011**	**0.0021**	<0.0002	**0.0015**
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**96.0**	**106**	**105**	**96.0**	**104**
13C8-PFOA	----	0.0002	%	**106**	**109**	**117**	**102**	**110**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)			*Client sample ID*	**QC05a**	**QC03a**	**----**	**----**	**----**
			Client sampling date / time	06-May-2020 00:00	06-May-2020 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2016983-008**	**ES2016983-010**	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**13.5**	**15.3**	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	**0.0003**	**0.0004**	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0044**	**0.0154**	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0280**	**0.178**	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	**0.001**	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0009**	**0.0018**	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0013**	**0.0020**	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0007**	**0.0008**	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0031**	**0.0033**	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	**0.0108**	**0.0012**	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0324**	**0.193**	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0495**	**0.204**	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**95.5**	**96.5**	----	----	----
13C8-PFOA	----	0.0002	%	**102**	**106**	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QC12a**	**----**	**----**	**----**	**----**
			Client sampling date / time	08-May-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2016983-002**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	**0.11**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	**2.23**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.98**	----	----	----	----
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	**0.12**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	**0.35**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	**0.12**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	**0.19**	----	----	----	----
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	**3.21**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	**4.10**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**103**	----	----	----	----
13C8-PFOA	----	0.02	%	**108**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

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

Sub-Matrix: **WATER**

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

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2016983**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 18-May-2020
Order number	: 12516828	Date Analysis Commenced	: 21-May-2020
C-O-C number	: ----	Issue Date	: 25-May-2020
Sampler	: Robert Webb		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 10		
No. of samples analysed	: 8		

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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3034509)									
ES2016983-004	QC06a	EA055: Moisture Content	----	0.1	%	36.5	35.6	2.55	0% - 20%
ES2017065-006	Anonymous	EA055: Moisture Content	----	0.1	%	19.1	17.6	8.32	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3036572)									
EM2008355-004	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
ES2016983-003	QC04a	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0004	0.0005	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0007	0.0007	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3036572)									
EM2008355-004	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
ES2016983-003	QC04a	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3036572)									
EM2008355-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3036572) - continued									
EM2008355-004	Anonymous	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES2016983-003	QC04a	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3036215)									
ES2017131-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.20	0.21	0.00	0% - 50%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	1.20	1.10	8.38	0% - 20%
ES2016983-002	QC12a	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.98	0.84	15.2	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.11	0.11	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	2.23	2.36	5.29	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3036215)									
ES2017131-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.10	0.10	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.21	0.21	0.00	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.06	0.06	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ES2016983-002	QC12a	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.19	0.17	10.2	0% - 50%
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.12	0.12	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.35	0.36	0.00	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.12	0.11	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3036215)									
ES2017131-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3036215) - continued									
ES2017131-001	Anonymous	EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2016983-002	QC12a	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3036572)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.6	72.0	128
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.4	67.0	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.4	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3036572)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	116	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	113	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	114	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	113	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3036572)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	93.2	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	107	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	111	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	120	69.2	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3036215)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	118	72.0	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	106	68.0	131
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	118	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3036215)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	98.1	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	122	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	122	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	128	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: 3036215)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	109	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	114	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	112	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	115	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: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3036572)							
EM2008355-004	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	108	72.0	128
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	106	67.0	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	112	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3036572)							
EM2008355-004	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	123	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	117	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	119	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	115	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	116	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3036572)							
EM2008355-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	106	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	118	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	115	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	121	69.2	143

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3036215)							
ES2016983-002	QC12a	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	127	72.0	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	# Not Determined	68.0	131
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	80.2	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3036215)							
ES2016983-002	QC12a	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	94.3	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	126	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	126	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	126	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	106	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3036215)							
ES2016983-002	QC12a	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	102	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	117	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	117	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	119	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2016983**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 18-May-2020
Site	:	Issue Date	: 25-May-2020
Sampler	: Robert Webb	No. of samples received	: 10
Order number	: 12516828	No. of samples analysed	: 8

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES2016983--002	QC12a	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA055: Moisture Content (Dried @ 105-110°C)						
HDPE Soil Jar QC04a, QC02a, QC05a, QC03a	----	----	----	21-May-2020	20-May-2020	**1**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QC04a, QC02a, QC05a, QC03a	**06-May-2020**	**----**	----	----	**21-May-2020**	20-May-2020	✗
HDPE Soil Jar (EA055) QC06a, QC08a	**07-May-2020**	**----**	----	----	**21-May-2020**	21-May-2020	✓
HDPE Soil Jar (EA055) QC11a	**08-May-2020**	**----**	----	----	**21-May-2020**	22-May-2020	✓

Matrix: **SOIL**

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

Method ***Container*** */ Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC04a, QC02a, QC05a, QC03a	**06-May-2020**	**23-May-2020**	02-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC06a, QC08a	**07-May-2020**	**23-May-2020**	03-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC11a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC04a, QC02a, QC05a, QC03a	**06-May-2020**	**23-May-2020**	02-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC06a, QC08a	**07-May-2020**	**23-May-2020**	03-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC11a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC04a, QC02a, QC05a, QC03a	**06-May-2020**	**23-May-2020**	02-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC06a, QC08a	**07-May-2020**	**23-May-2020**	03-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC11a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC04a, QC02a, QC05a, QC03a	**06-May-2020**	**23-May-2020**	02-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC06a, QC08a	**07-May-2020**	**23-May-2020**	03-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓
HDPE Soil Jar (EP231X) QC11a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	02-Jul-2020	✓

Matrix: **WATER**

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

Method ***Container*** */ Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X) QC12a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	04-Nov-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X) QC12a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	04-Nov-2020	✓

Matrix: **WATER**

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

Method ***Container*** */ Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) QC12a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	04-Nov-2020	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) QC12a	**08-May-2020**	**23-May-2020**	04-Nov-2020	✓	**24-May-2020**	04-Nov-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
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*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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 FORM - Client

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Client: GHD
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Sean.Sparrow@ghd.com
Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: ESDAT
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite (water)	PFAS Short Suite (sediment)	Hold													Provide as much information about the sample as you can
1	TB02		18/05/2020	water	1															
2	DC06		18/05/2020	water	1															
3	QA16		18/05/2020	water	1															
–	QA16A		18/05/2020	water	1															please forward to ALS
W → 4 , 5 ← sed	DC06A		18/05/2020	water, sediment			1													
6	QA17		18/05/2020	sediment			1													
7	QA17A		18/05/2020	sediment			1													
W → 8 , 9 ← sed	DC06B		18/05/2020	water, sediment			1													
10	RB02		18/05/2020	water	1															
11	FX08		18/05/2020	water	1															
12	FX09		18/05/2020	water			1													
13	FX10		18/05/2020	water			1													
14	FX11		18/05/2020	water			1													
15	FX12		18/05/2020	water			1													
16	FX13		18/05/2020	water	1															
17	FXB2		18/05/2020	water	1															
18	QA18		18/05/2020	water	1															
–	QA18A		18/05/2020	water	1															please forward to ALS
19	DD01		18/05/2020	water	1															
20	QA19		18/05/2020	water	1															
–	QA19A		18/05/2020	water	1															please forward to ALS
~~21~~																				

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD Pty Ltd	Received by (Company): ELS Syd	**Lab Use Only**	
Print Name: Sean Sparrow	Print Name: Ming Yan Zo	Job number: 243371	Cooling: Ice / [✓ Ice pack] / None
Date & Time: 19/05/2020 0:00 2:00:00 PM	Date & Time: 21/05/2020 12:30	Temperature: 10.0	Security seal: [✓ Intact] / Broken / None
Signature:	Signature: MZ	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

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CERTIFICATE OF ANALYSIS 243371

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	18 water, 2 sediment
Date samples received	21/05/2020
Date completed instructions received	21/05/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	29/05/2020
Date of Issue	27/05/2020

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Results Approved By
Fiona Tan, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

PFAS in Waters Short						
Our Reference		243371-1	243371-2	243371-3	243371-10	243371-11
Your Reference	UNITS	TB02	DC06	QA16	RB02	FX08
Date Sampled		18/05/2020	18/05/2020	18/05/2020	18/05/2020	18/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	22/05/2020	22/05/2020	22/05/2020	22/05/2020	22/05/2020
Date analysed	-	22/05/2020	22/05/2020	22/05/2020	22/05/2020	22/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	0.07	0.07	<0.01	0.13
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	0.17	0.07	<0.01	0.82
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01	0.04
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	0.11
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	0.1
Surrogate $^{13}C_8$ *PFOS*	%	96	102	105	102	101
Surrogate $^{13}C_2$ *PFOA*	%	108	106	106	100	103
Extracted ISTD $^{18}O_2$ *PFHxS*	%	100	96	100	97	103
Extracted ISTD $^{13}C_4$ *PFOS*	%	94	86	88	97	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	120	101	117	120	123
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	115	92	114	113	147
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	76	63	77	98	115
Total Positive PFHxS & PFOS	µg/L	<0.01	0.24	0.14	<0.01	0.95
Total Positive PFOA & PFOS	µg/L	<0.01	0.17	0.07	<0.01	0.86
Total Positive PFAS	µg/L	<0.01	0.24	0.14	<0.01	1.2

Client Reference: 12516828

PFAS in Waters Short						
Our Reference		243371-16	243371-17	243371-18	243371-19	243371-20
Your Reference	UNITS	FX13	FXB2	QA18	DD01	QA19
Date Sampled		18/05/2020	18/05/2020	18/05/2020	18/05/2020	18/05/2020
Type of sample		water	water	water	water	water
Date prepared	-	22/05/2020	22/05/2020	22/05/2020	22/05/2020	22/05/2020
Date analysed	-	22/05/2020	22/05/2020	22/05/2020	22/05/2020	22/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.06	<0.01	0.05	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.42	<0.01	0.33	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	0.01	<0.01	0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	98	100	94	102	105
Surrogate $^{13}C_2$ *PFOA*	%	104	103	108	104	106
Extracted ISTD $^{18}O_2$ *PFHxS*	%	110	96	101	109	105
Extracted ISTD $^{13}C_4$ *PFOS*	%	102	95	98	96	96
Extracted ISTD $^{13}C_4$ *PFOA*	%	143	118	130	121	129
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	178	123	151	120	145
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	101	103	103	87	85
Total Positive PFHxS & PFOS	µg/L	0.48	<0.01	0.39	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	0.44	<0.01	0.35	<0.01	<0.01
Total Positive PFAS	µg/L	0.49	<0.01	0.40	<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. 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	243371-2
Date prepared	-			22/05/2020	1	22/05/2020	22/05/2020		22/05/2020	22/05/2020
Date analysed	-			22/05/2020	1	22/05/2020	22/05/2020		22/05/2020	22/05/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	103	106
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	112	106
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	108	109
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	102	95
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	94	124
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	97	1	96	102	6	103	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	102	1	108	103	5	96	106
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	89	1	100	96	4	93	97
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	91	1	94	86	9	91	86
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	88	1	120	125	4	93	100
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	90	1	115	134	15	102	98
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	91	1	76	82	8	108	65

QUALITY CONTROL: PFAS in Waters Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	20	22/05/2020	22/05/2020		[NT]	[NT]
Date analysed	-			[NT]	20	22/05/2020	22/05/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	20	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	20	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	20	<0.01	<0.01	0	[NT]	[NT]
6:2 FTS	µg/L	0.01	Org-029	[NT]	20	<0.01	<0.01	0	[NT]	[NT]
8:2 FTS	µg/L	0.02	Org-029	[NT]	20	<0.02	<0.02	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	20	105	100	5	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	20	106	106	0	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	20	105	103	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	20	96	97	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	20	129	131	2	[NT]	[NT]

Client Reference: 12516828

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]	20	145	142	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	20	85	90	6	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Begin forwarded message:

From: Dilara Valiff <Dilara.Valiff@ghd.com>
Date: 20 June 2020 at 9:00:58 am ACST
To: Envirolab Adelaide <adelaide@envirolab.com.au>
Cc: Alex Stenta <astenta@envirolab.com.au>
Subject: Brukunga CFS PFAS analysis request

243371-A
Due: 29/6/20

Hi Alex
Could you please dearchive and test for PFAS short suite the following samples from the batch for the attached report 243371:

4 8

- Water samples DC06A and DC06B
- Soil samples SB01_0.9-1.1.

Kind regards

Dilara Valiff
Senior Environmental Consultant

GHD
Proudly employee owned
T: +61 8111 6572 | M: +61 420 959 236 | E: dilara.valiff@ghd.com
Level 4 211 Victoria Square Adelaide SA 5000 | www.ghd.com

Connect

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 243371-A

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	18 water, 2 sediment
Date samples received	21/05/2020
Date completed instructions received	20/06/2020

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	29/06/2020
Date of Issue	24/06/2020

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Results Approved By
Fiona Tan, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

NATA
ACCREDITED FOR
TECHNICAL
COMPETENCE

PFAS in Waters Short			
Our Reference	UNITS	243371-A-4	243371-A-8
Your Reference		DC06A	DC06B
Date Sampled		18/05/2020	18/05/2020
Type of sample		water	water
Date prepared	-	23/06/2020	23/06/2020
Date analysed	-	23/06/2020	23/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.07	0.06
Perfluorooctanesulfonic acid PFOS	µg/L	0.09	0.08
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	105	100
Surrogate $^{13}C_2$ *PFOA*	%	101	105
Extracted ISTD $^{18}O_2$ *PFHxS*	%	107	113
Extracted ISTD $^{13}C_4$ *PFOS*	%	100	102
Extracted ISTD $^{13}C_4$ *PFOA*	%	103	105
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	117	136
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	121	109
Total Positive PFHxS & PFOS	µg/L	0.16	0.14
Total Positive PFOA & PFOS	µg/L	0.09	0.08
Total Positive PFAS	µg/L	0.16	0.14

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. 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-1	[NT]
Date prepared	-			23/06/2020	[NT]	[NT]	[NT]	[NT]	23/06/2020	[NT]
Date analysed	-			23/06/2020	[NT]	[NT]	[NT]	[NT]	23/06/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	97	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	95	[NT]
6:2 FTS	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	96	[NT]
8:2 FTS	µg/L	0.02	Org-029	<0.02	[NT]	[NT]	[NT]	[NT]	95	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	104	[NT]	[NT]	[NT]	[NT]	102	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	125	[NT]	[NT]	[NT]	[NT]	117	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	114	[NT]	[NT]	[NT]	[NT]	110	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	113	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	125	[NT]	[NT]	[NT]	[NT]	104	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	119	[NT]	[NT]	[NT]	[NT]	123	[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.

Andrew (Fitzy) Fitzsimons

From: Alex Stenta
Sent: Monday, 29 June 2020 12:32 PM
To: Jessica Hie
Cc: Samplereceipt Distribution Sydney
Subject: FW: Results for Registration 243030-A 12516828
Attachments: 243371-COC.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

243371-B

Due: 6/7/20

Hi Jess,

Please see COC for 243371 additional testing for PFAS samples instead.

Kind Regards,

Alex Stenta | BD Manager SA | Envirolab Group

Celebrating 15 years of **Great Science. Great Service.**
7a The Parade Norwood SA 5067
T 08 7087 6800 **F** 08 8362 1776 **M** 0406 350 706
E astenta@envirolab.com.au | **W** www.envirolab.com.au

View reduced sampling bottle provision for PFAS in water | **COVID-19 Update**

Please note that all samples submitted to the Envirolab Group laboratories will be analysed under the Envirolab Group Terms and Conditions. The Terms and Conditions are accessible by clicking this link

From: Rob Webb <Robert.Webb2@ghd.com>
Sent: Monday, 29 June 2020 11:56 AM
To: Alex Stenta <astenta@envirolab.com.au>
Cc: Envirolab Adelaide <adelaide@envirolab.com.au>; Dilara Valiff <Dilara.Valiff@ghd.com>
Subject: RE: Results for Registration 243030-A 12516828

Hi Alex,

5 9

In the attached COCs there should have been two sediment samples at labelled DC06a and DC06b (lab report 243371). Are we able to get these two samples analysed for PFAS short suite?

Regards,

Robert Webb
Environmental Engineer

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 243371-B

Client Details

Client	GHD Pty Ltd
Attention	Robert Webb
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	18 water, 2 sediment
Date samples received	21/05/2020
Date completed instructions received	21/05/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	06/07/2020
Date of Issue	02/07/2020

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Results Approved By
Manju Dewendrage, Chemist
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Soils Short			
Our Reference		243371-B-5	243371-B-9
Your Reference	UNITS	DC06A	DC06B
Date Sampled		18/05/2020	18/05/2020
Type of sample		sediment	sediment
Date prepared	-	30/06/2020	30/06/2020
Date analysed	-	30/06/2020	30/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.8	0.5
Perfluorooctanesulfonic acid PFOS	µg/kg	28	15
Perfluorooctanoic acid PFOA	µg/kg	<0.5	<0.2
6:2 FTS	µg/kg	<0.5	<0.2
8:2 FTS	µg/kg	<1	<1
Surrogate $^{13}C_8$ *PFOS*	%	100	95
Surrogate $^{13}C_2$ *PFOA*	%	90	86
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	74
Extracted ISTD $^{13}C_4$ *PFOS*	%	86	79
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	56
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	149	55
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	99	31
Total Positive PFHxS & PFOS	µg/kg	29	15
Total Positive PFOS & PFOA	µg/kg	28	15
Total Positive PFAS	µg/kg	29	15

Moisture			
Our Reference		243371-B-5	243371-B-9
Your Reference	UNITS	DC06A	DC06B
Date Sampled		18/05/2020	18/05/2020
Type of sample		sediment	sediment
Date prepared	-	30/06/2020	30/06/2020
Date analysed	-	01/07/2020	01/07/2020
Moisture	%	80	52

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			30/06/2020	[NT]	[NT]	[NT]	[NT]	30/06/2020	[NT]
Date analysed	-			30/06/2020	[NT]	[NT]	[NT]	[NT]	30/06/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
6:2 FTS	µg/kg	0.1	Org-029	<0.1	[NT]	[NT]	[NT]	[NT]	93	[NT]
8:2 FTS	µg/kg	0.2	Org-029	<0.2	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	101	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	105	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	109	[NT]	[NT]	[NT]	[NT]	105	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	105	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	108	[NT]	[NT]	[NT]	[NT]	103	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	88	[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.

Report Comments

PFAS in Soil: The PQLs have been raised due to the high moisture content.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

CHAIN OF CUSTODY FORM - Client

ENVIROLAB GROUP
National phone number 1300 424 344

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Client: GHD
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address: 211 Victoria Square, Adelaide, SA 5000
Phone:
Mob: 0498260626
Email: GHDLabReports@ghd.com
Sean.Sparrow@ghd.com
Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No.:
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: ESDAT
Lab Comments:

Environmental Division
Sydney
Work Order Reference
ES2017792
Telephone : + 61-2-8784 8555

Sample information					Tests Required			Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite (water)	PFAS Short Suite (sediment)	Hold	Provide as much information about the sample as you can
1	TB02		18/05/2020	water	1			
2	DC06		18/05/2020	water	1			
3	QA16		18/05/2020	water	1			
—	QA16A		18/05/2020	water	1			please forward to ALS
W → 4, 5 ← sed	DC06A		18/05/2020	water, sediment			1	
6	QA17		18/05/2020	sediment			1	
7	QA17A		18/05/2020	sediment			1	
W → 8, 9 ← sed	DC06B		18/05/2020	water, sediment			1	
10	RB02		18/05/2020	water	1			
11	FX08		18/05/2020	water	1			
12	FX09		18/05/2020	water			1	
13	FX10		18/05/2020	water			1	
14	FX11		18/05/2020	water			1	
15	FX12		18/05/2020	water			1	
16	FX13		18/05/2020	water	1			
17	FXB2		18/05/2020	water	1			
18	QA18		18/05/2020	water	1			
—	QA18A		18/05/2020	water	1			please forward to ALS
19	DD01		18/05/2020	water	1			
20	QA19		18/05/2020	water	1			
—	QA19A		18/05/2020	water	1			please forward to ALS
~~21~~								

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	GHD Pty Ltd / ELS	Received by (Company):	ES Syd	**Lab Use Only**	
Print Name:	Sean Sparrow / Helen Wong	Print Name:	Ming Yan Zo	Job number: 243371	Cooling: Ice / [✓ Ice pack] / None
Date & Time:	19/05/2020 0:00 2:00:00 PM	Date & Time:	21/05/2020 1230	Temperature: 10.0	Security seal: [✓ Intact] / Broken / None
Signature:		Signature:	MJ	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Date & Time: 22-5-20
10:06

Rec - Scoffy
22/5/20 1540
12.6°C

Form 302_V006

Issue date: 7 October 2019

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2017792**
Client : **GHD PTY LTD**
Contact : SEAN SPARROW
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : ----
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005/19
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 4
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 22-May-2020 15:10
Date Analysis Commenced : 27-May-2020
Issue Date : 28-May-2020 10:31

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

The analytical procedures used by 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**)			*Client sample ID*	**QA16A**	**QA18A**	**QA19A**	**----**	**----**
			Client sampling date / time	18-May-2020 00:00	18-May-2020 00:00	18-May-2020 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2017792-001**	**ES2017792-002**	**ES2017792-003**	**--------**	**--------**
				Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	**0.08**	**0.06**	<0.02	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.11**	**0.40**	<0.01	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	**0.06**	**0.06**	<0.02	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	**0.01**	<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	<0.05	<0.05	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	**0.19**	**0.46**	<0.01	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	**0.25**	**0.53**	<0.01	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**112**	**117**	**115**	----	----
13C8-PFOA	----	0.02	%	**83.4**	**87.0**	**85.2**	----	----

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	: **ES2017792**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SEAN SPARROW	Contact	: Angus Harding
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	: 12516828	Date Samples Received	: 22-May-2020
Order number	: 12516828	Date Analysis Commenced	: 27-May-2020
C-O-C number	: ----	Issue Date	: 28-May-2020
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

The analytical procedures used by 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	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3042989)									
ES2017792-001	QA16A	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.11	0.13	17.6	0% - 50%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.08	0.08	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3042989)									
ES2017792-001	QA16A	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.06	0.06	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3042989)									
ES2017792-001	QA16A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3042989)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	106	72.0	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	114	68.0	131
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	115	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3042989)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	106	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	112	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	108	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	125	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	125	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3042989)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	114	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	121	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	124	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	115	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(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3042989)							
ES2017792-002	QA18A	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	120	72.0	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	130	68.0	131
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	99.2	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3042989)							
ES2017792-002	QA18A	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	119	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	102	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	116	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	114	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3042989)							

Sub-Matrix**: WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3042989) - continued							
ES2017792-002	QA18A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	101	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	118	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	108	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	99.2	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2017792**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SEAN SPARROW	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 22-May-2020
Site	:	Issue Date	: 28-May-2020
Sampler	: SEAN SPARROW	No. of samples received	: 3
Order number	: 12516828	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	1	13	7.69	10.00	NEPM 2013 B3 & ALS QC Standard

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) QA16A, QA18A, QA19A	**18-May-2020**	**27-May-2020**	14-Nov-2020	✓	**27-May-2020**	14-Nov-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X) QA16A, QA18A, QA19A	**18-May-2020**	**27-May-2020**	14-Nov-2020	✓	**27-May-2020**	14-Nov-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) QA16A, QA18A, QA19A	**18-May-2020**	**27-May-2020**	14-Nov-2020	✓	**27-May-2020**	14-Nov-2020	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) QA16A, QA18A, QA19A	**18-May-2020**	**27-May-2020**	14-Nov-2020	✓	**27-May-2020**	14-Nov-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	13	**7.69**	**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 FORM - Client

ENVIROLAB GROUP
ENVIROLAB SERVICES
mpl

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Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

ENVIROLAB GROUP

National phone number 1300 424 344

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Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample 1 2	PFAS Agirt Suite (water)	PFAS Short Suite (sediment)														Provide as much information about the sample as you can
1	DC08		9/06/2020	water, sediment	1	1														
2	QA20		9/06/2020	3 water, 4 sediment	1	1														
4 ALS	QA20A		9/06/2020	water	1															Please forward to ALS
TD 3 3 16/06	TB03		9/06/2020	5 water	1															

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD Pty Ltd
Print Name: Sean Sparrow
Date & Time: 12/06/2020
Signature:

Received by (Company): ELS
Print Name: Alex Stanton.
Date & Time: 12/06/20
Signature:

Lab Use Only
Job number: 244942
Cooling: [✓ Ice] / Ice pack / None
Temperature: 2.1 °C
Security seal: [✓ Intact] / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

ELS Sydney Group, 16.06.2020, 12:15.

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CERTIFICATE OF ANALYSIS 244942

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	3 Water, 2 Sediment
Date samples received	16/06/2020
Date completed instructions received	16/06/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	23/06/2020
Date of Issue	22/06/2020

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

Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Fiona Tan, LC Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

PFAS in Waters Short

Our Reference		244942-1	244942-3	244942-5
Your Reference	UNITS	DC08	QA20	TB03
Date Sampled		09/06/2020	09/06/2020	09/06/2020
Type of sample		Water	Water	Water
Date prepared	-	17/06/2020	17/06/2020	17/06/2020
Date analysed	-	17/06/2020	17/06/2020	17/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.06	0.06	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.08	0.07	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	109	105	105
Surrogate $^{13}C_2$ *PFOA*	%	108	109	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%	121	121	108
Extracted ISTD $^{13}C_4$ *PFOS*	%	102	106	102
Extracted ISTD $^{13}C_4$ *PFOA*	%	129	133	146
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	155	190	187
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	87	98	86
Total Positive PFHxS & PFOS	µg/L	0.14	0.13	<0.01
Total Positive PFOA & PFOS	µg/L	0.08	0.07	<0.01
Total Positive PFAS	µg/L	0.14	0.13	<0.01

PFAS in Soils Short

Our Reference		244942-2	244942-4
Your Reference	UNITS	DC08	QA20
Date Sampled		09/06/2020	09/06/2020
Type of sample		Sediment	Sediment
Date prepared	-	17/06/2020	17/06/2020
Date analysed	-	17/06/2020	17/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	2.1	1.7
Perfluorooctanesulfonic acid PFOS	µg/kg	65	53
Perfluorooctanoic acid PFOA	µg/kg	1.0	0.6
6:2 FTS	µg/kg	<0.5	<0.5
8:2 FTS	µg/kg	<1	<1
Surrogate $^{13}C_8$ *PFOS*	%	98	101
Surrogate $^{13}C_2$ *PFOA*	%	84	87
Extracted ISTD $^{18}O_2$ *PFHxS*	%	74	75
Extracted ISTD $^{13}C_4$ *PFOS*	%	81	84
Extracted ISTD $^{13}C_4$ *PFOA*	%	84	80
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	94	93
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	84	73
Total Positive PFHxS & PFOS	µg/kg	68	55
Total Positive PFOS & PFOA	µg/kg	66	54
Total Positive PFAS	µg/kg	69	56

Moisture			
Our Reference		244942-2	244942-4
Your Reference	UNITS	DC08	QA20
Date Sampled		09/06/2020	09/06/2020
Type of sample		Sediment	Sediment
Date prepared	-	17/06/2020	17/06/2020
Date analysed	-	18/06/2020	18/06/2020
Moisture	%	74	67

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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	244942-3
Date prepared	-			17/06/2020	1	17/06/2020	17/06/2020		17/06/2020	17/06/2020
Date analysed	-			17/06/2020	1	17/06/2020	17/06/2020		17/06/2020	17/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	0.06	0.06	0	95	79
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	0.08	0.08	0	98	98
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	97	96
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	95	92
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	92	88
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	100	1	109	103	6	100	102
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	1	108	106	2	102	109
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	104	1	121	123	2	106	118
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	106	1	102	107	5	103	101
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	104	1	129	131	2	103	130
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	111	1	155	171	10	114	177
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	87	1	87	87	0	96	88

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	244942-4
Date prepared	-			17/06/2020	2	17/06/2020	17/06/2020		17/06/2020	17/06/2020
Date analysed	-			17/06/2020	2	17/06/2020	17/06/2020		17/06/2020	17/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	2.1	1.9	10	111	100
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	65	59	10	123	##
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	1.0	1.0	0	101	100
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.5	<0.5	0	99	99
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<1	<1	0	114	109
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	2	98	100	2	97	95
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	87	2	84	90	7	90	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	98	2	74	81	9	96	76
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	115	2	81	87	7	118	85
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	125	2	84	87	4	120	82
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	123	2	94	101	7	116	96
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	131	2	84	84	0	123	79

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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Soil:
PQLs raised due to the high moisture content of the samples.

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Phone:
Mob: 0498 260 626
Email: GHDLabReports@ghd.com
Sean.Sparrow@ghd.com
Dilara.Valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample Information					Tests Required		Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Agit Suite (water)	PFAS Short Suite (sediment)	Provide as much information about the sample as you can
1	DC08		9/06/2020	water, sediment	1	1	
2	·QA20		9/06/2020	water, sediment	1	1	
ALS	QA20A		9/06/2020	water	1		Please forward to ALS
3	TB03		9/06/2020	water	1		

Relinquished by ELS Sydney
C. Mclean
17/6/20 900 am

Environmental Division
Sydney
Work Order Reference
ES2021003
Telephone : + 61-2-8784 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD Pty Ltd	Received by (Company): ELS	**Lab Use Only**	
Print Name: Sean Sparrow	Print Name: Alex Stanton.	Job number: 244942	Cooling: [✓ Ice] / Ice pack / None
Date & Time: 12/06/2020	Date & Time: 12/06/20	Temperature: 2.1°C	Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]	

Rec - Sophie 17/6/20 10·2°C 1755

ELS Sydney Samp, 16.06.2020, 12:15.

Form 302_V006

Issue date: 7 October 2019

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2021003**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SEAN SPARROW	Contact	: Angus Harding
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 17-Jun-2020 17:55
Order number	: 12516828	Date Analysis Commenced	: 24-Jun-2020
C-O-C number	: ----	Issue Date	: 25-Jun-2020 12:54
Sampler	: ----		
Site	:		
Quote number	: EN/005/19		
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. 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**)			Client sample ID	**QA20A**	----	----	----	----
			Client sampling date / time	09-Jun-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2021003-001**	--------	--------	--------	--------
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	**0.09**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.15**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	**0.04**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QA20A**	**----**	**----**	**----**	**----**
			Client sampling date / time	09-Jun-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2021003-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	**0.28**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	**0.24**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	**0.28**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**114**	----	----	----	----
13C8-PFOA	----	0.02	%	**109**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order : **ES2021003**

Client : **GHD PTY LTD**
Contact : SEAN SPARROW
Address : LEVEL 15, 133 CASTLEREAGH STREET
SYDNEY NSW, AUSTRALIA 2000
Telephone : ----
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : ----
Site :
Quote number : EN/005/19
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 17-Jun-2020
Date Analysis Commenced : 24-Jun-2020
Issue Date : 25-Jun-2020

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
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 hig

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3097130) - continued									
ES2021002-002	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3097130) - continued									
EM2010513-004	Anonymous	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2021002-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit

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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3097130)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	89.6	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	104	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	96.6	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	97.6	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	101	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	101	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3097130)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	96.0	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	106	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	97.8	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	99.8	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	100	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	98.6	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	93.6	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	108	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	108	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	115	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3097130)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	96.4	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	114	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	106	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	107	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	108	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	109	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	96.2	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	111	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	107	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	97.0	67.0	138

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	101	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(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	96.8	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	114	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	103	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	113	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	91.4	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	111	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	106	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	119	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	110	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	115	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	108	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	116	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	115	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	99.0	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	121	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	114	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	119	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	108	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	133	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	110	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	120	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	111	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	122	65.0	136

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3097130) - continued							
ES2021002-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	111	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	118	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	111	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	102	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	81.0	71.4	144

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2021003**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SEAN SPARROW	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 17-Jun-2020
Site	:	Issue Date	: 25-Jun-2020
Sampler	: ----	No. of samples received	: 1
Order number	: 12516828	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method ***Container*** */ Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X) QA20A	**09-Jun-2020**	**24-Jun-2020**	06-Dec-2020	✓	**24-Jun-2020**	06-Dec-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X) QA20A	**09-Jun-2020**	**24-Jun-2020**	06-Dec-2020	✓	**24-Jun-2020**	06-Dec-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X) QA20A	**09-Jun-2020**	**24-Jun-2020**	06-Dec-2020	✓	**24-Jun-2020**	06-Dec-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) QA20A	**09-Jun-2020**	**24-Jun-2020**	06-Dec-2020	✓	**24-Jun-2020**	06-Dec-2020	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) QA20A	**09-Jun-2020**	**24-Jun-2020**	06-Dec-2020	✓	**24-Jun-2020**	06-Dec-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
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 FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address:
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Phone:
Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): CFS BRUKUNGA
PO No.: 12516828
Envirolab Quote No. : 19SA002 V2
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite	PH	TDS	Metals (8 Suite)												Provide as much information about the sample as you can
1	GW01		15/06/2020	water	X															
2	QA20		15/06/2020	water	X															
ALS	QA20A		15/06/2020	water	X															Please forward to ALS
3	GW06		15/06/2020	water	X															
4	KAN23		15/06/2020	water	X	X	X	X												Metals sample was not filtered in the field
NR	GW03		15/06/2020	water	X															
5	GW05		15/06/2020	water	X															
6	H15		16/06/2020	water	X	X	X	X												Metals sample was not filtered in the field
7	C04a		16/06/2020	water	X	X	X	X												Metals sample was not filtered in the field
8	GW03		16/06/2020	water	X															
9	GW04		16/06/2020	water	X															
NR	GW05		16/06/2020	water	X															
10	TB05		16/06/2020	water	X															
11	RB05		16/06/2020	water	X															

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company): GHD	Received by (Company): ELS	***Lab Use Only***
Print Name: Sean Sparrow	Print Name: Alex Sterta	Job number: 245176 / Cooling: Ice / [✓ Ice pack] / None
Date & Time: 17/06/2020	Date & Time: 17/6/2020 @ 3.15p	Temperature: 5.4 ·c. / Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

extra samples received. GW02 15.06.2020 12
GW07. 16.06.2020. 13

ELS Syd. - 18.06.2020, 10:54

Form 302_V006

Issue date: 7 October 2019

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CERTIFICATE OF ANALYSIS 245176

Client Details

Client	GHD Pty Ltd
Attention	Sean Sparrow
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**CFS Brukunga**
Number of Samples	13 WATER
Date samples received	17/06/2020
Date completed instructions received	17/06/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	24/06/2020
Date of Issue	24/06/2020

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Nick Sarlamis, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Waters Short						
Our Reference		245176-1	245176-2	245176-3	245176-4	245176-5
Your Reference	UNITS	GW01	QA20	GW06	KAN23	GW05
Date Sampled		15/06/2020	15/06/2020	15/06/2020	15/06/2020	15/06/2020
Type of sample		WATER	WATER	WATER	WATER	WATER
Date prepared	-	19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
Date analysed	-	19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
Perfluorohexanesulfonic acid - PFHxS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	μg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	103	100	101	100	100
Surrogate $^{13}C_2$ *PFOA*	%	101	100	98	100	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	104	89	97	107	112
Extracted ISTD $^{13}C_4$ *PFOS*	%	87	80	91	92	106
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	69	99	101	120
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	100	65	89	100	131
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	86	68	87	60	81
Total Positive PFHxS & PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFAS	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01

PFAS in Waters Short						
Our Reference		245176-6	245176-7	245176-8	245176-9	245176-10
Your Reference	UNITS	H15	C04a	GW03	GW04	TB05
Date Sampled		16/06/2020	16/06/2020	16/06/2020	16/06/2020	16/06/2020
Type of sample		WATER	WATER	WATER	WATER	WATER
Date prepared	-	19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
Date analysed	-	19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	92	113	99	102	104
Surrogate $^{13}C_2$ *PFOA*	%	99	101	103	97	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	110	105	102	98	107
Extracted ISTD $^{13}C_4$ *PFOS*	%	103	91	87	84	97
Extracted ISTD $^{13}C_4$ *PFOA*	%	105	99	90	76	114
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	111	105	91	68	110
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	65	84	68	58	72
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	0.01	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	0.01	<0.01	<0.01
Total Positive PFAS	µg/L	<0.01	<0.01	0.01	<0.01	<0.01

PFAS in Waters Short				
Our Reference		245176-11	245176-12	245176-13
Your Reference	UNITS	RB05	GW02	GW07
Date Sampled		16/06/2020	15/06/2020	16/06/2020
Type of sample		WATER	WATER	WATER
Date prepared	-	19/06/2020	19/06/2020	19/06/2020
Date analysed	-	19/06/2020	19/06/2020	19/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	110	100	104
Surrogate $^{13}C_2$ *PFOA*	%	100	98	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	111	100	100
Extracted ISTD $^{13}C_4$ *PFOS*	%	99	92	91
Extracted ISTD $^{13}C_4$ *PFOA*	%	113	82	82
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	125	82	76
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	82	54	59
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	<0.01
Total Positive PFAS	µg/L	<0.01	<0.01	<0.01

HM in water - dissolved				
Our Reference		245176-4	245176-6	245176-7
Your Reference	UNITS	KAN23	H15	C04a
Date Sampled		15/06/2020	16/06/2020	16/06/2020
Type of sample		WATER	WATER	WATER
Date prepared	-	23/06/2020	23/06/2020	23/06/2020
Date analysed	-	23/06/2020	23/06/2020	23/06/2020
Arsenic-Dissolved	µg/L	3	7	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	5.3
Chromium-Dissolved	µg/L	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	1
Lead-Dissolved	µg/L	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	7	35
Zinc-Dissolved	µg/L	2	7	25

Miscellaneous Inorganics				
Our Reference		245176-4	245176-6	245176-7
Your Reference	UNITS	KAN23	H15	C04a
Date Sampled		15/06/2020	16/06/2020	16/06/2020
Type of sample		WATER	WATER	WATER
Date prepared	-	18/06/2020	18/06/2020	18/06/2020
Date analysed	-	18/06/2020	18/06/2020	18/06/2020
pH	pH Units	7.0	6.9	6.5
Total Dissolved Solids (grav)	mg/L	2,100	840	1,700

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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-W2	245176-2
Date prepared	-			19/06/2020	1	19/06/2020	19/06/2020		19/06/2020	19/06/2020
Date analysed	-			19/06/2020	1	19/06/2020	19/06/2020		19/06/2020	19/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	101	95
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	102	97
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	96	100
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	115	120
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	113	116
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	99	1	103	96	7	100	98
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	1	101	104	3	98	97
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	106	1	104	94	10	104	84
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	101	1	87	83	5	105	79
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	88	1	98	85	14	87	69
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	89	1	100	86	15	89	60
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	88	1	86	55	44	87	65

QUALITY CONTROL: PFAS in Waters Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	9	19/06/2020	19/06/2020		[NT]	[NT]
Date analysed	-			[NT]	9	19/06/2020	19/06/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	[NT]	9	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	[NT]	9	<0.01	<0.01	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	[NT]	9	<0.01	<0.01	0	[NT]	[NT]
6:2 FTS	µg/L	0.01	Org-029	[NT]	9	<0.01	<0.01	0	[NT]	[NT]
8:2 FTS	µg/L	0.02	Org-029	[NT]	9	<0.02	<0.02	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	9	102	100	2	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	9	97	100	3	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	9	98	98	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	9	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	9	76	72	5	[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]	9	68	68	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	9	58	71	20	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/06/2020	4	23/06/2020	23/06/2020		23/06/2020	[NT]
Date analysed	-			23/06/2020	4	23/06/2020	23/06/2020		23/06/2020	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	4	3	3	0	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	4	<0.1	<0.1	0	93	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	4	<1	<1	0	102	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	4	<1	<1	0	101	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	4	<1	<1	0	101	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	4	<0.05	<0.05	0	101	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	4	<1	<1	0	93	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	4	2	1	67	96	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			18/06/2020	[NT]	[NT]	[NT]	[NT]	18/06/2020	[NT]
Date analysed	-			18/06/2020	[NT]	[NT]	[NT]	[NT]	18/06/2020	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	92	[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.

Report Comments

pH:

Samples were out of the recommended holding time for this analysis.

Dissolved Metals:

For the determination of dissolved metals in samples #4, #6 and #7, the unpreserved sample was filtered through 0.45um filter at the lab due to the appearance of colloids and/or sediment in the supplied HNO3 bottle (it appears the sample has not been field filtered).

26/6

ENVIROLAB GROUP ENVIROLAB mpl

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address: Level 4 211 Victoria Square, Adelaide SA 5000
Phone: Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): CFS BRUKUNGA
PO No.: 12516828
Envirolab Quote No.: 19SA002 V2
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required				Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite	PH	TDS	Metals (8 Suite)	Provide as much information about the sample as you can
1	GW01		15/06/2020	water	X				
2	QA20		15/06/2020	water	X				
ALS	QA20A		15/06/2020	water	X				Please forward to ALS
3	GW06		15/06/2020	water	X				
4	KAN23		15/06/2020	water	X	X	X	X	Metals sample was not filtered in the field
NR	GW03		15/06/2020	water	X				
5	GW05		15/06/2020	water	X				
6	H15		16/06/2020	water	X	X	X	X	Metals sample was not filtered in the field
7	C04a		16/06/2020	water	X	X	X	X	Metals sample was not filtered in the field
8	GW03		16/06/2020	water	X				
9	GW04		16/06/2020	water	X				
NR	GW05		16/06/2020	water	X				
10	TB05		16/06/2020	water	X				
11	RB05		16/06/2020	water	X				

Environmental Division
Sydney
Work Order Reference
ES2021434
Telephone : + 61-2-8784 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD	ELS	Received by (Company): ELS	**Lab Use Only**
Print Name: Sean Sparrow	May	Print Name: Alex Strata	Job number: 245176 / Cooling: Ice / [✓ Ice pack] / None
Date & Time: 17/06/2020	19/6/2020	Date & Time: 17/6/2020 @ 3.15pm	Temperature: 5.4 °c / Security seal: [✓ Intact] / Broken / None
Signature:		Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

extra samples recived. GW02 15.06.2020
GW07 16.06.2020.

ELS Syd - 18.06.2020, 10:54

Rec-Syd 19/6/20 16:20
6.8c

Form 302_V006

Issue date: 7 October 2019

Page 1 of 1

245176.

Login

From: Sean Sparrow <Sean.Sparrow@ghd.com>
Sent: Thursday, 18 June 2020 2:05 PM
To: Login
Subject: Re: Issue - CES Brukunga

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

② ④

Thank you for communicating this, the QA2 is indeed QA20A. For the missing samples the COC is incorrect, GW03 and GW07 were sampled on 16/6 and GW02 and GW05 were sampled on 15/6, hopefully the dates on the bottles will allow you to differentiate. Please confirm if these answer your questions.

Thanks,
Sean

From: Login <Login@envirolab.com.au>
Sent: Thursday, 18 June 2020 1:06 PM
To: Sean Sparrow <Sean.Sparrow@ghd.com>
Subject: Issue - CES Brukunga

Good afternoon Sean,

We have some questions regarding the job CES Brukunga we received today.

We did not receive samples:
GW03: 15/06/2020
GW05: 16/06/2020

We received extra samples:
GW02: 15/06/2020
GW07: 16/06/2020

Is there a chance the COC states the incorrect number and what we received is what you meant to send? Or should we consider these last samples as extras and test them for PFAS short suite?

And lastly, we received only one 125mL bottle for sample QA20A. Yet there is a bottle labelled QA2. I think you may have forgotten to finish writing the sample ID. Is that possible?

I attach the pictures of these samples.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2021434**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: CFS BRUKUNGA	Date Samples Received	: 19-Jun-2020 15:50
Order number	: ----	Date Analysis Commenced	: 24-Jun-2020
C-O-C number	: ----	Issue Date	: 25-Jun-2020 12:25
Sampler	: ----		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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. 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**)			*Client sample ID*	**QA20A**	**----**	**----**	**----**	**----**
			Client sampling date / time	15-Jun-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2021434-001**	**--------**	**--------**	**--------**	**--------**
				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	<0.01	----	----	----	----
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	<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**113**	----	----	----	----
13C8-PFOA	----	0.02	%	**101**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order : **ES2021434**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : +61 08 8111 6600
Project : CFS BRUKUNGA
Order number : ----
C-O-C number : ----
Sampler : ----
Site :
Quote number : EN/005/19
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 19-Jun-2020
Date Analysis Commenced : 24-Jun-2020
Issue Date : 25-Jun-2020

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
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	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ES2021002-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3097130)									
EM2010513-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3097130) - continued									
EM2010513-004	Anonymous	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2021002-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3097130)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	89.6	72.0	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	96.6	68.0	131
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	101	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3097130)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	96.0	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	106	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	97.8	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	99.8	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	111	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	107	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	97.0	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	101	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(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	96.8	72.0	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	103	68.0	131
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	91.4	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3097130)							
ES2021002-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	106	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	119	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	110	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	115	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	108	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130)							

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3097130) - continued							
ES2021002-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	118	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	111	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	102	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	81.0	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2021434**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: CFS BRUKUNGA	Date Samples Received	: 19-Jun-2020
Site	:	Issue Date	: 25-Jun-2020
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QA20A	**15-Jun-2020**	**24-Jun-2020**	12-Dec-2020	✓	**24-Jun-2020**	12-Dec-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QA20A	**15-Jun-2020**	**24-Jun-2020**	12-Dec-2020	✓	**24-Jun-2020**	12-Dec-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QA20A	**15-Jun-2020**	**24-Jun-2020**	12-Dec-2020	✓	**24-Jun-2020**	12-Dec-2020	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QA20A	**15-Jun-2020**	**24-Jun-2020**	12-Dec-2020	✓	**24-Jun-2020**	12-Dec-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
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 FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address: Level 4, 211 Victoria Square, Adelaide 5000
Phone:
Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. :
Date results required: Standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: Esdat
Lab Comments:

Sample information					Tests Required				Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite	PH	TDS	Metals (8 Suite)	Provide as much information about the sample as you can
1	RB0~~5~~6		19/06/2020	water	X				
2	TB0~~5~~6		19/06/2020	water	X				
3	Hawthorn1		19/06/2020	water	X	X	X	X	Metals were not filtered in the field
4	QA21		19/06/2020	water	X	X	X	X	Metals were not filtered in the field
ALS	QA21A		19/06/2020	water	X	X	X	X	Please forward to ALS, Metals were not filtered in the field
5	KAN~~28~~ 26		19/06/2020	water	X	X	X	X	Metals were not filtered in the field

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD Pty Ltd	Received by (Company): ENVIROLAB	*Lab Use Only*
Print Name: Sean Sparrow	Print Name: J. BOWDEN	Job number: 245412 Cooling: Ice / [✓ Ice pack] / None
Date & Time: 22/06/2020	Date & Time: 22-06-2020	Temperature: 8.2°C Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

ELS Sydney, Trinidad cancels
23.06.2020, 10:42

Form 302_V006

Issue date: 7 October 2019

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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CERTIFICATE OF ANALYSIS 245412

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	5 Water
Date samples received	23/06/2020
Date completed instructions received	23/06/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	26/06/2020
Date of Issue	26/06/2020

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Hannah Nguyen, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

PFAS in Waters Short						
Our Reference		245412-1	245412-2	245412-3	245412-4	245412-5
Your Reference	UNITS	RB06	TB06	Hawthorn1	QA21	KAN26
Date Sampled		19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/06/2020	24/06/2020	24/06/2020	24/06/2020	24/06/2020
Date analysed	-	24/06/2020	24/06/2020	24/06/2020	24/06/2020	24/06/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	98	102	93	102	93
Surrogate $^{13}C_2$ *PFOA*	%	93	95	92	92	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	99	93	91	97
Extracted ISTD $^{13}C_4$ *PFOS*	%	84	89	81	79	86
Extracted ISTD $^{13}C_4$ *PFOA*	%	100	103	91	88	91
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	89	106	70	69	89
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	70	82	64	53	62
Total Positive PFHxS & PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Total Positive PFAS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01

HM in water - dissolved				
Our Reference		245412-3	245412-4	245412-5
Your Reference	UNITS	Hawthorn1	QA21	KAN26
Date Sampled		19/06/2020	19/06/2020	19/06/2020
Type of sample		Water	Water	Water
Date prepared	-	25/06/2020	25/06/2020	25/06/2020
Date analysed	-	25/06/2020	25/06/2020	25/06/2020
Arsenic-Dissolved	µg/L	<1	<1	<1
Cadmium-Dissolved	µg/L	0.8	0.8	<0.1
Chromium-Dissolved	µg/L	<1	<1	1
Copper-Dissolved	µg/L	5	<1	4
Lead-Dissolved	µg/L	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	20	24	4
Zinc-Dissolved	µg/L	54	69	2

Miscellaneous Inorganics				
Our Reference		245412-3	245412-4	245412-5
Your Reference	UNITS	Hawthorn1	QA21	KAN26
Date Sampled		19/06/2020	19/06/2020	19/06/2020
Type of sample		Water	Water	Water
Date prepared	-	23/06/2020	23/06/2020	23/06/2020
Date analysed	-	23/06/2020	23/06/2020	23/06/2020
pH	pH Units	7.2	7.2	6.8
Total Dissolved Solids (grav)	mg/L	3,300	3,400	890

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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	[NT]
Date prepared	-			24/06/2020	1	24/06/2020	24/06/2020		24/06/2020	[NT]
Date analysed	-			24/06/2020	1	24/06/2020	24/06/2020		24/06/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	100	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	94	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	93	[NT]
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	98	[NT]
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	96	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	95	1	98	95	3	95	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	104	1	93	95	2	96	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	91	1	94	95	1	98	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	93	1	84	92	9	102	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	100	1	100	102	2	111	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	103	1	89	110	21	125	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	91	1	70	70	0	103	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/06/2020	3	25/06/2020	25/06/2020		25/06/2020	[NT]
Date analysed	-			25/06/2020	3	25/06/2020	25/06/2020		25/06/2020	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	3	<1	[NT]		97	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	3	0.8	[NT]		98	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	3	<1	[NT]		97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	3	5	[NT]		98	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	3	<1	[NT]		109	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	3	<0.05	<0.05	0	99	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	3	20	[NT]		98	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	3	54	[NT]		100	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/06/2020	[NT]	[NT]	[NT]	[NT]	23/06/2020	[NT]
Date analysed	-			23/06/2020	[NT]	[NT]	[NT]	[NT]	23/06/2020	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	93	[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.

Report Comments

MISC_INORG:pH:Samples were out of the recommended holding time for this analysis.

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab. Note: there is a possibility some elements may be underestimated.

2.7.20

CHAIN OF CUSTODY FORM - Client

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ENVIROLAB GROUP
National phone number 1300 424 344

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address: Level 4, 211 Victoria Square, Adelaide 5000
Phone:
Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title):
PO No.: 12516828
Envirolab Quote No. :
Date results required: Standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: Esdat
Lab Comments:

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Short Suite	PH	TDS	Metals (8 Suite)	Comments: Provide as much information about the sample as you can
1	RB0~~8~~6		19/06/2020	water	X				
2	TB0~~5~~6		19/06/2020	water	X				
3	Hawthorn1		19/06/2020	water	X	X	X	X	Metals were not filtered in the field
4	QA21		19/06/2020	water	X	X	X	X	Metals were not filtered in the field
ALS	QA21A		19/06/2020	water	X	X	X	X	Please forward to ALS, Metals were not filtered in the field
5	KAN~~28~~ 26		19/06/2020	water	X	X	X	X	Metals were not filtered in the field

①

Environmental Division
Sydney
Work Order Reference
ES2021853
Telephone : + 61-2-8764 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): GHD Pty Ltd	ELS Syd	Received by (Company): ENVIROLAB	**Lab Use Only**
Print Name: Sean Sparrow	C. Mullen	Print Name: J. BOWDEN	Job number: 245412
Date & Time: 22/06/2020	24/6/20 1000	Date & Time: 22-06-2020	Temperature: 8.2°C
Signature:		Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

Cooling: Ice / [✓ Ice pack] / None
Security seal: [✓ Intact] / Broken / None

Rec - Sofia
24/6/20 1900
5.2°

ELS Sydney, Trinidad Canolles
23.06.2020, 10:42

Form 302_V006
Issue date: 7 October 2019
Page 1 of 1

CERTIFICATE OF ANALYSIS

Work Order	: **ES2021853**	Page	: 1 of 5
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828 CFS Brukunga DSI	Date Samples Received	: 24-Jun-2020 19:00
Order number	: 12516828	Date Analysis Commenced	: 25-Jun-2020
C-O-C number	: ----	Issue Date	: 01-Jul-2020 14:06
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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.
- Amendment (01/07/2020): This report has been amended to alter the project reference. All analysis results are as per the previous report.
- 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**)			*Client sample ID*	**QA21A**	**----**	**----**	**----**	**----**
			Client sampling date / time	19-Jun-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2021853-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.79**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**3420**	----	----	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.011**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0009**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.029**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.082**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
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	<0.01	----	----	----	----
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	----	----	----	----

Analytical Results

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

			Client sample ID	**QA21A**	----	----	----	----
			Client sampling date / time	19-Jun-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	**ES2021853-001**	--------	--------	--------	--------
				Result	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**104**	----	----	----	----
13C8-PFOA	----	0.02	%	**104**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

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

ALS Environmental

QUALITY CONTROL REPORT

Work Order : **ES2021853**
Amendment : **1**

Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : +61 08 8111 6600
Project : 12516828 CFS Brukunga DSI
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005/19
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 5

Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 24-Jun-2020
Date Analysis Commenced : 25-Jun-2020
Issue Date : 01-Jul-2020

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. 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*
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA005P: pH by PC Titrator (QC Lot: 3101764)									
ES2021897-006	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	3.94	3.94	0.00	0% - 20%
ES2021876-006	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.49	7.31	2.43	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 3104146)									
ES2021853-001	QA21A	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	3420	3460	1.08	0% - 20%
ES2021987-009	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	3420	3380	1.32	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 3104357)									
ES2021898-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.022	0.021	0.00	No Limit
ES2021882-003	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3104435)									
ES2021853-001	QA21A	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES2021958-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3108017)									

Sub-Matrix: **WATER**				*Laboratory Duplicate (DUP) Report*					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3108017) - continued									
ES2021853-001	QA21A	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ES2021880-008	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.76	1.78	1.18	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.95	0.90	5.19	0% - 20%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	1.77	1.81	2.21	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3108017)									
ES2021853-001	QA21A	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ES2021880-008	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.13	0.12	0.00	0% - 50%
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.12	0.13	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.56	0.55	2.70	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.11	0.10	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	0.1	0.1	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3108017)									
ES2021853-001	QA21A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2021880-008	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EA005P: pH by PC Titrator (QCLot: 3101764)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	99.8	98.0	102
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 3104146)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	97.3	87.0	109
				<10	293 mg/L	110	66.0	126
EG020T: Total Metals by ICP-MS (QCLot: 3104357)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	90.0	82.0	114
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	88.8	84.0	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	88.1	86.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	88.9	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.1	85.0	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	87.2	84.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	88.6	79.0	117
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3104435)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.6	77.0	111
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3108017)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	90.6	72.0	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	101	68.0	131
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	101	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3108017)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	113	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	124	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	116	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	119	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	120	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3108017)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	108	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	111	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	103	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	119	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(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 3104357)							
ES2021882-007	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	89.2	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	90.6	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	88.4	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	87.9	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	95.8	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	85.6	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	88.8	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3104435)							
ES2021882-003	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	78.4	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3108017)							
ES2021857-002	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	94.8	72.0	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	104	68.0	131
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	102	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3108017)							
ES2021857-002	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	108	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	124	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	116	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	118	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	117	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3108017)							
ES2021857-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	105	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	117	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	102	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	127	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2021853**	Page	: 1 of 5
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828 CFS Brukunga DSI	Date Samples Received	: 24-Jun-2020
Site	:	Issue Date	: 01-Jul-2020
Sampler	: SEAN SPARROW	No. of samples received	: 1
Order number	: 12516828	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	**Days overdue**	*Date analysed*	*Due for analysis*	**Days overdue**
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
QA21A	----	----	----	25-Jun-2020	19-Jun-2020	**6**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / *Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
QA21A	**19-Jun-2020**	**----**	----	----	**25-Jun-2020**	19-Jun-2020	✗
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
QA21A	**19-Jun-2020**	**----**	----	----	**26-Jun-2020**	26-Jun-2020	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unspecified (EG020A-T)							
QA21A	**19-Jun-2020**	**26-Jun-2020**	16-Dec-2020	✓	**26-Jun-2020**	16-Dec-2020	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unspecified (EG035T)							
QA21A	**19-Jun-2020**	**----**	----	----	**29-Jun-2020**	17-Jul-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QA21A	**19-Jun-2020**	**30-Jun-2020**	16-Dec-2020	✓	**30-Jun-2020**	16-Dec-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QA21A	**19-Jun-2020**	**30-Jun-2020**	16-Dec-2020	✓	**30-Jun-2020**	16-Dec-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QA21A	**19-Jun-2020**	**30-Jun-2020**	16-Dec-2020	✓	**30-Jun-2020**	16-Dec-2020	✓

Matrix: **WATER**

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

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) QA21A	**19-Jun-2020**	**30-Jun-2020**	16-Dec-2020	✓	**30-Jun-2020**	16-Dec-2020	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
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*
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)
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.

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Level 4, 211 Victoria Square, Adelaide 5000
Phone: Mob: 0498 260 626
Email: GHDLabReports@ghd.com
dilara.valiff@ghd.com
sean.sparrow@ghd.com

Client Project Name/Number/Site etc (ie report title):
12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 2 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra-trace	PFAS Short suite	Leachate analysis													Provide as much information about the sample as you can
1	DC09		8/07/2020	water	X															
3	QA25		8/07/2020	water	X															
—	QA25A		8/07/2020	water	X															Please forward to ALS
5	DC10		8/07/2020	water	X															
7	DC11		8/07/2020	water	X															
9	DC13		8/07/2020	water	X															
11	DC14		8/07/2020	water	X															
13	DC15		8/07/2020	water	X															
2	DC09S		8/07/2020	sediment		X														
4	QA25S		8/07/2020	sediment		X														
—	QA25AS		8/07/2020	sediment		X														Please forward to ALS
6	DC10S		8/07/2020	sediment		X														
8	DC11S		8/07/2020	sediment		X														
10	DC13S		8/07/2020	sediment		X														
12	DC14S		8/07/2020	sediment		X														
14	DC15S		8/07/2020	sediment		X														
15	WW01		8/07/2020	water	X															
16	WW02		8/07/2020	water	X															
17	QA26		8/07/2020	water	X															
—	QA26A		8/07/2020	water	X															Please forward to ALS
18	WW03		8/07/2020	water	X															
19	WW04		8/07/2020	water	X															
20	WW05		8/07/2020	water	X															
21	WW06		8/07/2020	water	X															
22	WW07		8/07/2020	water	X															
23	Tank4		3/07/2020	concrete		X	X													
24	Tank5		3/07/2020	concrete		X	X													
☐ 26.	EB (TB)		8/07/2020	water		X														
25	RB		8/07/2020	water		X														

Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis

Relinquished by (Company):	Received by (Company): ELS Sydney	*Lab Use Only*
Print Name: Sean Sparrow	Print Name: [illegible] Day	Job number: 246709 Cooling: Ice / [✓ Ice pack] / None
Date & Time: 9/07/2020	Date & Time: 10/07/2020 / 10:45	Temperature: 8.3 Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

Updated COC

ENVIROLAB GROUP ENVIROLAB SERVICES mpl

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address:
Level 4, 211 Victoria Square, Adelaide 5000
Phone: **Mob:** 0498 260 626
Email: GHDLabReports@ghd.com
dilara.valiff@ghd.com
sean.sparrow@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 2 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equls /
Lab Comments:

Sample Information					Tests Required															Comments
Envirolab Sample ID Water Soil	**Client Sample ID or information**	**Depth**	**Date sampled**	**Type of sample**	Trace analysis PFAS	PFAS Short														**Provide as much information about the sample as you can**
1, 2	DC09		08/07/2020	water, sediment	X															
3, 4	QA25		08/07/2020	water, sediment	X															
—	QA25A		08/07/2020	water, sediment	X															Please forward to ALS
5, 6	DC10		08/07/2020	water, sediment	X															
7, 8	DC11		08/07/2020	water, sediment	X															
9, 10	DC13		08/07/2020	water, sediment	X															
11, 12	DC14		08/07/2020	water, sediment	X															
13, 14	DC15		08/07/2020	water, sediment	X															
15	WW01		08/07/2020	water	X															
16	WW02		08/07/2020	water	X															
17	QA26		08/07/2020	water	X															
—	QA26A		08/07/2020	water	X															Please forward to ALS
18	WW03		08/07/2020	water	X															
19	WW04		08/07/2020	water	X															
20	WW05		08/07/2020	water	X															
21	WW06		08/07/2020	water	X															
22	WW07		08/07/2020	water	X															
23	Tank4		03/07/2020	concrete		X														
24	Tank5		03/07/2020	concrete		X														

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company):
Print Name: Sean Sparrow
Date & Time: 09/07/2020
Signature:

Received by (Company): ELS SYD
Print Name: Jason Day
Date & Time: 10/7/20 1045
Signature:

Lab Use Only
Job number: 246709
Temperature: 8.3
TAT Req - SAME day / 1 / [✓ 2] / 3 / 4 / STD
Cooling: Ice / [✓ Ice pack] / None
Security seal: [✓ Intact] / Broken / None

25 RB07 8/7/20 water
26 TB07 ✓ ✓

Envirolab Services Pty Ltd
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CERTIFICATE OF ANALYSIS 246709

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	17 Water, 7 Sediment, 2 Concrete
Date samples received	10/07/2020
Date completed instructions received	10/07/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	14/07/2020
Date of Issue	14/07/2020

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Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		246709-1	246709-3	246709-5	246709-7	246709-9
Your Reference	UNITS	DC09	QA25	DC10	DC11	DC13
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.11	0.12	0.11	0.11	0.088
Perfluorooctanesulfonic acid PFOS	µg/L	0.13	0.13	0.11	0.13	0.097
Perfluorooctanoic acid PFOA	µg/L	0.0088	0.0092	0.0080	0.0086	0.0065
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	92	102	100	95	94
Surrogate $^{13}C_2$ *PFOA*	%	85	84	80	81	82
Extracted ISTD $^{18}O_2$ *PFHxS*	%	71	67	67	73	70
Extracted ISTD $^{13}C_4$ *PFOS*	%	68	72	70	77	76
Extracted ISTD $^{13}C_4$ *PFOA*	%	87	90	86	90	88
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	163	146	142	145	145
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	168	162	151	170	150
Total Positive PFHxS & PFOS	µg/L	0.23	0.25	0.22	0.24	0.18
Total Positive PFOS & PFOA	µg/L	0.14	0.14	0.12	0.14	0.10
Total Positive PFAS	µg/L	0.24	0.26	0.23	0.25	0.19

PFAS in Water TRACE Short

Our Reference		246709-11	246709-13	246709-15	246709-16	246709-17
Your Reference	UNITS	DC14	DC15	WW01	WW02	QA26
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.081	0.066	0.0009	0.0024	0.0025
Perfluorooctanesulfonic acid PFOS	µg/L	0.081	0.080	<0.0002	0.0003	0.0003
Perfluorooctanoic acid PFOA	µg/L	0.0062	0.0057	0.0003	0.001	0.0009
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	100	98	98	94	99
Surrogate $^{13}C_2$ *PFOA*	%	84	82	85	83	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%	71	74	83	84	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	75	77	60	65	63
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	86	93	95	96
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	145	158	169	176	163
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	150	153	115	138	110
Total Positive PFHxS & PFOS	µg/L	0.16	0.15	0.0009	0.0026	0.0028
Total Positive PFOS & PFOA	µg/L	0.087	0.085	0.0003	0.001	0.001
Total Positive PFAS	µg/L	0.17	0.15	0.001	0.0036	0.0037

Client Reference: 12516828

PFAS in Water TRACE Short						
Our Reference		246709-18	246709-19	246709-20	246709-21	246709-22
Your Reference	UNITS	WW03	WW04	WW05	WW06	WW07
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	0.028	0.0049	0.0078	0.088
Perfluorooctanesulfonic acid PFOS	µg/L	0.0071	0.12	0.0004	0.035	0.023
Perfluorooctanoic acid PFOA	µg/L	0.0004	0.037	0.0039	0.0094	0.083
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	0.0005	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	89	91	98	98	96
Surrogate $^{13}C_2$ *PFOA*	%	87	84	92	79	88
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	83	86	81	70
Extracted ISTD $^{13}C_4$ *PFOS*	%	69	65	67	63	66
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	98	99	101	87
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	171	179	164	180	159
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	146	158	124	152	145
Total Positive PFHxS & PFOS	µg/L	0.0085	0.15	0.0053	0.043	0.11
Total Positive PFOS & PFOA	µg/L	0.0075	0.16	0.0043	0.045	0.11
Total Positive PFAS	µg/L	0.0088	0.19	0.0091	0.052	0.19

PFAS in Water TRACE Short			
Our Reference		246709-25	246709-26
Your Reference	UNITS	RB	TB
Date Sampled		08/07/2020	08/07/2020
Type of sample		Water	Water
Date prepared	-	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	96	90
Surrogate $^{13}C_2$ *PFOA*	%	91	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	97	71
Extracted ISTD $^{13}C_4$ *PFOA*	%	104	99
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	169	142
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	128	124
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002

PFAS in Soils Short						
Our Reference	UNITS	246709-2	246709-4	246709-6	246709-8	246709-10
Your Reference		DC09S	QA25S	DC10S	DC11S	DC13S
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	1.3	1.1	1.5	1.4	0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	22	37	59	31	3.1
Perfluorooctanoic acid PFOA	µg/kg	0.1	0.1	0.5	0.2	<0.1
6:2 FTS	µg/kg	<0.1	0.6	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	100	103	97	103	105
Surrogate $^{13}C_2$ *PFOA*	%	97	96	98	98	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%	72	74	71	73	74
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	57	63	67	68
Extracted ISTD $^{13}C_4$ *PFOA*	%	56	49	63	70	64
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	120	105	85	#	89
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	106	101	120	#	102
Total Positive PFHxS & PFOS	µg/kg	23	38	60	33	3.2
Total Positive PFOS & PFOA	µg/kg	22	37	59	32	3.1
Total Positive PFAS	µg/kg	24	39	61	33	3.2

PFAS in Soils Short					
Our Reference		246709-12	246709-14	246709-23	246709-24
Your Reference	UNITS	DC14S	DC15S	Tank4	Tank5
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Sediment	Sediment	Concrete	Concrete
Date prepared	-	13/07/2020	13/07/2020	14/07/2020	14/07/2020
Date analysed	-	13/07/2020	13/07/2020	14/07/2020	14/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.3	0.6	11	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	9.8	27	59	0.7
Perfluorooctanoic acid PFOA	µg/kg	<0.1	0.8	2.8	<0.1
6:2 FTS	µg/kg	<0.1	0.5	4.0	1.2
8:2 FTS	µg/kg	<0.2	<0.2	6.0	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	101	106	60	104
Surrogate $^{13}C_2$ *PFOA*	%	98	99	100	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	78	73	47	57
Extracted ISTD $^{13}C_4$ *PFOS*	%	57	62	87	57
Extracted ISTD $^{13}C_4$ *PFOA*	%	52	67	41	50
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	71	100	38	42
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	72	136	42	52
Total Positive PFHxS & PFOS	µg/kg	10	27	70	0.7
Total Positive PFOS & PFOA	µg/kg	9.8	27	62	0.7
Total Positive PFAS	µg/kg	10	29	82	1.9

Moisture						
Our Reference		246709-2	246709-4	246709-6	246709-8	246709-10
Your Reference	UNITS	DC09S	QA25S	DC10S	DC11S	DC13S
Date Sampled		08/07/2020	08/07/2020	08/07/2020	08/07/2020	08/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	13/07/2020	13/07/2020	13/07/2020	13/07/2020	13/07/2020
Date analysed	-	14/07/2020	14/07/2020	14/07/2020	14/07/2020	14/07/2020
Moisture	%	39	41	64	38	25

Moisture			
Our Reference		246709-12	246709-14
Your Reference	UNITS	DC14S	DC15S
Date Sampled		08/07/2020	08/07/2020
Type of sample		Sediment	Sediment
Date prepared	-	13/07/2020	13/07/2020
Date analysed	-	14/07/2020	14/07/2020
Moisture	%	36	57

PFAS in ASLP Short			
Our Reference		246709-23	246709-24
Your Reference	UNITS	Tank4	Tank5
Date Sampled		08/07/2020	08/07/2020
Type of sample		Concrete	Concrete
Date prepared	-	14/07/2020	14/07/2020
Date analysed	-	14/07/2020	14/07/2020
pH of final Leachate	pH units	11.8	11.8
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.20	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.61	0.01
Perfluorooctanoic acid PFOA	µg/L	0.04	<0.01
6:2 FTS	µg/L	0.03	0.01
8:2 FTS	µg/L	<0.02	<0.02
Surrogate $^{13}C_8$ PFOS	%	96	92
Surrogate $^{13}C_2$ PFOA	%	96	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	70	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	96	96
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	117	123
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	75	83
Total Positive PFHxS & PFOS	µg/L	0.81	0.01
Total Positive PFOS & PFOA	µg/L	0.65	0.01
Total Positive PFAS	µg/L	0.88	0.03

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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.
Org-029A	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	246709-3
Date prepared	-			13/07/2020	1	13/07/2020	13/07/2020		13/07/2020	13/07/2020
Date analysed	-			13/07/2020	1	13/07/2020	13/07/2020		13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.11	0.11	0	110	142
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	0.13	0.12	8	107	141
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.0088	0.0087	1	105	109
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	112	130
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	110	132
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	96	1	92	99	7	96	104
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	1	85	87	2	93	83
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	92	1	71	67	6	98	68
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	78	1	68	70	3	77	69
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	99	1	87	85	2	97	85
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	102	1	163	145	12	85	135
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	84	1	168	165	2	77	148

QUALITY CONTROL: PFAS in Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	13/07/2020	13/07/2020		[NT]	[NT]
Date analysed	-			[NT]	19	13/07/2020	13/07/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	19	0.028	0.028	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	19	0.12	0.12	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	19	0.037	0.037	0	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	19	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	19	0.0005	<0.0004	22	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	19	91	99	8	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	19	84	87	4	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	19	83	84	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	19	65	65	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	19	98	97	1	[NT]	[NT]

QUALITY CONTROL: PFAS in Water TRACE 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]	19	179	179	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	[NT]	19	158	136	15	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	246709-4
Date prepared	-			14/07/2020	2	13/07/2020	13/07/2020		13/07/2020	13/07/2020
Date analysed	-			14/07/2020	2	13/07/2020	13/07/2020		13/07/2020	13/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	1.3	2.0	42	102	106
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	22	34	43	101	##
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	0.1	0.2	67	103	100
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	91	87
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	112	118
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	104	2	100	101	1	102	103
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	100	2	97	96	1	98	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	91	2	72	75	4	89	64
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	86	2	71	60	17	88	52
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	93	2	56	43	26	88	42
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	105	2	120	77	44	102	101
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	116	2	106	70	41	105	98

QUALITY CONTROL: PFAS in ASLP Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			14/07/2020	[NT]	[NT]	[NT]	[NT]	14/07/2020	[NT]
Date analysed	-			14/07/2020	[NT]	[NT]	[NT]	[NT]	14/07/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029A	<0.01	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029A	<0.01	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029A	<0.01	[NT]	[NT]	[NT]	[NT]	100	[NT]
6:2 FTS	µg/L	0.01	Org-029A	<0.01	[NT]	[NT]	[NT]	[NT]	116	[NT]
8:2 FTS	µg/L	0.02	Org-029A	<0.02	[NT]	[NT]	[NT]	[NT]	112	[NT]
Surrogate $^{13}C_8$ PFOS	%		Org-029A	98	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate $^{13}C_2$ PFOA	%		Org-029A	102	[NT]	[NT]	[NT]	[NT]	105	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029A	94	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029A	92	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029A	88	[NT]	[NT]	[NT]	[NT]	90	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029A	87	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029A	83	[NT]	[NT]	[NT]	[NT]	87	[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.

Report Comments

PFAS in Soil Short - ## Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 246709-4 have caused interference.
PFAS in Soil Short - Please note that the analysis of PFAS in concrete is not covered by NATA accreditation.
PFAS in Soil Short - The results for sample 246709-23 and 24 are reported on the sample as received i.e. no moisture correction has been applied.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS_W_SHORT_TR: Matrix spike recoveries for 246709-3 for PFHxS and PFOS are outside global acceptance criteria (60-140%) due to background level of the analytes in the sample. However acceptable recoveries were obtained for the LCS.

Ming To

From: Aileen Hie
Sent: Friday, 9 October 2020 5:39 PM
To: Ming To
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Ref :246709-A
TAT : 1 day
Due: 12/10/2020 MT.

From: Alex Stenta <astenta@envirolab.com.au>
Sent: Friday, 9 October 2020 5:05 PM
To: Customer Service <CustomerService@envirolab.com.au>
Cc: Adelaide <adelaide@envirolab.com.au>; Alexander Maclean <AMaclean@envirolab.com.au>
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828
Importance: High

Hi Guys,

Can we please report **trace level PFAS extended suite** for all samples in Job Number 251682?

Also, can we please have **trace level PFAS extended suite** for the following samples:

DC14 – 246709 - 11 } 246709-A
DC15 – 246709 - 13 }
DC16 – 247753 - 1
DC17 - 247753 - 2
DC18 - 247753 - 3
DC19 - 247753 - 4

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 246709-A

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	17 Water, 7 Sediment, 2 Concrete
Date samples received	10/07/2020
Date completed instructions received	09/10/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	13/10/2020
Date of Issue	13/10/2020

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
Alexander Mitchell Maclean, Senior Chemist

Authorised By

Nancy

Nancy Zhang, Laboratory Manager

PFAS in Waters Trace Extended			
Our Reference		246709-A-11	246709-A-13
Your Reference	UNITS	DC14	DC15
Date Sampled		08/07/2020	08/07/2020
Type of sample		Water	Water
Date prepared	-	13/07/2020	13/07/2020
Date analysed	-	13/07/2020	13/07/2020
Perfluorobutanesulfonic acid	µg/L	0.0088	0.0071
Perfluoropentanesulfonic acid	µg/L	0.009	0.007
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.081	0.066
Perfluoroheptanesulfonic acid	µg/L	0.003	0.002
Perfluorooctanesulfonic acid PFOS	µg/L	0.081	0.080
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.01	0.01
Perfluoropentanoic acid	µg/L	0.01	0.009
Perfluorohexanoic acid	µg/L	0.020	0.016
Perfluoroheptanoic acid	µg/L	0.0048	0.0045
Perfluorooctanoic acid PFOA	µg/L	0.0062	0.0057
Perfluorononanoic acid	µg/L	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
Surrogate $^{13}C_8$ PFOS	%	100	98
Surrogate $^{13}C_2$ PFOA	%	84	82
Extracted ISTD $^{13}C_3$ PFBS	%	72	69
Extracted ISTD $^{18}O_2$ PFHxS	%	71	74
Extracted ISTD $^{13}C_4$ PFOS	%	75	77
Extracted ISTD $^{13}C_4$ PFBA	%	37	39

PFAS in Waters Trace Extended			
Our Reference		246709-A-11	246709-A-13
Your Reference	UNITS	DC14	DC15
Date Sampled		08/07/2020	08/07/2020
Type of sample		Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	36	36
Extracted ISTD $^{13}C_2$ *PFHxA*	%	51	52
Extracted ISTD $^{13}C_4$ *PFHpA*	%	71	70
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	86
Extracted ISTD $^{13}C_5$ *PFNA*	%	101	95
Extracted ISTD $^{13}C_2$ *PFDA*	%	83	83
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	67	61
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	54	42
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	42	37
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	114	128
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	145	158
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	150	153
Extracted ISTD $^{13}C_8$ *FOSA*	%	53	51
Extracted ISTD d_3 *N MeFOSA*	%	40	34
Extracted ISTD d_5 *N EtFOSA*	%	43	34
Extracted ISTD d_7 *N MeFOSE*	%	46	39
Extracted ISTD d_9 *N EtFOSE*	%	46	42
Extracted ISTD d_3 *N MeFOSAA*	%	82	80
Extracted ISTD d_5 *N EtFOSAA*	%	49	52
Total Positive PFHxS & PFOS	µg/L	0.16	0.15
Total Positive PFOS & PFOA	µg/L	0.087	0.085
Total Positive PFAS	µg/L	0.24	0.21

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. 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 Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			13/07/2020	[NT]	[NT]	[NT]	[NT]	13/07/2020	[NT]
Date analysed	-			13/07/2020	[NT]	[NT]	[NT]	[NT]	13/07/2020	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	107	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	82	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	106	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	126	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	92	[NT]
4:2 FTS	µg/L	0.001	Org-029	<0.001	[NT]	[NT]	[NT]	[NT]	105	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	112	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	110	[NT]
10:2 FTS	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	106	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	125	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	[NT]	[NT]	[NT]	[NT]	120	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	[NT]	[NT]	[NT]	[NT]	119	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	93	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	74	[NT]	[NT]	[NT]	[NT]	76	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	92	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	78	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	92	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	93	[NT]	[NT]	[NT]	[NT]	91	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	95	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	100	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	99	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	95	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	91	[NT]	[NT]	[NT]	[NT]	83	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	66	[NT]	[NT]	[NT]	[NT]	56	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	55	[NT]	[NT]	[NT]	[NT]	42	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	49	[NT]	[NT]	[NT]	[NT]	37	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	99	[NT]	[NT]	[NT]	[NT]	96	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	102	[NT]	[NT]	[NT]	[NT]	85	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	84	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	70	[NT]	[NT]	[NT]	[NT]	59	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	38	[NT]	[NT]	[NT]	[NT]	34	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	38	[NT]	[NT]	[NT]	[NT]	34	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	60	[NT]	[NT]	[NT]	[NT]	46	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	57	[NT]	[NT]	[NT]	[NT]	43	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	74	[NT]	[NT]	[NT]	[NT]	61	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	54	[NT]	[NT]	[NT]	[NT]	38	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

14/7

ENVIROLAB ENVIROLAB SERVICES mpl

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address:
Level 4, 211 Victoria Square, Adelaide 5000
Phone: Mob: 0498 260 626
Email: GHDLabReports@ghd.com
dilara.valiff@ghd.com
sean.sparrow@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 2 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

TAT

Environmental Division
Sydney
Work Order Reference
ES2023843
Telephone : + 61-2-8784 8555

Sample information					Tests Required															Comments
Envirolab Sample ID Water Soil	Client Sample ID or information	Depth	Date sampled	Type of sample	Trace analysis PFAS	PFAS Short														Provide as much information about the sample as you can
1, 2	DC09		08/07/2020	water, sediment	X															
3, 4	QA25		08/07/2020	water, sediment	X															
① —	QA25A		08/07/2020	water, sediment	X															Please forward to ALS
5, 6	DC10		08/07/2020	water, sediment	X															
7, 8	DC11		08/07/2020	water, sediment	X															
9, 10	DC13		08/07/2020	water, sediment	X															
11, 12	DC14		08/07/2020	water, sediment	X															
13, 14	DC15		08/07/2020	water, sediment	X															
15	WW01		08/07/2020	water	X															
16	WW02		08/07/2020	water	X															
17	QA26		08/07/2020	water	X															
②	QA26A		08/07/2020	water	X															Please forward to ALS
18	WW03		08/07/2020	water	X															
19	WW04		08/07/2020	water	X															
20	WW05		08/07/2020	water	X															
21	WW06		08/07/2020	water	X															
22	WW07		08/07/2020	water	X															
23	Tank4		03/07/2020	concrete		X														
24	Tank5		03/07/2020	concrete		X														

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):		ELS Syd	Received by (Company):	ELS SYD
Print Name:	Sean Sparrow	K-Gore	Print Name:	Jason Day
Date & Time:	09/07/2020	10.7.20 12:15pm	Date & Time:	10/7/20 1045
Signature:			Signature:	

Lab Use Only
Job number: 246709
Cooling: Ice / [✓ Ice pack] / None
Temperature: 8.3
Security seal: [✓ Intact] / Broken / None
TAT Req - SAME day / 1 / [✓ 2] / 3 / 4 / STD

25 RB07 8/7/20 water ✓
26 TB07 ✓

rec: FAzi 10/7/20 3:40

Form 302_V006

Issue date: 7 October 2019

CERTIFICATE OF ANALYSIS

Work Order : **ES2023843**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : LEVEL 15, 133 CASTLEREAGH STREET
SYDNEY NSW, AUSTRALIA 2000
Telephone : +61 08 8111 6600
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005/19
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 10-Jul-2020 15:38
Date Analysis Commenced : 13-Jul-2020
Issue Date : 16-Jul-2020 12:49

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, 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.
- EP231X: PFAS results for sample #2 confirmed by re-extraction and re-analysis.
- 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: **SEDIMENT**
(Matrix: **SOIL)**

			Client sample ID	**QA25A**	**----**	**----**	**----**	**----**
			Client sampling date / time	10-Jul-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2023843-003**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**28.6**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0005**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0142**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0147**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0147**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**104**	----	----	----	----
13C8-PFOA	----	0.0002	%	**104**	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QA25A**	**QA26A**	**----**	**----**	**----**
			Client sampling date / time	08-Jul-2020 00:00	08-Jul-2020 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2023843-001**	**ES2023843-002**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.011**	**0.009**	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.068**	<0.002	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.119**	<0.002	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	**0.01**	**0.01**	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	**0.012**	**0.004**	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.030**	**0.006**	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	**0.005**	<0.002	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.007**	<0.002	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.187**	<0.002	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.262**	**0.029**	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**96.5**	**98.0**	----	----	----
13C8-PFOA	----	0.002	%	**96.4**	**97.4**	----	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

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

Sub-Matrix: **WATER**

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

ALS Environmental

QUALITY CONTROL REPORT

Work Order : **ES2023843**

Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : LEVEL 15, 133 CASTLEREAGH STREET
SYDNEY NSW, AUSTRALIA 2000
Telephone : +61 08 8111 6600
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005/19
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 6

Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 10-Jul-2020
Date Analysis Commenced : 13-Jul-2020
Issue Date : 16-Jul-2020

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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, 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 hig

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3136040)									
ES2023366-001	Anonymous	EA055: Moisture Content	----	0.1	%	4.5	4.5	0.00	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3136427)									
ES2023843-003	QA25A	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0005	0.0005	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0142	0.0144	1.91	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3136427)									
ES2023843-003	QA25A	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3136427)									
ES2023843-003	QA25A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3133887)									
ES2023843-001	QA25A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.011	0.012	12.8	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3133887) - continued									
ES2023843-001	QA25A	EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.068	0.076	11.4	0% - 20%
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.119	0.135	12.1	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3133887)									
ES2023843-001	QA25A	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.012	0.011	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.030	0.032	4.56	0% - 50%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.005	0.005	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.007	0.007	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	0.01	0.01	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3133887)									
ES2023843-001	QA25A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3136427)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.4	72.0	128
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.8	67.0	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3136427)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	101	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	117	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	108	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	118	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	118	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3136427)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	109	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	102	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	119	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	139	69.2	143

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3133887)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	77.2	72.0	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	82.0	68.0	131
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	126	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3133887)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	88.3	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	92.8	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	92.8	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	89.6	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	89.2	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3133887)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	92.4	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	84.8	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	90.0	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	101	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3136427)							
ES2023843-003	QA25A	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	101	72.0	128
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	115	67.0	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3136427)							
ES2023843-003	QA25A	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	104	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	122	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	109	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	119	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	118	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3136427)							
ES2023843-003	QA25A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	99.2	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	92.0	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	104	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	80.4	69.2	143

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3133887)							
ES2023843-001	QA25A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	74.9	72.0	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	83.5	68.0	131
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	# Not Determined	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3133887)							
ES2023843-001	QA25A	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	107	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	82.9	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	84.2	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	94.9	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	87.2	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3133887)							
ES2023843-001	QA25A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	80.8	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	91.6	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	82.0	67.0	138

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3133887) - continued							
ES2023843-001	QA25A	EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	76.4	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2023843**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 10-Jul-2020
Site	:	Issue Date	: 16-Jul-2020
Sampler	: SEAN SPARROW	No. of samples received	: 3
Order number	: 12516828	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES2023843--003	QA25A	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES2023843--001	QA25A	**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: **SOIL**

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

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QA25A	**10-Jul-2020**	**----**	----	----	**13-Jul-2020**	24-Jul-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QA25A	**10-Jul-2020**	**14-Jul-2020**	06-Jan-2021	✓	**14-Jul-2020**	23-Aug-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QA25A	**10-Jul-2020**	**14-Jul-2020**	06-Jan-2021	✓	**14-Jul-2020**	23-Aug-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QA25A	**10-Jul-2020**	**14-Jul-2020**	06-Jan-2021	✓	**14-Jul-2020**	23-Aug-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QA25A	**10-Jul-2020**	**14-Jul-2020**	06-Jan-2021	✓	**14-Jul-2020**	23-Aug-2020	✓

Matrix: **WATER**

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

Matrix: **WATER**

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

Method **Container** / Client Sample ID(s)		**Sample Date**	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL)								
QA25A,	QA26A	**08-Jul-2020**	**13-Jul-2020**	04-Jan-2021	✓	**14-Jul-2020**	04-Jan-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-LL)								
QA25A,	QA26A	**08-Jul-2020**	**13-Jul-2020**	04-Jan-2021	✓	**14-Jul-2020**	04-Jan-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL)								
QA25A,	QA26A	**08-Jul-2020**	**13-Jul-2020**	04-Jan-2021	✓	**14-Jul-2020**	04-Jan-2021	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-LL)								
QA25A,	QA26A	**08-Jul-2020**	**13-Jul-2020**	04-Jan-2021	✓	**14-Jul-2020**	04-Jan-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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 FORM - Client

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Client Project Name/Number/Site etc (ie report title):
12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace	PFAS Short Suite														Provide as much information about the sample as you can
1	DC16		23/07/2020	water	X															
2	DC17		23/07/2020	water	X															
3	DC18		23/07/2020	water	X															
4	DC19		23/07/2020	water	X															
5	DC-UP01		23/07/2020	water	X															
6	DC-UP02		23/07/2020	water	X															
7	MBC01		23/07/2020	water	X															
8	MBC02		23/07/2020	water	X															
9	NC01		23/07/2020	water	X															
10	NC02		23/07/2020	water	X															
11	BR01		23/07/2020	water	X															
12	BR02		23/07/2020	water	X															
13	DC16S		23/07/2020	sediment		X														
14	DC17S		23/07/2020	sediment		X														

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 247753
2c
Date Received: 27/7/2020
Time Received: 1055
Received By: CM
Temp: [✓ Cool]/Ambient
Cooling: [✓ Ice]/Icepack
Security: [✓ Intact]/Broken/None

15	DC18S		23/07/2020	sediment		X														
16	DC19S		23/07/2020	sediment		X														
17	DC-UP01S		23/07/2020	sediment		X														
18	DC-UP02S		23/07/2020	sediment		X														
19	MBC01S		23/07/2020	sediment		X														
20	MBC02S		23/07/2020	sediment		X														
NR	NC01S		23/07/2020	sediment		X														
21	NC02S		23/07/2020	sediment		X														
22	BR01S		23/07/2020	sediment		X														
23	RB07		23/07/2020	water	X															
24	TB07		23/07/2020	water	X															
25	QC27		23/07/2020	water	X															
NR	QC27A		23/07/2020	water																Please forward to ALS
26	QC27S		23/07/2020	sediment		X														
–	QC27AS		23/07/2020	sediment																Please forward to ALS
27	QC28		23/07/2020	water	X															
–	QC28A		23/07/2020	water																Please forward to ALS
28	QC28S		23/07/2020	sediment		X														
–	QC28AS		23/07/2020	sediment																Please forward to ALS

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company):	**Received by (Company):** ELS Syd	***Lab Use Only***	
Print Name:	**Print Name:** C-Mulem	**Job number:** 247753	**Cooling:** Ice / [✓ Ice pack] / None
Date & Time:	**Date & Time:** 27/7/2020	**Temperature:** 9.2	**Security seal:** ~~Intact~~ / Broken / None
Signature:	**Signature:** Cm	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**	

29 NC02 sediment - Extra received.

30 QC29 water - Extra

31 QC29A water - Extra

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 247753

Client Details

Client	GHD Pty Ltd
Attention	Sean Sparrow
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	16 Water, 13 Sediment
Date samples received	27/07/2020
Date completed instructions received	28/07/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/08/2020
Date of Issue	04/08/2020

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

Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		247753-1	247753-2	247753-3	247753-4	247753-5
Your Reference	UNITS	DC 16	DC 17	DC 18	DC 19	DC-UP01
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Date analysed	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.072	0.070	0.014	0.014	0.0024
Perfluorooctanesulfonic acid PFOS	µg/L	0.087	0.078	0.012	0.012	0.0021
Perfluorooctanoic acid PFOA	µg/L	0.0062	0.0054	0.0032	0.0029	0.0023
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	98	100	100	94	107
Surrogate $^{13}C_2$ *PFOA*	%	109	104	106	105	111
Extracted ISTD $^{18}O_2$ *PFHxS*	%	103	99	94	97	107
Extracted ISTD $^{13}C_4$ *PFOS*	%	83	81	74	83	79
Extracted ISTD $^{13}C_4$ *PFOA*	%	115	114	96	106	108
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	185	188	158	152	187
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	187	157	154	159
Total Positive PFHxS & PFOS	µg/L	0.16	0.15	0.027	0.026	0.0046
Total Positive PFOS & PFOA	µg/L	0.093	0.083	0.016	0.015	0.0044
Total Positive PFAS	µg/L	0.17	0.15	0.030	0.029	0.0069

PFAS in Water TRACE Short						
Our Reference		247753-6	247753-7	247753-8	247753-9	247753-10
Your Reference	UNITS	DC-UP02	MBC01	MBC02	NC01	NC02
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Date analysed	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0022	0.0021	0.0027	0.0049	0.0047
Perfluorooctanesulfonic acid PFOS	µg/L	0.0020	0.0025	0.0029	0.0054	0.0061
Perfluorooctanoic acid PFOA	µg/L	0.0025	0.0031	0.0034	0.0009	0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	108	108	103	102	104
Surrogate $^{13}C_2$ *PFOA*	%	116	121	123	99	107
Extracted ISTD $^{18}O_2$ *PFHxS*	%	108	106	113	122	111
Extracted ISTD $^{13}C_4$ *PFOS*	%	85	77	86	91	85
Extracted ISTD $^{13}C_4$ *PFOA*	%	110	99	103	144	124
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	#	#	#	#	185
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	183	189	181	186
Total Positive PFHxS & PFOS	µg/L	0.0042	0.0046	0.0055	0.010	0.011
Total Positive PFOS & PFOA	µg/L	0.0045	0.0055	0.0063	0.0062	0.0071
Total Positive PFAS	µg/L	0.0067	0.0076	0.0090	0.011	0.012

PFAS in Water TRACE Short

Our Reference		247753-11	247753-12	247753-23	247753-24	247753-25
Your Reference	UNITS	BR01	BR02	RB07	TB07	QC27
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Date analysed	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.044	0.0002	<0.0002	<0.0002	0.011
Perfluorooctanesulfonic acid PFOS	µg/L	0.027	<0.0002	<0.0002	<0.0002	0.013
Perfluorooctanoic acid PFOA	µg/L	0.0036	<0.0002	<0.0002	<0.0002	0.0034
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	106	100	103	103	98
Surrogate $^{13}C_2$ *PFOA*	%	106	107	98	99	110
Extracted ISTD $^{18}O_2$ *PFHxS*	%	92	111	109	98	110
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	84	103	65	87
Extracted ISTD $^{13}C_4$ *PFOA*	%	105	122	138	117	112
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	167	141	146	137	184
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	161	126	146	90	184
Total Positive PFHxS & PFOS	µg/L	0.071	0.0002	<0.0002	<0.0002	0.024
Total Positive PFOS & PFOA	µg/L	0.030	<0.0002	<0.0002	<0.0002	0.016
Total Positive PFAS	µg/L	0.075	0.0002	<0.0002	<0.0002	0.027

PFAS in Water TRACE Short		
Our Reference		247753-27
Your Reference	UNITS	QC28
Date Sampled		23/07/2020
Type of sample		Water
Date prepared	-	03/08/2020
Date analysed	-	03/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0030
Perfluorooctanesulfonic acid PFOS	µg/L	0.0032
Perfluorooctanoic acid PFOA	µg/L	0.0033
6:2 FTS	µg/L	<0.0004
8:2 FTS	µg/L	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	109
Surrogate $^{13}C_2$ *PFOA*	%	112
Extracted ISTD $^{18}O_2$ *PFHxS*	%	110
Extracted ISTD $^{13}C_4$ *PFOS*	%	82
Extracted ISTD $^{13}C_4$ *PFOA*	%	113
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	187
Total Positive PFHxS & PFOS	µg/L	0.0062
Total Positive PFOS & PFOA	µg/L	0.0065
Total Positive PFAS	µg/L	0.0095

PFAS in Soils Short

Our Reference	UNITS	247753-13	247753-14	247753-15	247753-16	247753-17
Your Reference		DC16S	DC17S	DC18S	DC19S	DC-UP01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	1.3	1.7	0.2	<0.1	<0.3
Perfluorooctanesulfonic acid PFOS	µg/kg	34	48	5.8	0.4	1.4
Perfluorooctanoic acid PFOA	µg/kg	0.2	0.2	0.3	<0.1	<0.3
6:2 FTS	µg/kg	<0.3	<0.3	<0.2	<0.1	<0.3
8:2 FTS	µg/kg	<0.6	<0.6	<0.4	<0.2	<0.6
Surrogate $^{13}C_8$ *PFOS*	%	106	101	104	103	117
Surrogate $^{13}C_2$ *PFOA*	%	100	100	106	91	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	75	76	88	90	77
Extracted ISTD $^{13}C_4$ *PFOS*	%	55	72	84	71	46
Extracted ISTD $^{13}C_4$ *PFOA*	%	67	83	87	84	61
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	83	107	103	83	66
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	78	91	100	61	53
Total Positive PFHxS & PFOS	µg/kg	35	49	6.0	0.4	1.4
Total Positive PFOS & PFOA	µg/kg	34	48	6.0	0.4	1.4
Total Positive PFAS	µg/kg	35	50	6.3	0.4	1.4

PFAS in Soils Short						
Our Reference		247753-18	247753-19	247753-20	247753-21	247753-22
Your Reference	UNITS	DC-UP02S	MBC01S	MBC02S	NC02S	BR01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.3	<0.2	<0.2	0.4
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	1.4	2.2	0.4	1.2
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.3	0.4	<0.2	0.2
6:2 FTS	µg/kg	<0.1	<0.3	<0.2	<0.2	<0.1
8:2 FTS	µg/kg	<0.2	<0.6	<0.4	<0.4	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	105	100	103	102	111
Surrogate $^{13}C_2$ *PFOA*	%	96	100	99	97	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	83	83	83	93
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	82	80	63	91
Extracted ISTD $^{13}C_4$ *PFOA*	%	98	85	87	73	103
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	104	93	98	82	118
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	101	101	96	48	125
Total Positive PFHxS & PFOS	µg/kg	<0.1	1.4	2.2	0.4	1.6
Total Positive PFOS & PFOA	µg/kg	<0.1	1.4	2.5	0.4	1.4
Total Positive PFAS	µg/kg	<0.1	1.4	2.5	0.4	1.7

PFAS in Soils Short				
Our Reference		247753-26	247753-28	247753-29
Your Reference	UNITS	QC27S	QC28S	NC01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	30/07/2020	30/07/2020	30/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.3	<0.2
Perfluorooctanesulfonic acid PFOS	µg/kg	0.2	1.8	0.9
Perfluorooctanoic acid PFOA	µg/kg	<0.1	0.2	<0.2
6:2 FTS	µg/kg	<0.1	<0.3	<0.2
8:2 FTS	µg/kg	<0.2	<0.6	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	103	101	103
Surrogate $^{13}C_2$ *PFOA*	%	96	103	100
Extracted ISTD $^{18}O_2$ *PFHxS*	%	89	83	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	77	81
Extracted ISTD $^{13}C_4$ *PFOA*	%	97	81	79
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	111	84	94
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	79	85	86
Total Positive PFHxS & PFOS	µg/kg	0.2	1.8	0.9
Total Positive PFOS & PFOA	µg/kg	0.2	2.1	0.9
Total Positive PFAS	µg/kg	0.2	2.1	0.9

Moisture						
Our Reference	UNITS	247753-13	247753-14	247753-15	247753-16	247753-17
Your Reference		DC16S	DC17S	DC18S	DC19S	DC-UP01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	29/07/2020	29/07/2020	29/07/2020	29/07/2020	29/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Moisture	%	69	70	46	28	66

Moisture						
Our Reference	UNITS	247753-18	247753-19	247753-20	247753-21	247753-22
Your Reference		DC-UP02S	MBC01S	MBC02S	NC02S	BR01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
Date prepared	-	29/07/2020	29/07/2020	29/07/2020	29/07/2020	29/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020	30/07/2020	30/07/2020
Moisture	%	36	62	54	54	36

Moisture				
Our Reference	UNITS	247753-26	247753-28	247753-29
Your Reference		QC27S	QC28S	NC01S
Date Sampled		23/07/2020	23/07/2020	23/07/2020
Type of sample		Sediment	Sediment	Sediment
Date prepared	-	29/07/2020	29/07/2020	29/07/2020
Date analysed	-	30/07/2020	30/07/2020	30/07/2020
Moisture	%	26	67	46

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	247753-4
Date prepared	-			03/08/2020	3	03/08/2020	03/08/2020		03/08/2020	03/08/2020
Date analysed	-			03/08/2020	3	03/08/2020	03/08/2020		03/08/2020	03/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	3	0.014	0.015	7	95	114
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	3	0.012	0.015	22	89	112
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	3	0.0032	0.0029	10	92	104
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	100	94
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	89	99
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	3	100	101	1	100	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	3	106	105	1	99	108
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	106	3	94	104	10	106	100
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	84	3	74	84	13	87	77
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	119	3	96	118	21	112	102
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	130	3	158	184	15	123	176
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	99	3	157	149	5	91	161

QUALITY CONTROL: PFAS in Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	12	03/08/2020	03/08/2020		[NT]	[NT]
Date analysed	-			[NT]	12	03/08/2020	03/08/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	12	0.0002	0.0002	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	12	<0.0002	0.0003	40	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	12	<0.0002	<0.0002	0	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	12	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	12	<0.0004	<0.0004	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	12	100	101	1	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	12	107	109	2	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	12	111	110	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	12	84	84	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	12	122	117	4	[NT]	[NT]

QUALITY CONTROL: PFAS in Water TRACE 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]	12	141	142	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	12	126	160	24	[NT]	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	247753-14
Date prepared	-			30/07/2020	13	30/07/2020	30/07/2020		30/07/2020	30/07/2020
Date analysed	-			30/07/2020	13	30/07/2020	30/07/2020		30/07/2020	30/07/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	13	1.3	1.4	7	110	115
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	13	34	36	6	94	103
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	13	0.2	0.4	67	99	96
6:2 FTS	µg/kg	0.1	Org-029	<0.1	13	<0.3	<0.3	0	107	104
8:2 FTS	µg/kg	0.2	Org-029	<0.2	13	<0.6	<0.6	0	103	106
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	13	106	100	6	102	101
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	13	100	93	7	99	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	104	13	75	76	1	101	73
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	106	13	55	68	21	104	70
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	113	13	67	84	23	108	79
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	113	13	83	115	32	117	91
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	114	13	78	128	49	121	76

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	26	30/07/2020	30/07/2020		[NT]	[NT]
Date analysed	-			[NT]	26	30/07/2020	30/07/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	26	<0.1	<0.1	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	26	0.2	0.3	40	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	26	<0.1	<0.1	0	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	26	<0.1	<0.1	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	26	<0.2	<0.2	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	26	103	96	7	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	26	96	106	10	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	26	89	92	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	26	88	89	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	26	97	97	0	[NT]	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Soils 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]	26	111	128	14	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	26	79	127	47	[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.

Report Comments

PFAS_S_SHORT: PQLs have been raised for various samples due to high moisture content.

PFAS in Water TRACE Short - For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Ming To

From: Aileen Hie
Sent: Friday, 9 October 2020 5:39 PM
To: Ming To
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Ref: 247753-A
TAT: 1 day
Due: 12/10/2020 MT

From: Alex Stenta <astenta@envirolab.com.au>
Sent: Friday, 9 October 2020 5:05 PM
To: Customer Service <CustomerService@envirolab.com.au>
Cc: Adelaide <adelaide@envirolab.com.au>; Alexander Maclean <AMaclean@envirolab.com.au>
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828
Importance: High

Hi Guys,

Can we please report **trace level PFAS extended suite** for all samples in Job Number 251682?

Also, can we please have **trace level PFAS extended suite** for the following samples:

DC14 – 246709 - 11
DC15 – 246709 - 13
DC16 – 247753 - 1
DC17 - 247753 - 2
DC18 - 247753 - 3
DC19 - 247753 - 4

247753-A

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 247753-A

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	16 Water, 13 Sediment
Date samples received	27/07/2020
Date completed instructions received	09/10/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	13/10/2020
Date of Issue	13/10/2020

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
Alexander Mitchell Maclean, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

PFAS in Waters Trace Extended

Our Reference		247753-A-1	247753-A-2	247753-A-3	247753-A-4
Your Reference	UNITS	DC 16	DC 17	DC 18	DC 19
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Water	Water	Water	Water
Date prepared	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Date analysed	-	03/08/2020	03/08/2020	03/08/2020	03/08/2020
Perfluorobutanesulfonic acid	µg/L	0.0087	0.0087	0.003	0.003
Perfluoropentanesulfonic acid	µg/L	0.009	0.009	0.002	0.002
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.072	0.070	0.014	0.014
Perfluoroheptanesulfonic acid	µg/L	0.003	0.003	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.087	0.078	0.012	0.012
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.01	0.01	0.007	0.006
Perfluoropentanoic acid	µg/L	0.008	0.008	0.003	0.003
Perfluorohexanoic acid	µg/L	0.021	0.018	0.0064	0.0055
Perfluoroheptanoic acid	µg/L	0.0048	0.0046	0.002	0.002
Perfluorooctanoic acid PFOA	µg/L	0.0062	0.0054	0.0032	0.0029
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	100	100	94
Surrogate $^{13}C_2$ *PFOA*	%	109	104	106	105
Extracted ISTD $^{13}C_3$ *PFBS*	%	87	84	74	84
Extracted ISTD $^{18}O_2$ *PFHxS*	%	103	99	94	97
Extracted ISTD $^{13}C_4$ *PFOS*	%	83	81	74	83
Extracted ISTD $^{13}C_4$ *PFBA*	%	51	49	47	58

PFAS in Waters Trace Extended					
Our Reference		247753-A-1	247753-A-2	247753-A-3	247753-A-4
Your Reference	UNITS	DC 16	DC 17	DC 18	DC 19
Date Sampled		23/07/2020	23/07/2020	23/07/2020	23/07/2020
Type of sample		Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	74	69	64	77
Extracted ISTD $^{13}C_2$ *PFHxA*	%	94	96	85	94
Extracted ISTD $^{13}C_4$ *PFHpA*	%	131	114	98	110
Extracted ISTD $^{13}C_4$ *PFOA*	%	115	114	96	106
Extracted ISTD $^{13}C_5$ *PFNA*	%	136	138	125	127
Extracted ISTD $^{13}C_2$ *PFDA*	%	146	124	118	113
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	94	76	65	66
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	73	65	43	47
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	78	74	38	46
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	176	181	183	170
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	185	188	158	152
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	198	187	157	154
Extracted ISTD $^{13}C_8$ *FOSA*	%	63	61	49	53
Extracted ISTD d_3 *N MeFOSA*	%	40	39	26	29
Extracted ISTD d_5 *N EtFOSA*	%	44	43	31	33
Extracted ISTD d_7 *N MeFOSE*	%	53	49	35	40
Extracted ISTD d_9 *N EtFOSE*	%	56	50	37	42
Extracted ISTD d_3 *N MeFOSAA*	%	86	81	69	67
Extracted ISTD d_5 *N EtFOSAA*	%	77	67	51	49
Total Positive PFHxS & PFOS	µg/L	0.16	0.15	0.027	0.026
Total Positive PFOS & PFOA	µg/L	0.093	0.083	0.016	0.015
Total Positive PFAS	µg/L	0.23	0.22	0.053	0.048

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. 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 Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	247753-A-4
Date prepared	-			03/08/2020	3	03/08/2020	03/08/2020		03/08/2020	03/08/2020
Date analysed	-			03/08/2020	3	03/08/2020	03/08/2020		03/08/2020	03/08/2020
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	3	0.003	0.003	0	88	102
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	3	0.002	0.002	0	91	112
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	3	0.014	0.015	7	95	114
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	85	100
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	3	0.012	0.015	22	89	112
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	81	66
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	3	0.007	0.008	13	95	121
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	3	0.003	0.003	0	88	104
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	3	0.0064	0.0062	3	91	108
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	3	0.002	0.002	0	90	112
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	3	0.0032	0.0029	10	92	104
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	87	100
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	90	91
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	90	82
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	92	82
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	74	91
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	3	<0.05	<0.05	0	86	95
4:2 FTS	µg/L	0.001	Org-029	<0.001	3	<0.001	<0.001	0	99	127
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	100	94
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	3	<0.0004	<0.0004	0	89	99
10:2 FTS	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	77	86
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	93	113
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	75	60
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	3	<0.01	<0.01	0	66	##
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	3	<0.005	<0.005	0	97	103
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	3	<0.05	<0.05	0	99	102
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	97	84
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	3	<0.002	<0.002	0	88	91
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	98	3	100	101	1	97	100
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	108	3	106	105	1	107	108

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	247753-A-4
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	99	3	74	89	18	102	85
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	111	3	94	104	10	113	100
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	83	3	74	84	13	78	77
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	102	3	47	50	6	101	57
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	105	3	64	74	14	107	77
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	111	3	85	100	16	103	92
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	118	3	98	121	21	134	104
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	107	3	96	118	21	108	102
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	105	3	125	139	11	109	124
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	97	3	118	131	10	99	121
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	74	3	65	77	17	67	78
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	64	3	43	47	9	53	59
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	67	3	38	43	12	68	48
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	130	3	183	#		112	195
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	109	3	158	184	15	115	176
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	101	3	157	149	5	109	161
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	78	3	49	56	13	71	56
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	58	3	26	28	7	54	38
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	60	3	31	32	3	56	43
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	74	3	35	40	13	66	45

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	247753-A-4
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	76	3	37	41	10	68	46
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	72	3	69	73	6	69	78
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	70	3	51	49	4	68	59

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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Matrix spike recovery for EtFOSA (52%) is outside global accptance criteria (60-140%). However an acceptable recovery has been obatined for the LCS.

CHAIN OF CUSTODY FORM - Client

ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
☎ 02 9910 6200 | ✉ sydney@envirolab.com.au

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Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
☎ 08 8967 1201 | ✉ darwin@envirolab.com.au

Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address:
Level 4, 211 Victoria Square, Adelaide 5000
Phone: Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace	PFAS Short Suite														Provide as much information about the sample as you can
1	DC16		23/07/2020	water	X															
2	DC17		23/07/2020	water	X															
3	DC18		23/07/2020	water	X														753	
4	DC19		23/07/2020	water	X															x
5	DC-UP01		23/07/2020	water	X														0	
6	DC-UP02		23/07/2020	water	X														5	
7	MBC01		23/07/2020	water	X															
8	MBC02		23/07/2020	water	X															
9	NC01		23/07/2020	water	X															
10	NC02		23/07/2020	water	X															
11	BR01		23/07/2020	water	X															
12	BR02		23/07/2020	water	X															
13	DC16S		23/07/2020	sediment		X														
14	DC17S		23/07/2020	sediment		X														

Envirolab Services
12 Ashley St

Environmental Division
Sydney
Work Order Reference
ES2025997

Telephone : + 61-2-8784 8555

Relinquished by: ELS Syd K-Gore 28.7.20

Rec: Tmp: 28/7/20 4:30pm

15	DC18S		23/07/2020	sediment		X														
16	DC19S		23/07/2020	sediment		X														
17	DC-UP01S		23/07/2020	sediment		X														
18	DC-UP02S		23/07/2020	sediment		X														
19	MBC01S		23/07/2020	sediment		X														
20	MBC02S		23/07/2020	sediment		X														
NR	NC01S		23/07/2020	sediment		X														
21	NC02S		23/07/2020	sediment		X														
22	BR01S		23/07/2020	sediment		X														
23	RB07		23/07/2020	water	X															
24	TB07		23/07/2020	water	X															
25	QC27		23/07/2020	water	X															
NR	QC27A 1		23/07/2020	water																Please forward to ALS
26	QC27S		23/07/2020	sediment		X														
–	QC27AS 2		23/07/2020	sediment																Please forward to ALS
27	QC28		23/07/2020	water	X															
–	QC28A 3		23/07/2020	water																Please forward to ALS
28	QC28S		23/07/2020	sediment		X														
–	QC28AS 4		23/07/2020	sediment																Please forward to ALS

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company): EZS Syd	**Received by (Company):** ELS Syd	***Lab Use Only***			
Print Name: K. Gore	**Print Name:** C-Malem	**Job number:** 247753		**Cooling:** Ice / [✓ Ice pack] / None	
Date & Time: 28/07/2020	**Date & Time:** 27/7/2020	**Temperature:** 9.2		**Security seal:** [✓ Intact] / Broken / None	
Signature:	**Signature:** CM	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**			

29 NC02 sediment - Extra received.

30 QC29 water - Extra

31 QC29A water 5 - Extra → QC29A is missing QC27A → send to ALS.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2025997**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: GHD LAB REPORTS	Contact	: Angus Harding
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	: 12516828	Date Samples Received	: 28-Jul-2020 16:00
Order number	: 12516828	Date Analysis Commenced	: 03-Aug-2020
C-O-C number	: ----	Issue Date	: 07-Aug-2020 13:14
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 5		
No. of samples analysed	: 5		

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

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

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

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

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

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS 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: **SEDIMENT** (Matrix: **SOIL**)			*Client sample ID*	**QC27AS**	**QC28AS**	----	----	----
			Client sampling date / time	23-Jul-2020 00:00	23-Jul-2020 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2025997-002**	**ES2025997-004**	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**32.7**	**62.4**	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0003**	**0.0012**	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	**0.0003**	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	**0.0004**	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	----	----	----

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)			*Client sample ID*	**QC27AS**	**QC28AS**	**----**	**----**	**----**
			Client sampling date / time	23-Jul-2020 00:00	23-Jul-2020 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2025997-002**	**ES2025997-004**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	**0.0003**	**0.0019**	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0003**	**0.0012**	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0003**	**0.0015**	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**104**	**102**	----	----	----
13C8-PFOA	----	0.0002	%	**102**	**106**	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QC27A**	**QC28A**	**QC29A**	**----**	**----**
			Client sampling date / time	23-Jul-2020 00:00	23-Jul-2020 00:00	23-Jul-2020 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2025997-001**	**ES2025997-003**	**ES2025997-005**	**--------**	**--------**
				Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.004**	**0.005**	**0.004**	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.014**	**0.004**	**0.015**	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.020**	**0.004**	**0.020**	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<0.002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	<0.01	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.005**	**0.005**	**0.007**	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.003**	**0.003**	**0.003**	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	----	----
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	<0.002	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	----	----

Analytical Results

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

			Client sample ID	**QC27A**	**QC28A**	**QC29A**	**----**	**----**
			Client sampling date / time	23-Jul-2020 00:00	23-Jul-2020 00:00	23-Jul-2020 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2025997-001**	**ES2025997-003**	**ES2025997-005**	**--------**	**--------**
				Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	<0.005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	<0.005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	<0.005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	<0.005	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.002	µg/L	**0.046**	**0.021**	**0.049**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.034**	**0.008**	**0.035**	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.046**	**0.021**	**0.049**	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**91.6**	**91.0**	**91.3**	----	----
13C8-PFOA	----	0.002	%	**97.7**	**95.7**	**99.7**	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

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

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order	: **ES2025997**	Page	: 1 of 10
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: GHD LAB REPORTS	Contact	: Angus Harding
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	: 12516828	Date Samples Received	: 28-Jul-2020
Order number	: 12516828	Date Analysis Commenced	: 03-Aug-2020
C-O-C number	: ----	Issue Date	: 07-Aug-2020
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005/19		
No. of samples received	: 5		
No. of samples analysed	: 5		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3180310)									
ES2026402-013	Anonymous	EA055: Moisture Content	----	0.1	%	15.8	16.5	4.34	0% - 50%
ES2026531-014	Anonymous	EA055: Moisture Content	----	0.1	%	16.7	17.3	3.89	0% - 50%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3178881)									
EM2013258-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0008	0.0008	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
ES2026298-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3178881)									
EM2013258-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3178881) - continued									
EM2013258-001	Anonymous	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
ES2026298-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3178881)									
EM2013258-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES2026298-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3178881)									
EM2013258-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES2026298-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3174427)									
EM2013117-001	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.006	0.007	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.005	0.004	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.008	0.009	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3174427)									
EM2013117-001	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.005	0.006	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.010	0.010	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.012	0.011	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.027	0.026	0.00	0% - 50%
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.003	0.003	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3174427) - continued									
EM2013117-001	Anonymous	EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3174427)									
EM2013117-001	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3174427)									
EM2013117-001	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3178881)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	104	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	107	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	104	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	101	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3178881)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	95.7	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	117	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	117	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	118	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	122	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	101	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	123	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	117	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	95.7	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3178881)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	113	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	95.4	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	100	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	101	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	102	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	115	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	117	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3178881)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	111	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	109	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	104	65.0	137

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3178881) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	105	69.2	143

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3174427)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	111	72.0	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.025 µg/L	112	71.0	127
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	100	68.0	131
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.025 µg/L	114	69.0	134
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	118	65.0	140
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.025 µg/L	117	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3174427)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	104	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	117	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	114	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	112	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	116	71.0	133
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.025 µg/L	119	69.0	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.025 µg/L	109	71.0	129
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.025 µg/L	117	69.0	133
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.025 µg/L	110	72.0	134
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.025 µg/L	86.4	65.0	144
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.0625 µg/L	124	71.0	132
EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	0.025 µg/L	76.8	65.6	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3174427)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.025 µg/L	112	67.0	137
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.0625 µg/L	120	68.0	141
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.0625 µg/L	106	61.1	139
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.0625 µg/L	124	72.3	128
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.0625 µg/L	124	63.2	134
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.025 µg/L	106	65.0	136
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.025 µg/L	113	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3174427)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3174427) - continued								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	112	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	99.6	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	116	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	116	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3178881)							
EM2013258-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	110	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	112	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	110	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	102	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	92.4	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	74.0	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3178881)							
EM2013258-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	96.3	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	117	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	118	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	117	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	120	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	118	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	100	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	121	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	120	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	120	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	106	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3178881)							
EM2013258-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	119	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	106	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	94.7	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	101	68.7	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3178881) - continued							
EM2013258-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	108	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	121	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	116	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3178881)							
EM2013258-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	113	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	115	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	118	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	115	69.2	143

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3174427)							
EM2013117-002	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	110	72.0	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.025 µg/L	119	71.0	127
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	94.0	68.0	131
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.025 µg/L	112	69.0	134
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	84.4	65.0	140
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.025 µg/L	105	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3174427)							
EM2013117-002	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	99.8	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	114	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	105	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	114	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	102	71.0	133
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.025 µg/L	102	69.0	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.025 µg/L	97.6	71.0	129
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.025 µg/L	105	69.0	133
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.025 µg/L	106	72.0	134
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.025 µg/L	91.6	65.0	144
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0625 µg/L	106	71.0	132
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.025 µg/L	80.4	65.6	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3174427)							
EM2013117-002	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.025 µg/L	116	67.0	137
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0625 µg/L	110	68.0	141

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3174427) - continued							
EM2013117-002	Anonymous	EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0625 µg/L	101	61.1	139
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0625 µg/L	109	72.3	128
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0625 µg/L	111	63.2	134
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.025 µg/L	116	65.0	136
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.025 µg/L	120	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3174427)							
EM2013117-002	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	94.4	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	119	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	122	67.0	138
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	118	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2025997**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: GHD LAB REPORTS	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 28-Jul-2020
Site	:	Issue Date	: 07-Aug-2020
Sampler	: SEAN SPARROW	No. of samples received	: 5
Order number	: 12516828	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QC27AS, QC28AS	**23-Jul-2020**	**----**	----	----	**05-Aug-2020**	06-Aug-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC27AS, QC28AS	**23-Jul-2020**	**04-Aug-2020**	19-Jan-2021	✓	**05-Aug-2020**	13-Sep-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC27AS, QC28AS	**23-Jul-2020**	**04-Aug-2020**	19-Jan-2021	✓	**05-Aug-2020**	13-Sep-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) QC27AS, QC28AS	**23-Jul-2020**	**04-Aug-2020**	19-Jan-2021	✓	**05-Aug-2020**	13-Sep-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC27AS, QC28AS	**23-Jul-2020**	**04-Aug-2020**	19-Jan-2021	✓	**05-Aug-2020**	13-Sep-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC27AS, QC28AS	**23-Jul-2020**	**04-Aug-2020**	19-Jan-2021	✓	**05-Aug-2020**	13-Sep-2020	✓

Matrix: **WATER**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC27A, QC28A, QC29A	**23-Jul-2020**	**03-Aug-2020**	19-Jan-2021	✓	**04-Aug-2020**	19-Jan-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC27A, QC28A, QC29A	**23-Jul-2020**	**03-Aug-2020**	19-Jan-2021	✓	**04-Aug-2020**	19-Jan-2021	✓

Matrix: **WATER**

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

Method ***Container*** */ Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) QC27A, QC28A, QC29A	**23-Jul-2020**	**03-Aug-2020**	19-Jan-2021	✓	**04-Aug-2020**	19-Jan-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC27A, QC28A, QC29A	**23-Jul-2020**	**03-Aug-2020**	19-Jan-2021	✓	**04-Aug-2020**	19-Jan-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC27A, QC28A, QC29A	**23-Jul-2020**	**03-Aug-2020**	19-Jan-2021	✓	**04-Aug-2020**	19-Jan-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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 FORM - Client

ENVIROLAB GROUP

National phone number 1300 424 344

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
Address: Level 4, 211 Victoria Square, Adelaide 5000
Phone: **Mob:** 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 3 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace	PFAS Short Suite														Provide as much information about the sample as you can
1	DC17A		10/08/2020	Water	X															
2	DC17AS		10/08/2020	Sediment		X														
3	QC29		10/08/2020	Water	X															
4	QC29S		10/08/2020	Sediment		X														
—	QC29A		10/08/2020	Water																Please forward to ALS
—	QC29AS		10/08/2020	Sediment																Please forward to ALS
5	TB08		10/08/2020	Water	X															
6	RB08		10/08/2020	Water	X															

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	**Received by (Company):** ELS Sydney	***Lab Use Only***
Print Name:	**Print Name:** R L	**Job number:** 248875. **Cooling:** [✓ Ice] / Ice pack / None
Date & Time:	**Date & Time:** 12/08/2020. 14.50	**Temperature:** 6°C. **Security seal:** [✓ Intact] / Broken / None
Signature:	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**

sample received : 11/08/2020. 10.15

COC Received: 12/08/2020. 14.50.

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 248875

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	4 Water, 2 Sediment
Date samples received	11/08/2020
Date completed instructions received	12/08/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	17/08/2020
Date of Issue	17/08/2020

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

Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		248875-1	248875-3	248875-5	248875-6
Your Reference	UNITS	DC17A	QC29	TB08	RB08
Date Sampled		10/08/2020	10/08/2020	10/08/2020	10/08/2020
Type of sample		Water	Water	Water	Water
Date prepared	-	13/08/2020	13/08/2020	13/08/2020	13/08/2020
Date analysed	-	13/08/2020	13/08/2020	13/08/2020	13/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0064	0.0060	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	0.014	0.014	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	0.0028	0.0029	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	100	105	97	107
Surrogate $^{13}C_2$ *PFOA*	%	97	97	110	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	122	119	133	116
Extracted ISTD $^{13}C_4$ *PFOS*	%	54	49	94	112
Extracted ISTD $^{13}C_4$ *PFOA*	%	103	103	122	119
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	#	#	#	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	#	#	#
Total Positive PFHxS & PFOS	µg/L	0.021	0.020	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.017	0.017	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.024	0.023	<0.0002	<0.0002

PFAS in Soils Short

Our Reference		248875-2	248875-4
Your Reference	UNITS	DC17AS	QC29S
Date Sampled		10/08/2020	10/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	14/08/2020	14/08/2020
Date analysed	-	14/08/2020	14/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.2
Perfluorooctanesulfonic acid PFOS	µg/kg	2.9	3.9
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.2
6:2 FTS	µg/kg	<0.1	<0.2
8:2 FTS	µg/kg	<0.2	<0.4
Surrogate $^{13}C_8$ *PFOS*	%	103	103
Surrogate $^{13}C_2$ *PFOA*	%	99	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	90
Extracted ISTD $^{13}C_4$ *PFOS*	%	81	77
Extracted ISTD $^{13}C_4$ *PFOA*	%	79	77
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	93	95
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	101	117
Total Positive PFHxS & PFOS	µg/kg	2.9	3.9
Total Positive PFOS & PFOA	µg/kg	2.9	3.9
Total Positive PFAS	µg/kg	2.9	3.9

Moisture			
Our Reference		248875-2	248875-4
Your Reference	UNITS	DC17AS	QC29S
Date Sampled		10/08/2020	10/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	13/08/2020	13/08/2020
Date analysed	-	14/08/2020	14/08/2020
Moisture	%	39	46

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			13/08/2020	[NT]	[NT]	[NT]	[NT]	13/08/2020	[NT]
Date analysed	-			13/08/2020	[NT]	[NT]	[NT]	[NT]	13/08/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	101	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	106	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	92	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	96	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	112	[NT]	[NT]	[NT]	[NT]	113	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	81	[NT]	[NT]	[NT]	[NT]	90	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	114	[NT]	[NT]	[NT]	[NT]	108	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	145	[NT]	[NT]	[NT]	[NT]	133	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	130	[NT]	[NT]	[NT]	[NT]	115	[NT]

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	248875-4
Date prepared	-			14/08/2020	2	14/08/2020	14/08/2020		14/08/2020	14/08/2020
Date analysed	-			14/08/2020	2	14/08/2020	14/08/2020		14/08/2020	14/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	103	96
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	2.9	2.6	11	97	106
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	102	102
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	100	94
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	111	89
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	2	103	92	11	92	107
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	2	99	96	3	98	103
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	105	2	87	80	8	105	88
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	99	2	81	76	6	102	79
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	99	2	79	73	8	98	78
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	109	2	93	83	11	102	105
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	113	2	101	90	12	103	139

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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Soil Short - PQLs have been raised due to high moisture content in sample 248875-4.

CHAIN OF CUSTODY FORM - Client

ENVIROLAB GROUP
ENVIROLAB SERVICES
mpl

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Phone:
Mob: 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 3 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

TAT

Sample information					Tests Required		Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace	PFAS Short Suite	Provide as much information about the sample as you can
1	DC17A		10/08/2020	Water	X		
2	DC17AS		10/08/2020	Sediment		X	
3	QC29		10/08/2020	Water	X		
4	QC29S		10/08/2020	Sediment		X	
1 —	QC29A		10/08/2020	Water			Please forward to ALS
2 —	QC29AS		10/08/2020	Sediment			Please forward to ALS
5	TB08		10/08/2020	Water	X		
6	RB08		10/08/2020	Water	X		

Environmental Division
Sydney
Work Order Reference
ES2028322
Telephone : + 61-2-8784 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS SUD
Print Name: C-McKenzie
Date & Time: 13/8/20 800
Signature: CM

Received by (Company): ELS Sydney
Print Name: R L
Date & Time: 12/08/2020. 14.50
Signature:

Lab Use Only
Job number: 248875.
Temperature: 6°C.
Cooling: [✓ Ice] / Ice pack / None
Security seal: [✓ Intact] / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

Form 302_V006

rec: Fan: 13/8/20 2:30pm

sample received : 11/08/2020. 10.15

COC Received: 12/08/2020. 14.50.

Issue date: 7 October 2019

Page 1 of 1

Helen Simpson

From: Sean Sparrow <Sean.Sparrow@ghd.com>
Sent: Friday, 14 August 2020 12:24 PM
To: Helen Simpson; Dilara Valiff
Subject: [EXTERNAL] - RE: ALS Workorder ES2028322, Client GHDSER, Project 12516828

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi Helen,

Thank you for getting in touch, please go ahead and analyse the samples, QC29A (water) with PFAS Ultra-Trace (0.0002 ug/L) and QC29AS (sediment) with PFAS Short Suite.

Thank you,

Sean Sparrow
Environmental Scientist

GHD
Proudly employee owned
M: 0498 260 626 T: 61 8 8111 6608 V: 336608 E: Sean.Sparrow@ghd.com
Level 4 211 Victoria Square Adelaide SA 5000 Australia | http://www.ghd.com/
Water | Energy & Resources | Environment | Property & Buildings | Transportation

Connect

From: Helen Simpson <helen.simpson@alsglobal.com>
Sent: Friday, 14 August 2020 11:31 AM
To: Dilara Valiff <Dilara.Valiff@ghd.com>; Sean Sparrow <Sean.Sparrow@ghd.com>
Subject: ALS Workorder ES2028322, Client GHDSER, Project 12516828
Importance: High

Hi Dilara and Sean,

We have received the attached COC with no analysis requested. Do these samples need to be tested?

Kind Regards,

Helen Simpson
Sample Admin, Environmental
Sydney

T +61 2 8784 8555
F +61 2 8784 8500
helen.simpson@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

CERTIFICATE OF ANALYSIS

Work Order	: **ES2028322**	Page	: 1 of 5
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 13-Aug-2020 14:00
Order number	: ----	Date Analysis Commenced	: 17-Aug-2020
C-O-C number	: ----	Issue Date	: 21-Aug-2020 08:13
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005		
No. of samples received	: 2		
No. of samples analysed	: 2		

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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.
- Amendment (21/08/2020):This report has been amended following the correction of sampling date for QC29AS. All analysis results are as per the previous report.
- 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: **SEDIMENT** (Matrix: **SOIL)**			*Client sample ID*	**QC29AS**	----	----	----	----
			Client sampling date / time	10-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028322-002**	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**41.6**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0043**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0003**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0043**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0046**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**96.5**	----	----	----	----
13C8-PFOA	----	0.0002	%	**103**	----	----	----	----

Analytical Results

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

			Client sample ID	**QC29A**	**----**	**----**	**----**	**----**
			Client sampling date / time	10-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028322-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.002**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.012**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.016**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	**0.004**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.006**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.002**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.028**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.042**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**96.5**	----	----	----	----
13C8-PFOA	----	0.002	%	**95.9**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

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

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order	: **ES2028322**	Page	: 1 of 6
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: 2/11 VICTORIA SQUARE ADELAIDE SA, AUSTRALIA 5000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 13-Aug-2020
Order number	: ----	Date Analysis Commenced	: 17-Aug-2020
C-O-C number	: ----	Issue Date	: 21-Aug-2020
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3204179)									
EP2008375-032	Anonymous	EA055: Moisture Content	----	0.1	%	5.2	5.2	0.00	0% - 20%
EP2008375-043	Anonymous	EA055: Moisture Content	----	0.1	%	3.4	3.2	5.62	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3201539)									
ES2028322-002	QC29AS	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0043	0.0041	5.31	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3201539)									
ES2028322-002	QC29AS	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3201539)									
ES2028322-002	QC29AS	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3202250)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3202250) - continued									
ES2028322-001	QC29A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.002	0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.012	0.015	18.4	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.016	0.020	21.2	No Limit
EM2014028-010	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	2.66	2.78	4.56	0% - 20%
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	60.0	54.6	9.52	0% - 20%
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	76.0	75.1	1.24	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3202250)									
ES2028322-001	QC29A	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.004	0.005	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.006	0.007	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.002	0.003	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EM2014028-010	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	2.75	3.01	9.03	0% - 20%
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	6.41	7.48	15.4	0% - 20%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.900	1.02	12.1	0% - 20%
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	2.39	2.76	14.5	0% - 20%
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	0.90	1.09	19.4	0% - 20%
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3202250)									
ES2028322-001	QC29A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EM2014028-010	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.010	<0.010	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3201539)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.8	72.0	128
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	114	67.0	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3201539)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	90.4	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	124	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	122	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	122	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	114	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3201539)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	126	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	118	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	117	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	89.2	69.2	143

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3202250)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	109	72.0	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	115	68.0	131
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	117	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3202250)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	96.7	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	114	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	111	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	112	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	117	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3202250)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	120	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	115	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	118	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	113	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3201539)							
ES2028322-002	QC29AS	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	72.8	72.0	128
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	79.6	67.0	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	101	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3201539)							
ES2028322-002	QC29AS	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	72.5	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	105	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	88.0	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	82.8	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	86.0	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3201539)							
ES2028322-002	QC29AS	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	75.6	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	81.2	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	88.4	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	74.8	69.2	143

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3202250)							
ES2028322-001	QC29A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	110	72.0	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	121	68.0	131
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	133	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3202250)							
ES2028322-001	QC29A	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	115	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	116	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	112	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	130	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	120	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3202250)							
ES2028322-001	QC29A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	104	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	122	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	119	67.0	138
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	106	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2028322**	Page	: 1 of 4
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 13-Aug-2020
Site	:	Issue Date	: 21-Aug-2020
Sampler	: SEAN SPARROW	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QC29AS	**10-Aug-2020**	**----**	----	----	**18-Aug-2020**	24-Aug-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC29AS	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	26-Sep-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC29AS	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	26-Sep-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC29AS	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	26-Sep-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC29AS	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	26-Sep-2020	✓

Matrix: **WATER**

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

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC29A	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	06-Feb-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC29A	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	06-Feb-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC29A	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	06-Feb-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC29A	**10-Aug-2020**	**17-Aug-2020**	06-Feb-2021	✓	**18-Aug-2020**	06-Feb-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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 FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
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Email: GHDLabReports@ghd.com
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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 3 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace	PFAS Short Suite														Provide as much information about the sample as you can
1	6627-5944		17/08/2020	water	X															
2	DC02A		17/08/2020	water	X															
3	DC02AS		17/08/2020	sediment		X														
4	QC30		17/08/2020	water	X															
5	QC30S		17/08/2020	sediment		X														
—	QC30A		17/08/2020	water	X															Please forward to ALS
—	QC30AS		17/08/2020	sediment		X														Please forward to ALS
6	TB09		17/08/2020	water	X															
7	RB09		17/08/2020	water	X															

Eli Sydney
C Mullen
18/8/20 815

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company):	Received by (Company): ENVIROLAB	***Lab Use Only***
Print Name:	Print Name: J. BOWDEN	Job number: 249198
Date & Time:	Date & Time: 17-08-2020,	Temperature: 12 3
Signature:	Signature:	TAT Req - SAME day / 1 / [✓ 2 / 3] / 4 / STD

Cooling: Ice / [✓ Ice pack] / None
Security seal: [✓ Intact] / Broken / None

Envirolab Services Pty Ltd
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CERTIFICATE OF ANALYSIS 249198

Client Details

Client	GHD Pty Ltd
Attention	Sean Sparrow
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	5 Water, 2 Sediment
Date samples received	18/08/2020
Date completed instructions received	18/08/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	21/08/2020
Date of Issue	21/08/2020

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Results Approved By
Manju Dewendrage, Chemist
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short						
Our Reference		249198-1	249198-2	249198-4	249198-6	249198-7
Your Reference	UNITS	6627-5944	DC02A	QC30	TB09	RB09
Date Sampled		17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.037	0.070	0.039	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	0.049	0.058	0.043	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	0.0046	0.0092	0.0047	<0.0002	<0.0002
6:2 FTS	µg/L	0.001	<0.0004	0.001	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	111	102	101	108	108
Surrogate $^{13}C_2$ *PFOA*	%	111	111	114	109	108
Extracted ISTD $^{18}O_2$ *PFHxS*	%	126	126	128	129	135
Extracted ISTD $^{13}C_4$ *PFOS*	%	64	61	64	78	111
Extracted ISTD $^{13}C_4$ *PFOA*	%	112	100	112	120	131
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	#	#	#	177	194
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	178	#	189	118	#
Total Positive PFHxS & PFOS	µg/L	0.086	0.13	0.082	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.054	0.067	0.047	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.092	0.14	0.088	<0.0002	<0.0002

PFAS in Soils Short			
Our Reference		249198-3	249198-5
Your Reference	UNITS	DC02AS	QC30S
Date Sampled		17/08/2020	17/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	21/08/2020	21/08/2020
Date analysed	-	21/08/2020	21/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	1.2	1.0
Perfluorooctanesulfonic acid PFOS	µg/kg	34	26
Perfluorooctanoic acid PFOA	µg/kg	0.2	0.2
6:2 FTS	µg/kg	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	98	108
Surrogate $^{13}C_2$ *PFOA*	%	99	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	91	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	74
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	85
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	122	116
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	188	162
Total Positive PFHxS & PFOS	µg/kg	35	27
Total Positive PFOS & PFOA	µg/kg	34	26
Total Positive PFAS	µg/kg	35	27

Moisture			
Our Reference		249198-3	249198-5
Your Reference	UNITS	DC02AS	QC30S
Date Sampled		17/08/2020	17/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	21/08/2020	21/08/2020
Date analysed	-	24/08/2020	24/08/2020
Moisture	%	42	39

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	249198-2
Date prepared	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.037	0.039	5	86	87
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	0.049	0.043	13	96	76
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.0046	0.0048	4	96	102
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	0.001	0.001	0	103	115
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	106	70
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	103	1	111	100	10	101	101
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	1	111	113	2	101	110
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	119	1	126	118	7	111	120
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	81	1	64	65	2	83	61
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	119	1	112	118	5	107	108
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	142	1	#	#		112	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	1	178	183	3	87	#

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/08/2020	3	21/08/2020	21/08/2020		21/08/2020	[NT]
Date analysed	-			21/08/2020	3	21/08/2020	21/08/2020		21/08/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	3	1.2	1.2	0	93	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	3	34	39	14	91	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	3	0.2	0.2	0	97	[NT]
6:2 FTS	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	101	[NT]
8:2 FTS	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	95	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	100	3	98	97	1	94	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	105	3	99	104	5	103	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	110	3	91	102	11	109	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	100	3	88	90	2	107	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	105	3	91	92	1	105	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	3	122	152	22	102	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	128	3	188	#		124	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

ENVIROLAB GROUP ENVIROLAB SERVICES mpl

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Phone: **Mob:** 0498 260 626
Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
dilara.valiff@ghd.com

Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: 3 day
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Environmental Division
Sydney
Work Order Reference
ES2028971
Telephone : + 61-2-8784 8555

Sample information					Tests Required		Comments
Envirolab Sample ID	**Client Sample ID or information**	**Depth**	**Date sampled**	**Type of sample**	**PFAS Ultra Trace**	**PFAS Short Suite**	**Provide as much information about the sample as you can**
1	6627-5944		17/08/2020	water	X		
2	DC02A		17/08/2020	water	X		
3	DC02AS		17/08/2020	sediment		X	
4	QC30		17/08/2020	water	X		
5	QC30S		17/08/2020	sediment		X	
—	1 QC30A		17/08/2020	water	X		Please forward to ALS
—	2 QC30AS		17/08/2020	sediment		X	Please forward to ALS
6	TB09		17/08/2020	water	X		
7	RB09		17/08/2020	water	X		

ELS Sydney
[illegible]
18/8/20 815

TAT

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS Sydney
Print Name: R. Lhazeen
Date & Time: 17/08/2020 12.09
Signature:

Received by (Company): ENVIROLAB
Print Name: J. BOWDEN
Date & Time: 17-08-2020
Signature:

Lab Use Only
Job number: 249198
Temperature: 12.3
TAT Req - SAME day / 1 / 2 / [✓ 3] / 4 / STD
Cooling: Ice / [✓ Ice pack] / None
Security seal: [✓ Intact] / Broken / None

Received by: ALS SYDNEY
18/8/20 1800

Form 302_V006

Issue date: 7 October 2019

Page 1 of 1

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2028971**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: GHD LAB REPORTS	Contact	: Angus Harding
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	: 12516828	Date Samples Received	: 18-Aug-2020 17:30
Order number	: 12516828	Date Analysis Commenced	: 20-Aug-2020
C-O-C number	: ----	Issue Date	: 25-Aug-2020 12:06
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005		
No. of samples received	: 2		
No. of samples analysed	: 2		

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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.
- EP231X: Poor matrix spike recoveries due to matrix interferences.
- 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: **SOIL** (Matrix: **SOIL)**			*Client sample ID*	**QC30AS**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028971-002**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**66.4**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0018**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0403**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0002**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0002**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0421**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0425**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**96.5**	----	----	----	----
13C8-PFOA	----	0.0002	%	**85.5**	----	----	----	----

Analytical Results

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

			Client sample ID	**QC30A**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028971-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.008**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.047**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.063**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	**0.006**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.019**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	**0.002**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.005**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.110**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.150**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**108**	----	----	----	----
13C8-PFOA	----	0.002	%	**103**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

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

Sub-Matrix: **WATER**

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

ALS Environmental

QUALITY CONTROL REPORT

Work Order : **ES2028971**

Client : **GHD PTY LTD**
Contact : GHD LAB REPORTS
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : ----
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 18-Aug-2020
Date Analysis Commenced : 20-Aug-2020
Issue Date : 25-Aug-2020

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3211712)									
ES2028688-039	Anonymous	EA055: Moisture Content	----	0.1	%	5.4	5.7	6.38	0% - 20%
ES2028763-011	Anonymous	EA055: Moisture Content	----	0.1	%	14.2	14.2	0.00	0% - 50%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3211362)									
ES2028625-069	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0008	0.0006	22.2	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0242	0.0211	13.5	0% - 20%
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.100	0.0967	3.76	0% - 20%
ES2028686-028	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3211362)									
ES2028625-069	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0025	0.0025	0.00	0% - 50%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0085	0.0087	2.54	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0015	0.0014	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0058	0.0058	0.00	0% - 20%
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	0.001	0.001	0.00	No Limit
ES2028686-028	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3211362)									
ES2028625-069	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3211362) - continued									
ES2028625-069	Anonymous	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES2028686-028	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3213638)									
ES2028971-001	QC30A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.008	0.007	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.047	0.046	2.39	0% - 20%
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.063	0.056	13.3	0% - 20%
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3213638)									
ES2028971-001	QC30A	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.006	0.006	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.019	0.020	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.002	0.003	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.005	0.004	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3213638)									
ES2028971-001	QC30A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

Method: Compound	*CAS Number*	*LOR*	*Unit*	*Method Blank (MB) Report*	*Laboratory Control Spike (LCS) Report*			
				Result	*Spike Concentration*	*Spike Recovery (%) LCS*	*Recovery Limits (%) Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3211362)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	72.0	128
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.0	67.0	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	103	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3211362)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	111	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	109	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	109	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3211362)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	104	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	103	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	101	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	111	69.2	143

Sub-Matrix: **WATER**

Method: Compound	*CAS Number*	*LOR*	*Unit*	*Method Blank (MB) Report*	*Laboratory Control Spike (LCS) Report*			
				Result	*Spike Concentration*	*Spike Recovery (%) LCS*	*Recovery Limits (%) Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3213638)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	75.6	72.0	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	84.0	68.0	131
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	84.8	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3213638)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	79.8	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	85.6	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	88.0	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	85.6	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	87.2	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3213638)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	91.6	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	85.6	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	93.2	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	94.0	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3211362)							
ES2028625-069	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	74.8	72.0	128
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	# Not Determined	67.0	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	68.0	136
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3211362)							
ES2028625-069	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	88.1	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	77.6	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	# Not Determined	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	# 69.6	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	96.8	69.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3211362)							
ES2028625-069	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	72.0	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	70.0	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	70.8	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	75.2	69.2	143

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2028971**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: GHD LAB REPORTS	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 18-Aug-2020
Site	:	Issue Date	: 25-Aug-2020
Sampler	: SEAN SPARROW	No. of samples received	: 2
Order number	: 12516828	No. of samples analysed	: 2

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

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES2028625--069	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES2028625--069	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES2028625--069	Anonymous	**Perfluorohexanoic acid (PFHxA)**	307-24-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES2028625--069	Anonymous	**Perfluoroheptanoic acid (PFHpA)**	375-85-9	69.6 %	71.0-131%	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QC30AS	**17-Aug-2020**	**----**	----	----	**20-Aug-2020**	31-Aug-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC30AS	**17-Aug-2020**	**20-Aug-2020**	13-Feb-2021	✓	**21-Aug-2020**	29-Sep-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC30AS	**17-Aug-2020**	**20-Aug-2020**	13-Feb-2021	✓	**21-Aug-2020**	29-Sep-2020	✓

Matrix: **SOIL**

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

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC30AS	**17-Aug-2020**	**20-Aug-2020**	13-Feb-2021	✓	**21-Aug-2020**	29-Sep-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC30AS	**17-Aug-2020**	**20-Aug-2020**	13-Feb-2021	✓	**21-Aug-2020**	29-Sep-2020	✓

Matrix: **WATER**

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

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC30A	**17-Aug-2020**	**24-Aug-2020**	13-Feb-2021	✓	**24-Aug-2020**	13-Feb-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC30A	**17-Aug-2020**	**24-Aug-2020**	13-Feb-2021	✓	**24-Aug-2020**	13-Feb-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC30A	**17-Aug-2020**	**24-Aug-2020**	13-Feb-2021	✓	**24-Aug-2020**	13-Feb-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC30A	**17-Aug-2020**	**24-Aug-2020**	13-Feb-2021	✓	**24-Aug-2020**	13-Feb-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	0	1	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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 FORM - Client

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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample Information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace in Water															Provide as much information about the sample as you can
1	BR03_1A		11/09/2020	water	X															
2	BR03_1B		11/09/2020	water	X															
3	BR03_1C		11/09/2020	water	X															
4	BR02_1A		11/09/2020	water	X															
5	BR02_1B		11/09/2020	water	X															
6	BR02_1C		11/09/2020	water	X															
7	MBC02_1A		11/09/2020	water	X															
8	MBC02_1B		11/09/2020	water	X															
9	MBC02_1C		11/09/2020	water	X															
10	MBC01_1A		11/09/2020	water	X															
11	MBC01_1B		11/09/2020	water	X															
12	MBC01_1C		11/09/2020	water	X															
13	BR03_2A		17/09/2020	water	X															
14	BR03_2B		17/09/2020	water	X															
15	BR03_2C		17/09/2020	water	X															
16	BR02_2A		17/09/2020	water	X															
17	BR02_2B		17/09/2020	water	X															
18	BR02_2C		17/09/2020	water	X															
19	MBC02_2A		17/09/2020	water	X															
20	MBC02_2B		17/09/2020	water	X															
21	MBC02_2C		17/09/2020	water	X															
22	MBC01_2A		17/09/2020	water	X															
23	MBC01_2B		17/09/2020	water	X															
24	MBC01_2C		17/09/2020	water	X															
25	QC31		11/09/2020	water	X															
–	QC31A		11/09/2020	water	X															Please forward to ALS
26	QC32		11/09/2020	water	X															
–	QC32A		11/09/2020	water	X															Please forward to ALS
27	QC35		17/09/2020	water	X															
–	QC35A		17/09/2020	water	X															Please forward to ALS
28	QC36		17/09/2020	water	X															
–	QC36A		17/09/2020	water	X															Please forward to ALS

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS	Received by (Company): ELS SYD	*Lab Use Only*
Print Name: [illegible]	Print Name: C. Mullens	Job number: 251082 / Cooling: Ice / [✓ Ice pack] / None
Date & Time: 18/9/20 @ 9.30am	Date & Time: 21/9/20 1020	Temperature: 18.5 / Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

1st esky received: 15/9/20 1015

2nd esky received 21/9/20 1020.

Extras
#29 FB01 11/9
30 RB01 11/9
31 FB 17/9
32 RB 17/9

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CERTIFICATE OF ANALYSIS 251682

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	32 Water
Date samples received	21/09/2020
Date completed instructions received	21/09/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	28/09/2020
Date of Issue	28/09/2020

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Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

PFAS in Water TRACE Short

Our Reference		251682-1	251682-2	251682-3	251682-4	251682-5
Your Reference	UNITS	BR03_1A	BR03_1B	BR03_1C	BR02_1A	BR02_1B
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.033	0.031	0.031	0.0038	0.0036
Perfluorooctanesulfonic acid PFOS	µg/L	0.0072	0.0074	0.0086	0.0008	0.0007
Perfluorooctanoic acid PFOA	µg/L	0.001	0.001	0.001	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	102	102	98	96	98
Surrogate $^{13}C_2$ *PFOA*	%	96	96	95	94	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	78	84	81	84	80
Extracted ISTD $^{13}C_4$ *PFOS*	%	78	83	76	80	73
Extracted ISTD $^{13}C_4$ *PFOA*	%	82	84	81	94	88
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	138	142	138	150	154
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	#	#	#	190
Total Positive PFHxS & PFOS	µg/L	0.040	0.038	0.040	0.0046	0.0043
Total Positive PFOS & PFOA	µg/L	0.0085	0.0085	0.0097	0.0008	0.0007
Total Positive PFAS	µg/L	0.042	0.039	0.041	0.0046	0.0043

Client Reference: 12516828

PFAS in Water TRACE Short						
Our Reference		251682-6	251682-7	251682-8	251682-9	251682-10
Your Reference	UNITS	BR02_1C	MBC02_1A	MBC02_1B	MBC02_1C	MBC01_1A
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0034	0.0036	0.0037	0.0036	0.0037
Perfluorooctanesulfonic acid PFOS	µg/L	0.0006	0.0045	0.0045	0.0042	0.0038
Perfluorooctanoic acid PFOA	µg/L	<0.0002	0.0040	0.0040	0.0038	0.0032
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	101	103	94	96	101
Surrogate $^{13}C_2$ *PFOA*	%	95	94	93	93	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	86	84	85	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	69	81	83	81	76
Extracted ISTD $^{13}C_4$ *PFOA*	%	89	91	93	92	95
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	138	161	167	167	160
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	186	#	#	#	#
Total Positive PFHxS & PFOS	µg/L	0.0040	0.0082	0.0082	0.0078	0.0075
Total Positive PFOS & PFOA	µg/L	0.0006	0.0085	0.0085	0.0080	0.0070
Total Positive PFAS	µg/L	0.0040	0.012	0.012	0.012	0.011

PFAS in Water TRACE Short						
Our Reference		251682-11	251682-12	251682-13	251682-14	251682-15
Your Reference	UNITS	MBC01_1B	MBC01_1C	BR03_2A	BR03_2B	BR03_2C
Date Sampled		11/09/2020	11/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0037	0.0040	0.061	0.061	0.060
Perfluorooctanesulfonic acid PFOS	µg/L	0.0040	0.0032	0.014	0.016	0.016
Perfluorooctanoic acid PFOA	µg/L	0.0032	0.0035	0.0022	0.002	0.0020
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	104	98	99	104	99
Surrogate $^{13}C_2$ *PFOA*	%	93	98	92	92	97
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	82	78	76	80
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	81	71	62	63
Extracted ISTD $^{13}C_4$ *PFOA*	%	94	94	80	83	77
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	158	159	143	152	140
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	#	#	#	#
Total Positive PFHxS & PFOS	µg/L	0.0078	0.0072	0.074	0.077	0.076
Total Positive PFOS & PFOA	µg/L	0.0072	0.0067	0.016	0.018	0.018
Total Positive PFAS	µg/L	0.011	0.011	0.076	0.079	0.078

PFAS in Water TRACE Short						
Our Reference		251682-16	251682-17	251682-18	251682-19	251682-20
Your Reference	UNITS	BR02_2A	BR02_2B	BR02_2C	MBC02_2A	MBC02_2B
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	28/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0032	0.0027	0.0026	0.0038	0.0035
Perfluorooctanesulfonic acid PFOS	µg/L	0.0007	0.0006	0.0007	0.0071	0.0066
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002	<0.0002	0.0050	0.0049
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	98	94	100	98	95
Surrogate $^{13}C_2$ *PFOA*	%	96	95	94	95	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	66	82	83	112
Extracted ISTD $^{13}C_4$ *PFOS*	%	76	57	75	78	97
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	79	95	90	97
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	137	109	146	167	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	172	123	181	#	#
Total Positive PFHxS & PFOS	µg/L	0.0039	0.0033	0.0033	0.011	0.010
Total Positive PFOS & PFOA	µg/L	0.0007	0.0006	0.0007	0.012	0.012
Total Positive PFAS	µg/L	0.0039	0.0033	0.0033	0.016	0.015

PFAS in Water TRACE Short						
Our Reference		251682-21	251682-22	251682-23	251682-24	251682-25
Your Reference	UNITS	MBC02_2C	MBC01_2A	MBC01_2B	MBC01_2C	QC31
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	25/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0032	0.0046	0.0046	0.0044	0.032
Perfluorooctanesulfonic acid PFOS	µg/L	0.0042	0.0041	0.0045	0.0040	0.0083
Perfluorooctanoic acid PFOA	µg/L	0.0043	0.0043	0.0042	0.0044	0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	99	103	99	97	97
Surrogate $^{13}C_2$ *PFOA*	%	94	93	92	92	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%	116	113	111	112	102
Extracted ISTD $^{13}C_4$ *PFOS*	%	96	93	88	91	88
Extracted ISTD $^{13}C_4$ *PFOA*	%	102	105	104	101	86
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	155	156	153	149	124
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	176	186	160	157
Total Positive PFHxS & PFOS	µg/L	0.0075	0.0087	0.0091	0.0084	0.040
Total Positive PFOS & PFOA	µg/L	0.0086	0.0084	0.0087	0.0084	0.0094
Total Positive PFAS	µg/L	0.012	0.013	0.013	0.013	0.042

PFAS in Water TRACE Short						
Our Reference		251682-26	251682-27	251682-28	251682-29	251682-30
Your Reference	UNITS	QC32	QC35	QC36	FB10	RB10
Date Sampled		17/09/2020	17/09/2020	17/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	25/09/2020	25/09/2020	25/09/2020	24/09/2020	24/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0038	0.0046	0.060	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	0.0047	0.0044	0.013	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	0.0043	0.0041	0.002	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	99	93	91	106	97
Surrogate $^{13}C_2$ *PFOA*	%	91	91	92	108	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	108	109	102	99	102
Extracted ISTD $^{13}C_4$ *PFOS*	%	90	92	87	53	89
Extracted ISTD $^{13}C_4$ *PFOA*	%	102	102	93	113	119
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	153	155	134	121	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	161	170	169	73	#
Total Positive PFHxS & PFOS	µg/L	0.0085	0.0090	0.072	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.0090	0.0085	0.015	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.013	0.013	0.074	<0.0002	<0.0002

PFAS in Water TRACE Short

Our Reference		251682-31	251682-32
Your Reference	UNITS	FB11	RB11
Date Sampled		17/09/2020	17/09/2020
Type of sample		Water	Water
Date prepared	-	24/09/2020	24/09/2020
Date analysed	-	28/09/2020	28/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	98	100
Surrogate $^{13}C_2$ *PFOA*	%	102	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	59	76
Extracted ISTD $^{13}C_4$ *PFOA*	%	117	120
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	129	129
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	71	94
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002

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. 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.

Client Reference: 12516828

QUALITY CONTROL: PFAS in Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	251682-2
Date prepared	-			24/09/2020	1	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Date analysed	-			25/09/2020	1	25/09/2020	25/09/2020		25/09/2020	25/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.033	0.033	0	109	108
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	0.0072	0.0067	7	110	115
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.001	0.001	0	104	108
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	100	119
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	96	118
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	1	102	100	2	107	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	1	96	94	2	98	94
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	80	1	78	82	5	82	78
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	65	1	78	84	7	72	73
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	118	1	82	77	6	115	73
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	105	1	138	141	2	95	136
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	93	1	#	#		114	#

QUALITY CONTROL: PFAS in Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	251682-22
Date prepared	-			[NT]	11	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Date analysed	-			[NT]	11	25/09/2020	25/09/2020		28/09/2020	28/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	11	0.0037	0.0039	5	104	102
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	11	0.0040	0.0038	5	104	100
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	11	0.0032	0.0034	6	102	107
6:2 FTS	µg/L	0.0004	Org-029	[NT]	11	<0.0004	<0.0004	0	104	115
8:2 FTS	µg/L	0.0004	Org-029	[NT]	11	<0.0004	<0.0004	0	92	110
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	11	104	96	8	102	94
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	11	93	96	3	95	95
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	11	85	82	4	109	115
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	11	71	74	4	89	99
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	11	94	91	3	133	100

QUALITY CONTROL: PFAS in Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	251682-22
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	11	158	158	0	88	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	11	#	#		105	175

QUALITY CONTROL: PFAS in Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	24/09/2020	24/09/2020		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	21	0.0032	0.0033	3	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	21	0.0042	0.0041	2	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	21	0.0043	0.0041	5	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	21	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	21	<0.0004	<0.0004	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	21	99	94	5	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	21	94	96	2	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	21	116	114	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	21	96	99	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	21	102	100	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	21	155	153	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	21	#	#		[NT]	[NT]

QUALITY CONTROL: PFAS in Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	24	24/09/2020	24/09/2020		[NT]	[NT]
Date analysed	-			[NT]	24	28/09/2020	28/09/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	24	0.0044	0.0046	4	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	24	0.0040	0.0041	2	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	24	0.0044	0.0042	5	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	24	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	24	<0.0004	<0.0004	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	24	97	92	5	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	24	92	91	1	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	24	112	108	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	24	91	96	5	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	24	101	101	0	[NT]	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	24	149	151	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	24	160	182	13	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

Ming To

From: Aileen Hie
Sent: Friday, 9 October 2020 5:39 PM
To: Ming To
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Ref: 251682-A
TAT: 1 day
Due: 12/10/2020 MT.

From: Alex Stenta <astenta@envirolab.com.au>
Sent: Friday, 9 October 2020 5:05 PM
To: Customer Service <CustomerService@envirolab.com.au>
Cc: Adelaide <adelaide@envirolab.com.au>; Alexander Maclean <AMaclean@envirolab.com.au>
Subject: FW: Envirolab Invoice No SY574974 for Registration 251682 12516828
Importance: High

Hi Guys,

① - ㉜ 251682-A.

Can we please report **trace level PFAS extended suite** for all samples in Job Number 251682?

Also, can we please have **trace level PFAS extended suite** for the following samples:

DC14 – 246709 - 11
DC15 – 246709 - 13
DC16 – 247753 - 1
DC17 - 247753 - 2
DC18 - 247753 - 3
DC19 - 247753 - 4

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 251682-A

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	32 Water
Date samples received	21/09/2020
Date completed instructions received	09/10/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	12/10/2020
Date of Issue	12/10/2020

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
Alexander Mitchell Maclean, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

PFAS in Waters Trace Extended

Our Reference		251682-A-1	251682-A-2	251682-A-3	251682-A-4	251682-A-5
Your Reference	UNITS	BR03_1A	BR03_1B	BR03_1C	BR02_1A	BR02_1B
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorobutanesulfonic acid	µg/L	0.003	0.003	0.002	0.001	0.001
Perfluoropentanesulfonic acid	µg/L	0.003	0.003	0.003	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.033	0.031	0.031	0.0038	0.0036
Perfluoroheptanesulfonic acid	µg/L	0.001	0.001	0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0072	0.0074	0.0086	0.0008	0.0007
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.01	0.01	0.01	0.006	0.006
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0048	0.0049	0.0054	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.001	0.001	0.001	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	102	102	98	96	98
Surrogate $^{13}C_2$ *PFOA*	%	96	96	95	94	94
Extracted ISTD $^{13}C_3$ *PFBS*	%	75	79	77	79	74
Extracted ISTD $^{18}O_2$ *PFHxS*	%	78	84	81	84	80
Extracted ISTD $^{13}C_4$ *PFOS*	%	78	83	76	80	73
Extracted ISTD $^{13}C_4$ *PFBA*	%	#	#	#	20	#

PFAS in Waters Trace Extended						
Our Reference	UNITS	251682-A-1	251682-A-2	251682-A-3	251682-A-4	251682-A-5
Your Reference		BR03_1A	BR03_1B	BR03_1C	BR02_1A	BR02_1B
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	25	25	23	26	24
Extracted ISTD $^{13}C_2$ *PFHxA*	%	36	36	34	40	37
Extracted ISTD $^{13}C_4$ *PFHpA*	%	61	61	59	73	68
Extracted ISTD $^{13}C_4$ *PFOA*	%	82	84	81	94	88
Extracted ISTD $^{13}C_5$ *PFNA*	%	90	93	85	98	91
Extracted ISTD $^{13}C_2$ *PFDA*	%	128	136	120	127	117
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	107	124	102	97	94
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	81	89	77	75	72
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	45	49	64	82	82
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	86	88	96	98	89
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	138	142	138	150	154
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	#	#	#	190
Extracted ISTD $^{13}C_8$ *FOSA*	%	51	54	44	48	47
Extracted ISTD d_3 *N MeFOSA*	%	23	31	26	22	27
Extracted ISTD d_5 *N EtFOSA*	%	26	34	27	23	30
Extracted ISTD d_7 *N MeFOSE*	%	53	62	48	49	54
Extracted ISTD d_9 *N EtFOSE*	%	49	54	51	48	51
Extracted ISTD d_3 *N MeFOSAA*	%	87	93	82	69	74
Extracted ISTD d_5 *N EtFOSAA*	%	73	79	65	61	59
Total Positive PFHxS & PFOS	µg/L	0.040	0.038	0.040	0.0046	0.0043
Total Positive PFOS & PFOA	µg/L	0.0085	0.0085	0.0097	0.0008	0.0007
Total Positive PFAS	µg/L	0.065	0.063	0.065	0.011	0.011

PFAS in Waters Trace Extended

Our Reference		251682-A-6	251682-A-7	251682-A-8	251682-A-9	251682-A-10
Your Reference	UNITS	BR02_1C	MBC02_1A	MBC02_1B	MBC02_1C	MBC01_1A
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorobutanesulfonic acid	µg/L	0.001	0.002	0.002	0.002	0.002
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0034	0.0036	0.0037	0.0036	0.0037
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0006	0.0045	0.0045	0.0042	0.0038
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.006	0.006	0.006	0.006	0.007
Perfluoropentanoic acid	µg/L	<0.002	0.002	0.003	0.003	0.003
Perfluorohexanoic acid	µg/L	<0.0004	0.0060	0.0063	0.0065	0.0053
Perfluoroheptanoic acid	µg/L	<0.0004	0.0009	0.0009	0.001	0.0008
Perfluorooctanoic acid PFOA	µg/L	<0.0002	0.0040	0.0040	0.0038	0.0032
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	101	103	94	96	101
Surrogate $^{13}C_2$ *PFOA*	%	95	94	93	93	93
Extracted ISTD $^{13}C_3$ *PFBS*	%	77	88	86	84	82
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	86	84	85	83
Extracted ISTD $^{13}C_4$ *PFOS*	%	69	81	83	81	76
Extracted ISTD $^{13}C_4$ *PFBA*	%	20	28	29	28	28

PFAS in Waters Trace Extended						
Our Reference	UNITS	251682-A-6	251682-A-7	251682-A-8	251682-A-9	251682-A-10
Your Reference		BR02_1C	MBC02_1A	MBC02_1B	MBC02_1C	MBC01_1A
Date Sampled		11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	26	31	31	31	31
Extracted ISTD $^{13}C_2$ *PFHxA*	%	39	47	48	48	47
Extracted ISTD $^{13}C_4$ *PFHpA*	%	69	77	77	79	79
Extracted ISTD $^{13}C_4$ *PFOA*	%	89	91	93	92	95
Extracted ISTD $^{13}C_5$ *PFNA*	%	93	102	96	101	98
Extracted ISTD $^{13}C_2$ *PFDA*	%	113	129	132	124	127
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	92	112	104	93	97
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	70	87	88	72	80
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	73	100	70	69	112
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	98	127	136	137	126
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	138	161	167	167	160
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	186	#	#	#	#
Extracted ISTD $^{13}C_8$ *FOSA*	%	46	54	55	48	55
Extracted ISTD d_3 *N MeFOSA*	%	23	31	34	29	37
Extracted ISTD d_5 *N EtFOSA*	%	27	32	37	32	40
Extracted ISTD d_7 *N MeFOSE*	%	48	60	62	57	62
Extracted ISTD d_9 *N EtFOSE*	%	47	58	60	49	61
Extracted ISTD d_3 *N MeFOSAA*	%	67	85	83	74	74
Extracted ISTD d_5 *N EtFOSAA*	%	59	74	75	62	67
Total Positive PFHxS & PFOS	μg/L	0.0040	0.0082	0.0082	0.0078	0.0075
Total Positive PFOS & PFOA	μg/L	0.0006	0.0085	0.0085	0.0080	0.0070
Total Positive PFAS	μg/L	0.011	0.029	0.030	0.030	0.028

PFAS in Waters Trace Extended						
Our Reference		251682-A-11	251682-A-12	251682-A-13	251682-A-14	251682-A-15
Your Reference	UNITS	MBC01_1B	MBC01_1C	BR03_2A	BR03_2B	BR03_2C
Date Sampled		11/09/2020	11/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Perfluorobutanesulfonic acid	µg/L	0.002	0.002	0.0047	0.0047	0.0044
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	0.005	0.005	0.005
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0037	0.0040	0.061	0.061	0.060
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	0.002	0.003	0.002
Perfluorooctanesulfonic acid PFOS	µg/L	0.0040	0.0032	0.014	0.016	0.016
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.007	0.007	0.01	0.01	0.01
Perfluoropentanoic acid	µg/L	0.003	0.003	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0048	0.0048	0.0089	0.0092	0.0091
Perfluoroheptanoic acid	µg/L	0.001	0.001	0.0005	0.0006	0.0005
Perfluorooctanoic acid PFOA	µg/L	0.0032	0.0035	0.0022	0.002	0.0020
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	104	98	99	104	99
Surrogate $^{13}C_2$ *PFOA*	%	93	98	92	92	97
Extracted ISTD $^{13}C_3$ *PFBS*	%	86	83	75	76	80
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	82	78	76	80
Extracted ISTD $^{13}C_4$ *PFOS*	%	71	81	71	62	63
Extracted ISTD $^{13}C_4$ *PFBA*	%	27	27	#	#	#

PFAS in Waters Trace Extended						
Our Reference	UNITS	251682-A-11	251682-A-12	251682-A-13	251682-A-14	251682-A-15
Your Reference		MBC01_1B	MBC01_1C	BR03_2A	BR03_2B	BR03_2C
Date Sampled		11/09/2020	11/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	32	30	24	25	24
Extracted ISTD $^{13}C_2$ *PFHxA*	%	48	46	34	34	33
Extracted ISTD $^{13}C_4$ *PFHpA*	%	78	76	60	61	60
Extracted ISTD $^{13}C_4$ *PFOA*	%	94	94	80	83	77
Extracted ISTD $^{13}C_5$ *PFNA*	%	98	103	82	84	80
Extracted ISTD $^{13}C_2$ *PFDA*	%	122	134	117	109	102
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	94	110	96	91	80
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	70	81	78	72	62
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	61	109	56	48	57
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	126	123	97	92	94
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	158	159	143	152	140
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	#	#	#	196
Extracted ISTD $^{13}C_8$ *FOSA*	%	53	58	50	47	42
Extracted ISTD d_3 *N MeFOSA*	%	28	28	23	26	21
Extracted ISTD d_5 *N EtFOSA*	%	28	27	23	27	20
Extracted ISTD d_7 *N MeFOSE*	%	54	63	57	55	45
Extracted ISTD d_9 *N EtFOSE*	%	51	59	54	55	43
Extracted ISTD d_3 *N MeFOSAA*	%	63	81	85	76	68
Extracted ISTD d_5 *N EtFOSAA*	%	55	71	70	70	50
Total Positive PFHxS & PFOS	µg/L	0.0078	0.0072	0.074	0.077	0.076
Total Positive PFOS & PFOA	µg/L	0.0072	0.0067	0.016	0.018	0.018
Total Positive PFAS	µg/L	0.028	0.028	0.11	0.11	0.11

PFAS in Waters Trace Extended

Our Reference		251682-A-16	251682-A-17	251682-A-18	251682-A-19	251682-A-20
Your Reference	UNITS	BR02_2A	BR02_2B	BR02_2C	MBC02_2A	MBC02_2B
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	25/09/2020	25/09/2020	25/09/2020	25/09/2020	28/09/2020
Perfluorobutanesulfonic acid	µg/L	0.0009	0.0008	0.0007	0.002	0.002
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0032	0.0027	0.0026	0.0038	0.0035
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0007	0.0006	0.0007	0.0071	0.0066
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.005	0.005	0.006	0.007	0.007
Perfluoropentanoic acid	µg/L	<0.002	<0.002	<0.002	0.003	0.003
Perfluorohexanoic acid	µg/L	<0.0004	<0.0004	<0.0004	0.0066	0.0056
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004	<0.0004	0.001	0.001
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002	<0.0002	0.0050	0.0049
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.02	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.05	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	94	100	98	95
Surrogate $^{13}C_2$ *PFOA*	%	96	95	94	95	94
Extracted ISTD $^{13}C_3$ *PFBS*	%	77	63	76	83	89
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	66	82	83	112
Extracted ISTD $^{13}C_4$ *PFOS*	%	76	57	75	78	97
Extracted ISTD $^{13}C_4$ *PFBA*	%	22	20	23	31	45

PFAS in Waters Trace Extended						
Our Reference		251682-A-16	251682-A-17	251682-A-18	251682-A-19	251682-A-20
Your Reference	UNITS	BR02_2A	BR02_2B	BR02_2C	MBC02_2A	MBC02_2B
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	29	26	31	33	47
Extracted ISTD $^{13}C_2$ *PFHxA*	%	43	39	44	47	59
Extracted ISTD $^{13}C_4$ *PFHpA*	%	73	65	78	76	85
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	79	95	90	97
Extracted ISTD $^{13}C_5$ *PFNA*	%	96	78	97	97	97
Extracted ISTD $^{13}C_2$ *PFDA*	%	124	83	122	120	97
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	94	57	87	99	77
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	69	42	53	76	53
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	73	43	63	61	34
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	93	83	99	122	126
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	137	109	146	167	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	172	123	181	#	#
Extracted ISTD $^{13}C_8$ *FOSA*	%	45	33	47	48	53
Extracted ISTD d_3 *N MeFOSA*	%	20	#	21	22	23
Extracted ISTD d_5 *N EtFOSA*	%	23	#	23	24	22
Extracted ISTD d_7 *N MeFOSE*	%	51	29	48	51	39
Extracted ISTD d_9 *N EtFOSE*	%	44	28	45	48	35
Extracted ISTD d_3 *N MeFOSAA*	%	74	47	73	78	55
Extracted ISTD d_5 *N EtFOSAA*	%	52	35	54	63	49
Total Positive PFHxS & PFOS	µg/L	0.0039	0.0033	0.0033	0.011	0.010
Total Positive PFOS & PFOA	µg/L	0.0007	0.0006	0.0007	0.012	0.012
Total Positive PFAS	µg/L	0.0099	0.0090	0.010	0.035	0.033

PFAS in Waters Trace Extended						
Our Reference		251682-A-21	251682-A-22	251682-A-23	251682-A-24	251682-A-25
Your Reference	UNITS	MBC02_2C	MBC01_2A	MBC01_2B	MBC01_2C	QC31
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Perfluorobutanesulfonic acid	μg/L	0.002	0.003	0.003	0.003	0.003
Perfluoropentanesulfonic acid	μg/L	<0.001	0.001	0.001	0.001	0.002
Perfluorohexanesulfonic acid - PFHxS	μg/L	0.0032	0.0046	0.0046	0.0044	0.032
Perfluoroheptanesulfonic acid	μg/L	<0.001	<0.001	<0.001	<0.001	0.001
Perfluorooctanesulfonic acid PFOS	μg/L	0.0042	0.0041	0.0045	0.0040	0.0083
Perfluorodecanesulfonic acid	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	μg/L	0.007	0.008	0.008	0.008	0.01
Perfluoropentanoic acid	μg/L	0.003	0.003	0.002	0.003	<0.002
Perfluorohexanoic acid	μg/L	0.0057	0.0048	0.0047	0.0050	0.0045
Perfluoroheptanoic acid	μg/L	0.001	0.001	0.001	0.001	0.0004
Perfluorooctanoic acid PFOA	μg/L	0.0043	0.0043	0.0042	0.0044	0.001
Perfluorononanoic acid	μg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	μg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	μg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	μg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	μg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	μg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	μg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	μg/L	<0.005	<0.005	<0.005	<0.005	<0.02
N-Ethyl perfluorooctanesulfon amide	μg/L	<0.01	<0.01	<0.01	<0.01	<0.05
N-Me perfluorooctanesulfonamid oethanol	μg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	μg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	μg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	99	103	99	97	97
Surrogate $^{13}C_2$ *PFOA*	%	94	93	92	92	93
Extracted ISTD $^{13}C_3$ *PFBS*	%	84	83	86	87	84
Extracted ISTD $^{18}O_2$ *PFHxS*	%	116	113	111	112	102
Extracted ISTD $^{13}C_4$ *PFOS*	%	96	93	88	91	88
Extracted ISTD $^{13}C_4$ *PFBA*	%	48	46	46	45	26

PFAS in Waters Trace Extended

Our Reference		251682-A-21	251682-A-22	251682-A-23	251682-A-24	251682-A-25
Your Reference	UNITS	MBC02_2C	MBC01_2A	MBC01_2B	MBC01_2C	QC31
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ PFPeA	%	47	50	50	48	33
Extracted ISTD $^{13}C_2$ PFHxA	%	55	63	62	61	46
Extracted ISTD $^{13}C_4$ PFHpA	%	90	91	90	89	70
Extracted ISTD $^{13}C_4$ PFOA	%	102	105	104	101	86
Extracted ISTD $^{13}C_5$ PFNA	%	100	100	96	97	84
Extracted ISTD $^{13}C_2$ PFDA	%	99	97	95	96	88
Extracted ISTD $^{13}C_2$ PFUnDA	%	84	75	73	68	71
Extracted ISTD $^{13}C_2$ PFDoDA	%	63	53	54	47	50
Extracted ISTD $^{13}C_2$ PFTeDA	%	32	31	37	31	22
Extracted ISTD $^{13}C_2$ 4:2FTS	%	109	139	135	136	120
Extracted ISTD$^{13}C_2$ 6:2FTS	%	155	156	153	149	124
Extracted ISTD $^{13}C_2$ 8:2FTS	%	#	176	186	160	157
Extracted ISTD $^{13}C_8$ FOSA	%	55	55	51	48	42
Extracted ISTD d_3 N MeFOSA	%	35	25	27	27	#
Extracted ISTD d_5 N EtFOSA	%	34	26	25	26	#
Extracted ISTD d_7 N MeFOSE	%	50	44	46	41	37
Extracted ISTD d_9 N EtFOSE	%	44	38	39	36	30
Extracted ISTD d_3 N MeFOSAA	%	70	60	61	56	59
Extracted ISTD d_5 N EtFOSAA	%	60	53	52	50	51
Total Positive PFHxS & PFOS	μg/L	0.0075	0.0087	0.0091	0.0084	0.040
Total Positive PFOS & PFOA	μg/L	0.0086	0.0084	0.0087	0.0084	0.0094
Total Positive PFAS	μg/L	0.030	0.034	0.033	0.034	0.065

PFAS in Waters Trace Extended						
Our Reference		251682-A-26	251682-A-27	251682-A-28	251682-A-29	251682-A-30
Your Reference	UNITS	QC32	QC35	QC36	FB10	RB10
Date Sampled		17/09/2020	17/09/2020	17/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Perfluorobutanesulfonic acid	µg/L	0.002	0.002	0.0046	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001	0.005	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0038	0.0046	0.060	<0.0002	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001	0.002	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.0047	0.0044	0.013	<0.0002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.006	0.008	0.01	<0.002	<0.002
Perfluoropentanoic acid	µg/L	0.003	0.003	<0.002	<0.002	<0.002
Perfluorohexanoic acid	µg/L	0.0060	0.0048	0.0078	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	0.001	0.001	0.0006	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0043	0.0041	0.002	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	99	93	91	106	97
Surrogate $^{13}C_2$ *PFOA*	%	91	91	92	108	102
Extracted ISTD $^{13}C_3$ *PFBS*	%	91	91	90	102	107
Extracted ISTD $^{18}O_2$ *PFHxS*	%	108	109	102	99	102
Extracted ISTD $^{13}C_4$ *PFOS*	%	90	92	87	53	89
Extracted ISTD $^{13}C_4$ *PFBA*	%	45	44	27	89	86

PFAS in Waters Trace Extended						
Our Reference	UNITS	251682-A-26	251682-A-27	251682-A-28	251682-A-29	251682-A-30
Your Reference		QC32	QC35	QC36	FB10	RB10
Date Sampled		17/09/2020	17/09/2020	17/09/2020	11/09/2020	11/09/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	46	51	38	108	109
Extracted ISTD $^{13}C_2$ *PFHxA*	%	61	64	51	74	79
Extracted ISTD $^{13}C_4$ *PFHpA*	%	92	92	77	91	97
Extracted ISTD $^{13}C_4$ *PFOA*	%	102	102	93	113	119
Extracted ISTD $^{13}C_5$ *PFNA*	%	94	98	87	81	118
Extracted ISTD $^{13}C_2$ *PFDA*	%	92	98	89	74	122
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	71	74	76	60	54
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	52	54	57	46	23
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	31	25	#	33	46
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	156	147	143	97	118
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	153	155	134	121	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	161	170	169	73	#
Extracted ISTD $^{13}C_8$ *FOSA*	%	54	54	52	65	85
Extracted ISTD d_3 *N MeFOSA*	%	29	29	25	43	28
Extracted ISTD d_5 *N EtFOSA*	%	29	30	26	37	31
Extracted ISTD d_7 *N MeFOSE*	%	48	48	47	60	30
Extracted ISTD d_9 *N EtFOSE*	%	39	40	40	67	61
Extracted ISTD d_3 *N MeFOSAA*	%	55	62	69	43	61
Extracted ISTD d_5 *N EtFOSAA*	%	49	59	64	52	39
Total Positive PFHxS & PFOS	µg/L	0.0085	0.0090	0.072	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.0090	0.0085	0.015	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.031	0.032	0.11	<0.0002	<0.0002

PFAS in Waters Trace Extended			
Our Reference		251682-A-31	251682-A-32
Your Reference	UNITS	FB11	RB11
Date Sampled		17/09/2020	17/09/2020
Type of sample		Water	Water
Date prepared	-	24/09/2020	24/09/2020
Date analysed	-	28/09/2020	28/09/2020
Perfluorobutanesulfonic acid	µg/L	<0.0004	<0.0004
Perfluoropentanesulfonic acid	µg/L	<0.001	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002
Perfluorobutanoic acid	µg/L	<0.002	<0.002
Perfluoropentanoic acid	µg/L	<0.002	<0.002
Perfluorohexanoic acid	µg/L	<0.0004	<0.0004
Perfluoroheptanoic acid	µg/L	<0.0004	<0.0004
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
10:2 FTS	µg/L	<0.002	<0.002
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	98	100
Surrogate $^{13}C_2$ *PFOA*	%	102	102
Extracted ISTD $^{13}C_3$ *PFBS*	%	95	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	59	76
Extracted ISTD $^{13}C_4$ *PFBA*	%	97	97

PFAS in Waters Trace Extended			
Our Reference		251682-A-31	251682-A-32
Your Reference	UNITS	FB11	RB11
Date Sampled		17/09/2020	17/09/2020
Type of sample		Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	102	105
Extracted ISTD $^{13}C_2$ *PFHxA*	%	79	84
Extracted ISTD $^{13}C_4$ *PFHpA*	%	97	98
Extracted ISTD $^{13}C_4$ *PFOA*	%	117	120
Extracted ISTD $^{13}C_5$ *PFNA*	%	85	88
Extracted ISTD $^{13}C_2$ *PFDA*	%	71	92
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	60	78
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	40	47
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	29	52
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	106	106
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	129	129
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	71	94
Extracted ISTD $^{13}C_8$ *FOSA*	%	60	61
Extracted ISTD d_3 *N MeFOSA*	%	38	40
Extracted ISTD d_5 *N EtFOSA*	%	33	35
Extracted ISTD d_7 *N MeFOSE*	%	51	59
Extracted ISTD d_9 *N EtFOSE*	%	55	55
Extracted ISTD d_3 *N MeFOSAA*	%	47	44
Extracted ISTD d_5 *N EtFOSAA*	%	48	52
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002

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. 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 Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	251682-A-2
Date prepared	-			24/09/2020	1	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Date analysed	-			25/09/2020	1	25/09/2020	25/09/2020		25/09/2020	25/09/2020
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	<0.0004	1	0.003	0.003	0	106	109
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	<0.001	1	0.003	0.003	0	104	132
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.033	0.033	0	109	108
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	<0.001	1	0.001	0.001	0	110	111
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	0.0072	0.0067	7	110	115
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	79	58
Perfluorobutanoic acid	µg/L	0.002	Org-029	<0.002	1	0.01	0.01	0	103	111
Perfluoropentanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	105	97
Perfluorohexanoic acid	µg/L	0.0004	Org-029	<0.0004	1	0.0048	0.0048	0	106	114
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	109	107
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.001	0.001	0	104	108
Perfluorononanoic acid	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	105	120
Perfluorodecanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	103	87
Perfluoroundecanoic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	103	91
Perfluorododecanoic acid	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	104	110
Perfluorotridecanoic acid	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	131	135
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	109	116
4:2 FTS	µg/L	0.001	Org-029	<0.001	1	<0.001	<0.001	0	104	110
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	100	119
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	96	118
10:2 FTS	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	117	85
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	108	106
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	83	106
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	85	113
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	<0.005	1	<0.005	<0.005	0	105	112
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	107	122
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	90	84
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	<0.002	1	<0.002	<0.002	0	95	109
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	102	1	102	100	2	107	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	1	96	94	2	98	94

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	251682-A-2
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	82	1	75	75	0	84	73
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	80	1	78	82	5	82	78
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	65	1	78	84	7	72	73
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	90	1	#	#		87	#
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	89	1	25	22	13	83	22
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	85	1	36	32	12	83	31
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	95	1	61	58	5	90	56
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	118	1	82	77	6	115	73
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	88	1	90	90	0	87	79
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	86	1	128	135	5	93	114
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	68	1	107	128	18	76	95
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	81	1	81	79	2	88	71
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	79	1	45	59	27	79	57
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	96	1	86	100	15	90	89
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	105	1	138	141	2	95	136
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	93	1	#	#		114	#
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	58	1	51	47	8	60	44
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	32	1	23	#		33	20
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	33	1	26	20	26	35	20
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	66	1	53	44	19	69	46

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	251682-A-2
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	70	1	49	43	13	74	42
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	59	1	87	97	11	69	83
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	64	1	73	78	7	70	61

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	251682-A-22
Date prepared	-			[NT]	11	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Date analysed	-			[NT]	11	25/09/2020	25/09/2020		28/09/2020	28/09/2020
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	[NT]	11	0.002	0.002	0	102	113
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	[NT]	11	<0.001	<0.001	0	104	125
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	11	0.0037	0.0039	5	104	104
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	[NT]	11	<0.001	<0.001	0	111	107
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	11	0.0040	0.0038	5	104	101
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	92	71
Perfluorobutanoic acid	µg/L	0.002	Org-029	[NT]	11	0.007	0.007	0	99	101
Perfluoropentanoic acid	µg/L	0.002	Org-029	[NT]	11	0.003	0.003	0	106	120
Perfluorohexanoic acid	µg/L	0.0004	Org-029	[NT]	11	0.0048	0.0048	0	96	100
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	[NT]	11	0.001	0.0009	11	102	108
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	11	0.0032	0.0034	6	102	107
Perfluorononanoic acid	µg/L	0.001	Org-029	[NT]	11	<0.001	<0.001	0	95	106
Perfluorodecanoic acid	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	98	93
Perfluoroundecanoic acid	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	106	93
Perfluorododecanoic acid	µg/L	0.005	Org-029	[NT]	11	<0.005	<0.005	0	101	109
Perfluorotridecanoic acid	µg/L	0.01	Org-029	[NT]	11	<0.01	<0.01	0	103	136
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	[NT]	11	<0.05	<0.05	0	101	114
4:2 FTS	µg/L	0.001	Org-029	[NT]	11	<0.001	<0.001	0	102	118
6:2 FTS	µg/L	0.0004	Org-029	[NT]	11	<0.0004	<0.0004	0	104	115
8:2 FTS	µg/L	0.0004	Org-029	[NT]	11	<0.0004	<0.0004	0	92	110
10:2 FTS	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	99	76
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	[NT]	11	<0.01	<0.01	0	109	108
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	[NT]	11	<0.005	<0.005	0	124	123
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	[NT]	11	<0.01	<0.01	0	117	128
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	[NT]	11	<0.005	<0.005	0	108	120
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	[NT]	11	<0.05	<0.05	0	105	121
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	101	100
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	11	<0.002	<0.002	0	104	106
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	11	104	96	8	102	94
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	11	93	96	3	95	95

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	251682-A-22
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	[NT]	11	86	84	2	95	87
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	11	85	82	4	109	115
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	11	71	74	4	89	99
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	[NT]	11	27	26	4	104	49
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	[NT]	11	32	31	3	110	51
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	[NT]	11	48	47	2	99	62
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	[NT]	11	78	79	1	113	89
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	11	94	91	3	133	100
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	[NT]	11	98	96	2	103	98
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	[NT]	11	122	120	2	92	98
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	[NT]	11	94	89	5	82	76
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	[NT]	11	70	67	4	81	54
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	[NT]	11	61	77	23	62	31
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	[NT]	11	126	123	2	93	132
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	11	158	158	0	88	148
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	11	#	#		105	175
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	[NT]	11	53	51	4	72	54
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	[NT]	11	28	29	4	42	33
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	[NT]	11	28	33	16	41	33
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	[NT]	11	54	54	0	68	48

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	251682-A-22
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	[NT]	11	51	50	2	65	42
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	[NT]	11	63	75	17	64	62
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	[NT]	11	55	59	7	66	56

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	24/09/2020	24/09/2020		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	[NT]	21	0.002	0.002	0	[NT]	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	[NT]	21	<0.001	<0.001	0	[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	21	0.0032	0.0033	3	[NT]	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	[NT]	21	<0.001	<0.001	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	21	0.0042	0.0041	2	[NT]	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	[NT]	21	0.007	0.007	0	[NT]	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	[NT]	21	0.003	0.003	0	[NT]	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	[NT]	21	0.0057	0.0058	2	[NT]	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	[NT]	21	0.001	0.001	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	21	0.0043	0.0041	5	[NT]	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	[NT]	21	<0.001	<0.001	0	[NT]	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	[NT]	21	<0.01	<0.01	0	[NT]	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	[NT]	21	<0.05	<0.05	0	[NT]	[NT]
4:2 FTS	µg/L	0.001	Org-029	[NT]	21	<0.001	<0.001	0	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	21	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	21	<0.0004	<0.0004	0	[NT]	[NT]
10:2 FTS	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	[NT]	21	<0.01	<0.01	0	[NT]	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	[NT]	21	<0.01	<0.01	0	[NT]	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	[NT]	21	<0.005	<0.005	0	[NT]	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	[NT]	21	<0.05	<0.05	0	[NT]	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	21	<0.002	<0.002	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	21	99	94	5	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	21	94	96	2	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	[NT]	21	84	90	7	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	21	116	114	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	21	96	99	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	[NT]	21	48	47	2	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	[NT]	21	47	47	0	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	[NT]	21	55	61	10	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	[NT]	21	90	90	0	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	21	102	100	2	[NT]	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	[NT]	21	100	96	4	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	[NT]	21	99	94	5	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	[NT]	21	84	77	9	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	[NT]	21	63	58	8	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	[NT]	21	32	33	3	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	[NT]	21	109	142	26	[NT]	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	21	155	153	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	21	#	191		[NT]	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	[NT]	21	55	54	2	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	[NT]	21	35	35	0	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	[NT]	21	34	36	6	[NT]	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	[NT]	21	50	50	0	[NT]	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Waters Trace Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	[NT]	21	44	45	2	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	[NT]	21	70	64	9	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	[NT]	21	60	60	0	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	24	24/09/2020	24/09/2020		[NT]	[NT]
Date analysed	-			[NT]	24	28/09/2020	28/09/2020		[NT]	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-029	[NT]	24	0.003	0.003	0	[NT]	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-029	[NT]	24	0.001	0.001	0	[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	[NT]	24	0.0044	0.0046	4	[NT]	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-029	[NT]	24	<0.001	<0.001	0	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	[NT]	24	0.0040	0.0041	2	[NT]	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-029	[NT]	24	0.008	0.008	0	[NT]	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-029	[NT]	24	0.003	0.003	0	[NT]	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-029	[NT]	24	0.0050	0.0049	2	[NT]	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-029	[NT]	24	0.001	0.001	0	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	[NT]	24	0.0044	0.0042	5	[NT]	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-029	[NT]	24	<0.001	<0.001	0	[NT]	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-029	[NT]	24	<0.005	<0.005	0	[NT]	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-029	[NT]	24	<0.01	<0.01	0	[NT]	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-029	[NT]	24	<0.05	<0.05	0	[NT]	[NT]
4:2 FTS	µg/L	0.001	Org-029	[NT]	24	<0.001	<0.001	0	[NT]	[NT]
6:2 FTS	µg/L	0.0004	Org-029	[NT]	24	<0.0004	<0.0004	0	[NT]	[NT]
8:2 FTS	µg/L	0.0004	Org-029	[NT]	24	<0.0004	<0.0004	0	[NT]	[NT]
10:2 FTS	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-029	[NT]	24	<0.01	<0.01	0	[NT]	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-029	[NT]	24	<0.005	<0.005	0	[NT]	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.01	Org-029	[NT]	24	<0.01	<0.01	0	[NT]	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-029	[NT]	24	<0.005	<0.005	0	[NT]	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	[NT]	24	<0.05	<0.05	0	[NT]	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-029	[NT]	24	<0.002	<0.002	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	24	97	92	5	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	24	92	91	1	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	[NT]	24	87	83	5	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	24	112	108	4	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	24	91	96	5	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	[NT]	24	45	43	5	[NT]	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	[NT]	24	48	49	2	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	[NT]	24	61	59	3	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	[NT]	24	89	87	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	24	101	101	0	[NT]	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	[NT]	24	97	94	3	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	[NT]	24	96	97	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	[NT]	24	68	75	10	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	[NT]	24	47	52	10	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	[NT]	24	31	32	3	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	[NT]	24	136	149	9	[NT]	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	[NT]	24	149	151	1	[NT]	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	[NT]	24	160	182	13	[NT]	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	[NT]	24	48	51	6	[NT]	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	[NT]	24	27	31	14	[NT]	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	[NT]	24	26	28	7	[NT]	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	[NT]	24	41	46	11	[NT]	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Extracted ISTD d₉ *N EtFOSE*	%		Org-029	[NT]	24	36	39	8	[NT]	[NT]
Extracted ISTD d₃ *N MeFOSAA*	%		Org-029	[NT]	24	56	59	5	[NT]	[NT]
Extracted ISTD d₅ *N EtFOSAA*	%		Org-029	[NT]	24	50	52	4	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

ENVIROLAB GROUP ENVIROLAB SERVICES mpl

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd	Client Project Name/Number/Site etc (ie report title): 12516828
Contact Person: Sean Sparrow	
Project Mgr: Dilara Valiff	PO No.: 12516828
Sampler: Sean Sparrow	Envirolab Quote No. :
Address: Level 4, 211 Victoria Square, Adelaide 5000	Date results required: standard Or choose: standard / same day / 1 day / 2 day / 3 day *Note: inform lab in advance if urgent turnaround is required - surcharges apply*
Phone: Mob: 0498 260 626	Additional report format: esdat / equis /
Email: GHDLabReports@ghd.com sean.sparrow@ghd.com dilara.valiff@ghd.com	Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace in Water	PFAS in Soil	Hold													Provide as much information about the sample as you can
1	6627-5944_B		17/09/2020	water	X															Relinquished by EU SUD
2	Garden1		17/09/2020	soil		X														C.Mulema
3	Garden2		17/09/2020	soil		X														22/9/20 800
4	Garden3		17/09/2020	soil		X														CM
5	Garden4		17/09/2020	soil		X														
6	Garden5		17/09/2020	soil			X													
7	Garden6		17/09/2020	soil			X													
8	Garden7		17/09/2020	soil			X													
9	Garden8		17/09/2020	soil			X													
10	QC33		17/09/2020	soil		X														
—	QC33A		17/09/2020	soil		X														Please forward to ALS
11	QC34		17/09/2020	water	X															
—	QC34A		17/09/2020	water	X															Please forward to ALS

Environmental Division
Sydney
Work Order Reference
ES2033438
Telephone : + 61-2-8784 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS	Received by (Company): EU SUD	751708 *Lab Use Only*
Print Name: Alex Stento	Print Name: C-Mulema	Job number: ~~457082~~ / Cooling: Ice / [✓ Ice pack] / None
Date & Time: 15/9/20 @ 930am	Date & Time: 21/9/20 1820	Temperature: 18.5 / Security seal: Intact / Broken / None
Signature:	Signature: CM	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

~~28 FB~~
~~29 RB~~ } ~~Extras CM~~ CM

Rec-[illegible] 22/9/20 1820 3.8c

Form 302_V006

Issue date: 7 October 2019

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2033438**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : LEVEL 15, 133 CASTLEREAGH STREET
SYDNEY NSW, AUSTRALIA 2000
Telephone : +61 08 8111 6600
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : ----
Site :
Quote number : EN/005
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 22-Sep-2020 18:20
Date Analysis Commenced : 23-Sep-2020
Issue Date : 30-Sep-2020 10:28

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. 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*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS 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: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	**QC33A**	----	----	----	----
			Client sampling date / time	17-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033438-001**	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**16.0**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0005**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**QC33A**	----	----	----	----
			Client sampling date / time	17-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033438-001**	--------	--------	--------	--------
				Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	**0.0005**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0005**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0005**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**93.5**	----	----	----	----
13C8-PFOA	----	0.0002	%	**102**	----	----	----	----

Analytical Results

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

			Client sample ID	**QC34A**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033438-002**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.005**	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	**0.006**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.038**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	**0.003**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.046**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	**0.005**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.022**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.004**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	----	----	----	----
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QC34A**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033438-002**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.002	µg/L	**0.129**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.084**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.120**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**94.8**	----	----	----	----
13C8-PFOA	----	0.002	%	**114**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

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

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order	: **ES2033438**	Page	: 1 of 9
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 22-Sep-2020
Order number	: 12516828	Date Analysis Commenced	: 23-Sep-2020
C-O-C number	: ----	Issue Date	: 30-Sep-2020
Sampler	: ----		
Site	:		
Quote number	: EN/005		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3273499)									
ES2032555-045	Anonymous	EA055: Moisture Content	----	0.1	%	3.8	3.4	9.72	0% - 20%
ES2033438-001	QC33A	EA055: Moisture Content	----	0.1	%	16.0	14.9	7.35	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3276145)									
EP2010127-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0018	0.0016	10.5	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3276145)									
EP2010127-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0023	0.0020	18.1	0% - 50%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0046	0.0040	14.3	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0028	0.0028	0.00	0% - 50%
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0216	0.0209	3.13	0% - 20%
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0026	0.0025	5.58	0% - 50%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0230	0.0213	7.70	0% - 20%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0022	0.0023	5.91	0% - 50%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0074	0.0074	0.00	0% - 20%
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0010	0.0011	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	0.0018	0.0017	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3276145)									
EP2010127-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3276145) - continued									
EP2010127-001	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	0.0002	0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3276145)									
EP2010127-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0046	0.0044	4.99	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0115	0.0115	0.00	0% - 20%
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0060	0.0064	6.41	0% - 50%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3276767)									
ES2033438-002	QC34A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.005	0.005	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.006	0.006	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.038	0.037	3.48	0% - 50%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.003	0.003	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.046	0.043	5.61	0% - 20%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3276767)									
ES2033438-002	QC34A	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.005	0.005	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.022	0.022	0.00	0% - 50%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.004	0.004	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3276767) - continued									
ES2033438-002	QC34A	EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3276767)									
ES2033438-002	QC34A	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3276767)									
ES2033438-002	QC34A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276145)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.2	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	105	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	108	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276145)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	84.4	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	125	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	113	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	120	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	124	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	120	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	78.0	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276145)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	106	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	94.4	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	106	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	115	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.6	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276145)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	107	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	119	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	109	65.0	137

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276145) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	101	69.2	143

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276767)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	87.2	72.0	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.025 µg/L	106	71.0	127
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	96.0	68.0	131
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.025 µg/L	97.6	69.0	134
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	95.2	65.0	140
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.025 µg/L	94.0	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276767)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	80.4	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	99.6	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	108	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	100	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	98.0	71.0	133
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.025 µg/L	97.2	69.0	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.025 µg/L	96.8	71.0	129
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.025 µg/L	111	69.0	133
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.025 µg/L	103	72.0	134
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.025 µg/L	108	65.0	144
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.0625 µg/L	88.5	71.0	132
EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	0.025 µg/L	119	65.6	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276767)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.025 µg/L	100	67.0	137
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.0625 µg/L	94.1	68.0	141
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.0625 µg/L	94.1	61.1	139
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.0625 µg/L	98.4	72.3	128
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.0625 µg/L	113	63.2	134
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.025 µg/L	96.8	65.0	136
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.025 µg/L	106	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767)								

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767) - continued								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	90.8	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	101	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	93.2	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	83.2	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276145)							
EP2010127-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	94.0	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	117	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	113	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	121	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	86.0	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	103	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276145)							
EP2010127-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	96.9	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	93.6	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	130	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	123	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	# Not Determined	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	103	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	# Not Determined	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	105	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# Not Determined	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	122	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	88.8	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276145)							
EP2010127-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	118	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	93.1	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	112	69.8	131

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276145) - continued							
EP2010127-001	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	104	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	105	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	99.2	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	113	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276145)							
EP2010127-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	119	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	123	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	# Not Determined	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	# Not Determined	69.2	143

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276767)							
ES2033439-002	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	104	72.0	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.025 µg/L	110	71.0	127
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	98.0	68.0	131
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.025 µg/L	96.8	69.0	134
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	92.0	65.0	140
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.025 µg/L	90.8	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276767)							
ES2033439-002	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	78.5	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	109	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	102	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	94.4	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	100	71.0	133
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.025 µg/L	95.6	69.0	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.025 µg/L	105	71.0	129
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.025 µg/L	126	69.0	133
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.025 µg/L	117	72.0	134
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.025 µg/L	127	65.0	144
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0625 µg/L	75.4	71.0	132
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.025 µg/L	98.4	65.6	133

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276767)							
ES2033439-002	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.025 µg/L	91.2	67.0	137
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0625 µg/L	97.6	68.0	141
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0625 µg/L	81.9	61.1	139
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0625 µg/L	80.0	72.3	128
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0625 µg/L	104	63.2	134
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.025 µg/L	89.2	65.0	136
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.025 µg/L	86.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767)							
ES2033439-002	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	99.2	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	96.0	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	96.4	67.0	138
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	99.2	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2033438**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 22-Sep-2020
Site	:	Issue Date	: 30-Sep-2020
Sampler	: ----	No. of samples received	: 2
Order number	: 12516828	No. of samples analysed	: 2

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Matrix Spike (MS) Recoveries							
EP231B: Perfluoroalkyl Carboxylic Acids	EP2010127--001	Anonymous	**Perfluorooctanoic acid (PFOA)**	335-67-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EP2010127--001	Anonymous	**Perfluorodecanoic acid (PFDA)**	335-76-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EP2010127--001	Anonymous	**Perfluorododecanoic acid (PFDoDA)**	307-55-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP2010127--001	Anonymous	**8:2 Fluorotelomer sulfonic acid (8:2 FTS)**	39108-34-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP2010127--001	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) QC33A	**17-Sep-2020**	**----**	----	----	**23-Sep-2020**	01-Oct-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) QC33A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**25-Sep-2020**	04-Nov-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) QC33A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**25-Sep-2020**	04-Nov-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) QC33A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**25-Sep-2020**	04-Nov-2020	✓

Matrix: **SOIL**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container */ Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) QC33A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**25-Sep-2020**	04-Nov-2020	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) QC33A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**25-Sep-2020**	04-Nov-2020	✓

Matrix: **WATER**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container */ Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC34A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC34A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) QC34A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC34A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC34A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		*Count*		*Rate (%)*			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		*Count*		*Rate (%)*			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Sample Extraction for PFAS in solid matrices	ORG73	SOIL	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.
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.

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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required			Comments
Envirolab Sample ID	**Client Sample ID or information**	**Depth**	**Date sampled**	**Type of sample**	PFAS Ultra Trace in Water	PFAS in Soil	Hold	**Provide as much information about the sample as you can**
1	6627-5944_B		17/09/2020	water	X			
2	Garden1		17/09/2020	soil		X		
3	Garden2		17/09/2020	soil		X		
4	Garden3		17/09/2020	soil		X		
5	Garden4		17/09/2020	soil		X		
6	Garden5		17/09/2020	soil			X	
7	Garden6		17/09/2020	soil			X	
8	Garden7		17/09/2020	soil			X	
9	Garden8		17/09/2020	soil			X	
10	QC33		17/09/2020	soil		X		
–	QC33A		17/09/2020	soil		X		Please forward to ALS
11	QC34		17/09/2020	water	X			
→	QC34A		17/09/2020	water	X			Please forward to ALS

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS	**Received by (Company):** ELS SYD	251708 *Lab Use Only*
Print Name: Alex Steele	**Print Name:** C-Mullen	**Job number:** ~~[illegible]~~ / **Cooling:** Ice / [✓ Ice pack] / None
Date & Time: 16/9/20 @ 930am	**Date & Time:** 21/9/20 1020	**Temperature:** 18.5 / **Security seal:** Intact / Broken / None
Signature:	**Signature:** CM	**TAT Req** - SAME day / 1 / 2 / 3 / 4 / STD

~~28~~ FB
~~29~~ RFB } ~~Extras CM~~ CM

Form 302_V006

Issue date: 7 October 2019

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CERTIFICATE OF ANALYSIS 251708

Client Details

Client	GHD Pty Ltd
Attention	Sean Sparrow
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	2 Water, 9 Soil
Date samples received	21/09/2020
Date completed instructions received	21/09/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	28/09/2020
Date of Issue	28/09/2020

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

Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		251708-1	251708-11
Your Reference	UNITS	6627-5944_B	QC34
Date Sampled		17/09/2020	17/09/2020
Type of sample		Water	Water
Date prepared	-	23/09/2020	23/09/2020
Date analysed	-	24/09/2020	24/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.033	0.035
Perfluorooctanesulfonic acid PFOS	µg/L	0.040	0.040
Perfluorooctanoic acid PFOA	µg/L	0.0040	0.0042
6:2 FTS	µg/L	0.001	0.001
8:2 FTS	µg/L	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	99	97
Surrogate $^{13}C_2$ *PFOA*	%	100	104
Extracted ISTD $^{18}O_2$ *PFHxS*	%	83	81
Extracted ISTD $^{13}C_4$ *PFOS*	%	67	66
Extracted ISTD $^{13}C_4$ *PFOA*	%	87	87
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	110	103
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	168	168
Total Positive PFHxS & PFOS	µg/L	0.074	0.074
Total Positive PFOS & PFOA	µg/L	0.044	0.044
Total Positive PFAS	µg/L	0.079	0.079

PFAS in Soils Short

Our Reference		251708-2	251708-3	251708-4	251708-5	251708-10
Your Reference	UNITS	Garden1	Garden2	Garden3	Garden4	QC33
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Date analysed	-	24/09/2020	24/09/2020	24/09/2020	24/09/2020	24/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.3	0.4	0.3	1.4	0.3
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	87	98	97	102	96
Surrogate $^{13}C_2$ *PFOA*	%	91	89	89	88	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%	99	95	100	96	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	110	102	101	96	99
Extracted ISTD $^{13}C_4$ *PFOA*	%	111	126	119	126	126
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	176	154	#	#	171
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	166	184	194	173
Total Positive PFHxS & PFOS	µg/kg	0.3	0.4	0.3	1.4	0.3
Total Positive PFOS & PFOA	µg/kg	0.3	0.4	0.3	1.4	0.3
Total Positive PFAS	µg/kg	0.3	0.4	0.3	1.4	0.3

Moisture						
Our Reference		251708-2	251708-3	251708-4	251708-5	251708-10
Your Reference	UNITS	Garden1	Garden2	Garden3	Garden4	QC33
Date Sampled		17/09/2020	17/09/2020	17/09/2020	17/09/2020	17/09/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/09/2020	22/09/2020	22/09/2020	22/09/2020	22/09/2020
Date analysed	-	23/09/2020	23/09/2020	23/09/2020	23/09/2020	23/09/2020
Moisture	%	15	24	7.5	15	13

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/09/2020	[NT]	[NT]	[NT]	[NT]	23/09/2020	[NT]
Date analysed	-			24/09/2020	[NT]	[NT]	[NT]	[NT]	24/09/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	101	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	100	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	102	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	103	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	99	[NT]	[NT]	[NT]	[NT]	101	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	85	[NT]	[NT]	[NT]	[NT]	82	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	73	[NT]	[NT]	[NT]	[NT]	71	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	94	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	165	[NT]	[NT]	[NT]	[NT]	174	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	107	[NT]	[NT]	[NT]	[NT]	116	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Soils Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	251708-3
Date prepared	-			24/09/2020	2	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Date analysed	-			24/09/2020	2	24/09/2020	24/09/2020		24/09/2020	24/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	102	106
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	0.3	0.3	0	99	99
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	101	99
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	93	95
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	89	100
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	97	2	87	100	14	97	96
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	94	2	91	99	8	95	90
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	96	2	99	104	5	96	98
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	97	2	110	99	11	95	101
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	126	2	111	110	1	103	122
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	122	2	176	185	5	78	157
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	113	2	#	#		101	170

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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS_W_EXT1_LL: 6:2-FTS Extracted Internal Standard is outside of global acceptance criteria (50-150%) for MB and LCS but within analyte specific acceptance criteria.

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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS Ultra Trace in Water	Comments: Provide as much information about the sample as you can
1	BR03_1A		11/09/2020	water	x	
2	BR03_1B		11/09/2020	water	x	
3	BR03_1C		11/09/2020	water	x	
4	BR02_1A		11/09/2020	water	x	
5	BR02_1B		11/09/2020	water	x	
6	BR02_1C		11/09/2020	water	x	
7	MBC02_1A		11/09/2020	water	x	
8	MBC02_1B		11/09/2020	water	x	
9	MBC02_1C		11/09/2020	water	x	
10	MBC01_1A		11/09/2020	water	x	
11	MBC01_1B		11/09/2020	water	x	
12	MBC01_1C		11/09/2020	water	x	
13	BR03_2A		17/09/2020	water	x	
14	BR03_2B		17/09/2020	water	x	
15	BR03_2C		17/09/2020	water	x	
16	BR02_2A		17/09/2020	water	x	
17	BR02_2B		17/09/2020	water	x	
18	BR02_2C		17/09/2020	water	x	
19	MBC02_2A		17/09/2020	water	x	
20	MBC02_2B		17/09/2020	water	x	
21	MBC02_2C		17/09/2020	water	x	
22	MBC01_2A		17/09/2020	water	x	
23	MBC01_2B		17/09/2020	water	x	
24	MBC01_2C		17/09/2020	water	x	
25	QC31		11/09/2020	water	x	
–	QC31A		11/09/2020	water	x	Please forward to ALS
26	QC32		11/09/2020	water	x	
–	QC32A		11/09/2020	water	x	Please forward to ALS
27	QC35		17/09/2020	water	x	
–	QC35A		17/09/2020	water	x	Please forward to ALS
28	QC36		17/09/2020	water	x	
–	QC36A		17/09/2020	water	x	Please forward to ALS

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): SGS	Received by (Company): ES SYD	Lab Use Only	
Print Name: [illegible]	Print Name: C Mullens	Job number: 251082	Cooling: Ice / [✓ Ice pack] / None
Date & Time: 18/9/20 @ 9.30am	Date & Time: 21/9/20 1020	Temperature: 18.5	Security seal: [✓ Intact] / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Environmental Division
Sydney
Work Order Reference
ES2033439
Telephone : + 61-2-8784 8555

QC01A

QC02A

Relinquished by ES Sydney
C Mullenre
22/9/20 800
cm

1st esky received:
15/9/20 1015

2nd esky received
21/9/20 1020.

Extras
#29 FB01 11/9
30 RB01 11/9
31 FB 17/9
32 RB 17/9

Rec: SGS/PHo 22/9/20 1820 3.8°

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2033439**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : LEVEL 15, 133 CASTLEREAGH STREET
SYDNEY NSW, AUSTRALIA 2000
Telephone : +61 08 8111 6600
Project : 12516828
Order number : ----
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005
No. of samples received : 4
No. of samples analysed : 4

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 22-Sep-2020 18:20
Date Analysis Commenced : 25-Sep-2020
Issue Date : 29-Sep-2020 13:07

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

The analytical procedures used by 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**)			*Client sample ID*	**QC31A**	**QC32A**	**QC35A**	**QC36A**	**----**
			Client sampling date / time	11-Sep-2020 00:00	11-Sep-2020 00:00	17-Sep-2020 00:00	17-Sep-2020 00:00	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033439-001**	**ES2033439-002**	**ES2033439-003**	**ES2033439-004**	**--------**
				Result	Result	Result	Result	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.002**	<0.002	<0.002	**0.004**	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	**0.002**	<0.002	<0.002	**0.005**	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.038**	**0.004**	**0.005**	**0.073**	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	<0.002	**0.003**	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.010**	**0.005**	**0.007**	**0.016**	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.006**	**0.009**	**0.007**	**0.011**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	**0.004**	**0.004**	<0.002	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----

Analytical Results

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

			Client sample ID	**QC31A**	**QC32A**	**QC35A**	**QC36A**	**----**
			Client sampling date / time	11-Sep-2020 00:00	11-Sep-2020 00:00	17-Sep-2020 00:00	17-Sep-2020 00:00	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2033439-001**	**ES2033439-002**	**ES2033439-003**	**ES2033439-004**	**--------**
				Result	Result	Result	Result	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.002	µg/L	**0.058**	**0.022**	**0.023**	**0.112**	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.048**	**0.009**	**0.012**	**0.089**	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.056**	**0.022**	**0.023**	**0.104**	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**88.8**	**90.6**	**94.8**	**95.7**	----
13C8-PFOA	----	0.002	%	**119**	**116**	**118**	**120**	----

Surrogate Control Limits

Sub-Matrix: **WATER**

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

QUALITY CONTROL REPORT

Work Order	: **ES2033439**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 22-Sep-2020
Order number	: ----	Date Analysis Commenced	: 25-Sep-2020
C-O-C number	: ----	Issue Date	: 29-Sep-2020
Sampler	: SEAN SPARROW		
Site	:		
Quote number	: EN/005		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3276767)									
ES2033438-002	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.005	0.005	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.006	0.006	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.038	0.037	3.48	0% - 50%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.003	0.003	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.046	0.043	5.61	0% - 20%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3276767)									
ES2033438-002	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.005	0.005	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.022	0.022	0.00	0% - 50%
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.004	0.004	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3276767) - continued									
ES2033438-002	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3276767)									
ES2033438-002	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3276767)									
ES2033438-002	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276767)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	87.2	72.0	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.025 µg/L	106	71.0	127
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	96.0	68.0	131
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.025 µg/L	97.6	69.0	134
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	95.2	65.0	140
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.025 µg/L	94.0	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276767)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	80.4	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	99.6	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	108	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	100	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	98.0	71.0	133
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.025 µg/L	97.2	69.0	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.025 µg/L	96.8	71.0	129
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.025 µg/L	111	69.0	133
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.025 µg/L	103	72.0	134
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.025 µg/L	108	65.0	144
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.0625 µg/L	88.5	71.0	132
EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	0.025 µg/L	119	65.6	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276767)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.025 µg/L	100	67.0	137
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.0625 µg/L	94.1	68.0	141
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.0625 µg/L	94.1	61.1	139
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.0625 µg/L	98.4	72.3	128
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.0625 µg/L	113	63.2	134
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.025 µg/L	96.8	65.0	136
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.025 µg/L	106	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	90.8	63.0	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767) - continued								
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	101	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	93.2	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	83.2	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3276767)							
ES2033439-002	QC32A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	104	72.0	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.025 µg/L	110	71.0	127
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	98.0	68.0	131
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.025 µg/L	96.8	69.0	134
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	92.0	65.0	140
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.025 µg/L	90.8	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3276767)							
ES2033439-002	QC32A	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	78.5	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	109	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	102	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	94.4	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	100	71.0	133
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.025 µg/L	95.6	69.0	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.025 µg/L	105	71.0	129
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.025 µg/L	126	69.0	133
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.025 µg/L	117	72.0	134
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.025 µg/L	127	65.0	144
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0625 µg/L	75.4	71.0	132
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.025 µg/L	98.4	65.6	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276767)							
ES2033439-002	QC32A	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.025 µg/L	91.2	67.0	137
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0625 µg/L	97.6	68.0	141
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0625 µg/L	81.9	61.1	139

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3276767) - continued							
ES2033439-002	QC32A	EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0625 µg/L	80.0	72.3	128
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0625 µg/L	104	63.2	134
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.025 µg/L	89.2	65.0	136
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.025 µg/L	86.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3276767)							
ES2033439-002	QC32A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	99.2	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	96.0	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	96.4	67.0	138
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	99.2	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2033439**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 22-Sep-2020
Site	:	Issue Date	: 29-Sep-2020
Sampler	: SEAN SPARROW	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC31A, QC32A	**11-Sep-2020**	**25-Sep-2020**	10-Mar-2021	✓	**28-Sep-2020**	10-Mar-2021	✓
HDPE (no PTFE) (EP231X-LL) QC35A, QC36A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC31A, QC32A	**11-Sep-2020**	**25-Sep-2020**	10-Mar-2021	✓	**28-Sep-2020**	10-Mar-2021	✓
HDPE (no PTFE) (EP231X-LL) QC35A, QC36A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) QC31A, QC32A	**11-Sep-2020**	**25-Sep-2020**	10-Mar-2021	✓	**28-Sep-2020**	10-Mar-2021	✓
HDPE (no PTFE) (EP231X-LL) QC35A, QC36A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC31A, QC32A	**11-Sep-2020**	**25-Sep-2020**	10-Mar-2021	✓	**28-Sep-2020**	10-Mar-2021	✓
HDPE (no PTFE) (EP231X-LL) QC35A, QC36A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC31A, QC32A	**11-Sep-2020**	**25-Sep-2020**	10-Mar-2021	✓	**28-Sep-2020**	10-Mar-2021	✓
HDPE (no PTFE) (EP231X-LL) QC35A, QC36A	**17-Sep-2020**	**25-Sep-2020**	16-Mar-2021	✓	**28-Sep-2020**	16-Mar-2021	✓

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-LL	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	6	**16.67**	**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-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

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

ENVIROLAB GROUP ENVIROLAB SERVICES mpl

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Client: GHD Pty Ltd	**Client Project Name/Number/Site etc (ie report title):** CFS Brukunga State Training Centre
Contact Person: Sean Sparrow	**PO No.:** 12516828
Project Mgr: Dilara Valiff	**Envirolab Quote No. :**
Sampler: Sean Sparrow	**Date results required:** Standard
Address: Level 4, 211 Victoria Square, Adelaide 5000	**Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*
Phone: **Mob:** 0498 260 626	**Additional report format:** esdat / equis /
Email: GHDLabReports@ghd.com sean.sparrow@ghd.com dilara.valiff@ghd.com	**Lab Comments:**

Sample information					Tests Required															Comments
Envirolab Sample ID	**Client Sample ID or information**	**Depth**	**Date sampled**	**Type of sample**	**PFAS in Water Ultra Trace**															**Provide as much information about the sample as you can**
1	6627-11131		23/09/2020	water	X															
2	QC37		23/09/2020	water	X															
3	QC37A		23/09/2020	water	X															Please forward to ALS
4.	FB12		23/09/2020	water	X															
5.	RB12		23/09/2020	water	X															

☐ ***Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis***

Relinquished by (Company):	**Received by (Company):** GLS syd.	***Lab Use Only***	
Print Name:	**Print Name:** R.Chazeen	**Job number:** 252146.	**Cooling:** Ice / [✓ Ice pack] / None
Date & Time:	**Date & Time:** 25/09/2020 12.20	**Temperature:** 13.7	**Security seal:** [✓ Intact] / Broken / None
Signature:	**Signature:**	**TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]**	

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CERTIFICATE OF ANALYSIS 252146

Client Details

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

Sample Details

Your Reference	**CFS Brukunga State Training Centre**
Number of Samples	5 Water
Date samples received	25/09/2020
Date completed instructions received	25/09/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	02/10/2020
Date of Issue	30/09/2020

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Results Approved By
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		252146-1	252146-2	252146-4	252146-5
Your Reference	UNITS	6627-11131	QC37	FB12	RB12
Date Sampled		23/09/2020	23/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	29/09/2020	29/09/2020	29/09/2020	29/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
6:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	97	94	93	94
Surrogate $^{13}C_2$ *PFOA*	%	98	96	97	97
Extracted ISTD $^{18}O_2$ *PFHxS*	%	85	82	79	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	67	67	68	89
Extracted ISTD $^{13}C_4$ *PFOA*	%	90	87	85	93
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	146	136	128	136
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	67	61	61	96
Total Positive PFHxS & PFOS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	<0.0002	<0.0002	<0.0002	<0.0002
Total Positive PFAS	µg/L	<0.0002	<0.0002	<0.0002	<0.0002

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. 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.

Client Reference: CFS Brukunga State Training Centre

QUALITY CONTROL: PFAS in Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	252146-2
Date prepared	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			29/09/2020	1	29/09/2020	29/09/2020		29/09/2020	29/09/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	<0.0002	<0.0002	0	106	105
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	<0.0002	<0.0002	0	99	102
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	<0.0002	<0.0002	0	103	102
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	102	104
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	103	106
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	95	1	97	95	2	91	91
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	97	1	98	91	7	95	96
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	90	1	85	86	1	89	87
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	82	1	67	71	6	84	70
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	91	1	90	92	2	90	88
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	105	1	146	149	2	97	152
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	69	1	67	72	7	73	75

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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2034113**
Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : +61 08 8111 6600
Project : CFS Brukunga State Training Centre
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 4
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 28-Sep-2020 17:00
Date Analysis Commenced : 01-Oct-2020
Issue Date : 06-Oct-2020 13:43

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

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

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

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

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

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS 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**)			*Client sample ID*	**QC37A**	----	----	----	----
			Client sampling date / time	23-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2034113-001**	--------	--------	--------	--------
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**101**	----	----	----	----
13C8-PFOA	----	0.002	%	**104**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

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

ALS Environmental

QUALITY CONTROL REPORT

Work Order : **ES2034113**

Client : **GHD PTY LTD**
Contact : DILARA VALIFF
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : +61 08 8111 6600
Project : CFS Brukunga State Training Centre
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 4

Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 28-Sep-2020
Date Analysis Commenced : 01-Oct-2020
Issue Date : 06-Oct-2020

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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3286122)									
ES2034113-001	QC37A	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3286122)									
ES2034113-001	QC37A	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3286122)									
ES2034113-001	QC37A	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3286122)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	96.4	72.0	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	122	68.0	131
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	116	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3286122)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	99.7	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	120	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	117	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	122	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	123	71.0	133
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3286122)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	109	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	116	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	114	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	109	75.2	137

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3286122)							
ES2034160-001	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.025 µg/L	82.4	72.0	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.025 µg/L	# Not Determined	68.0	131
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.025 µg/L	122	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3286122)							
ES2034160-001	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.125 µg/L	74.1	73.0	129
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.025 µg/L	91.2	72.0	129
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.025 µg/L	# Not Determined	72.0	129
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.025 µg/L	112	72.0	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.025 µg/L	120	71.0	133

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	Concentration	MS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3286122)							
ES2034160-001	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.025 µg/L	108	63.0	143
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.025 µg/L	114	64.0	140
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.025 µg/L	100	67.0	138
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.025 µg/L	87.6	75.2	137

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2034113**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: CFS Brukunga State Training Centre	Date Samples Received	: 28-Sep-2020
Site	:	Issue Date	: 06-Oct-2020
Sampler	: SEAN SPARROW	No. of samples received	: 1
Order number	: 12516828	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	ES2034160--001	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	ES2034160--001	Anonymous	**Perfluorohexanoic acid (PFHxA)**	307-24-4	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	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC37A	**23-Sep-2020**	**01-Oct-2020**	22-Mar-2021	✓	**01-Oct-2020**	22-Mar-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) QC37A	**23-Sep-2020**	**01-Oct-2020**	22-Mar-2021	✓	**01-Oct-2020**	22-Mar-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) QC37A	**23-Sep-2020**	**01-Oct-2020**	22-Mar-2021	✓	**01-Oct-2020**	22-Mar-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) QC37A	**23-Sep-2020**	**01-Oct-2020**	22-Mar-2021	✓	**01-Oct-2020**	22-Mar-2021	✓

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-LL	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

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

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

CHAIN OF CUSTODY FORM - Client

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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required:
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS full suite (standard LOR)															Provide as much information about the sample as you can
1	Tank1		28/10/2020	water	X															
2	Tank2		28/10/2020	water	X															
3	Tank3		28/10/2020	water	X															
4	Tank4		28/10/2020	water	X															
5	Tank5		28/10/2020	water	X															
6	Tank6		28/10/2020	water	X															
7	Tank7		28/10/2020	water	X															
8	QC38		28/10/2020	water	X															
–	QC38A		28/10/2020	water	X															Please forward to ALS
9	FB13		28/10/2020	water	X															
10	RB13		28/10/2020	water	X															

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	**Received by (Company):** ELS SYD	***Lab Use Only***
Print Name:	**Print Name:** G Mulley	**Job number:** 254518 **Cooling:** Ice / [✓ Ice pack] / None
Date & Time:	**Date & Time:** 29/10/20 810	**Temperature:** 9.9 **Security seal:** [✓ Intact] / Broken / None
Signature:	**Signature:** CM	**TAT Req - SAME day / 1 / 2 / 3 / 4 / STD**

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CERTIFICATE OF ANALYSIS 254518

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	10 Water
Date samples received	29/10/2020
Date completed instructions received	29/10/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/11/2020
Date of Issue	02/11/2020

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Results Approved By
Alexander Mitchell Maclean, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Waters Extended

Our Reference		254518-1	254518-2	254518-3	254518-4	254518-5
Your Reference	UNITS	Tank-1	Tank-2	Tank-3	Tank-4	Tank-5
Date Sampled		28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/10/2020	30/10/2020	30/10/2020	30/10/2020	30/10/2020
Date analysed	-	30/10/2020	30/10/2020	30/10/2020	30/10/2020	30/10/2020
Perfluorobutanesulfonic acid	µg/L	0.02	0.02	0.02	0.01	0.02
Perfluoropentanesulfonic acid	µg/L	0.01	0.01	0.01	<0.01	0.02
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.08	0.09	0.08	0.07	0.09
Perfluoroheptanesulfonic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.41	0.36	0.34	0.25	0.36
Perfluorodecanesulfonic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorobutanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid	µg/L	<0.02	0.02	<0.02	<0.02	0.02
Perfluorohexanoic acid	µg/L	0.05	0.06	0.05	0.04	0.06
Perfluoroheptanoic acid	µg/L	<0.01	0.01	<0.01	0.01	0.01
Perfluorooctanoic acid PFOA	µg/L	0.02	0.02	0.02	0.01	0.02
Perfluorononanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorodecanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorotridecanoic acid	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorotetradecanoic acid	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
4:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	0.02	0.02	0.01	<0.01	0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
10:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctane sulfonamide	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
N-Methyl perfluorooctane sulfonamide	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	98	101	99	104	100
Surrogate $^{13}C_2$ *PFOA*	%	93	96	98	95	97
Extracted ISTD $^{13}C_3$ *PFBS*	%	95	98	96	97	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%	107	110	105	109	109
Extracted ISTD $^{13}C_4$ *PFOS*	%	107	103	105	105	105
Extracted ISTD $^{13}C_4$ *PFBA*	%	87	85	83	74	74

PFAS in Waters Extended						
Our Reference	UNITS	254518-1	254518-2	254518-3	254518-4	254518-5
Your Reference		Tank-1	Tank-2	Tank-3	Tank-4	Tank-5
Date Sampled		28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	97	96	96	94	94
Extracted ISTD $^{13}C_2$ *PFHxA*	%	112	111	108	109	110
Extracted ISTD $^{13}C_4$ *PFHpA*	%	111	112	113	110	114
Extracted ISTD $^{13}C_4$ *PFOA*	%	110	108	105	107	106
Extracted ISTD $^{13}C_5$ *PFNA*	%	105	107	101	102	104
Extracted ISTD $^{13}C_2$ *PFDA*	%	126	124	118	121	124
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	121	133	130	123	121
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	89	99	106	116	108
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	97	76	90	112	107
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	145	135	134	141	133
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	153	139	145	146	139
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	181	161	141	162	150
Extracted ISTD $^{13}C_8$ *FOSA*	%	110	110	112	106	108
Extracted ISTD d_3 *N MeFOSA*	%	76	89	92	108	113
Extracted ISTD d_5 *N EtFOSA*	%	95	100	101	115	119
Extracted ISTD d_7 *N MeFOSE*	%	88	95	97	112	121
Extracted ISTD d_9 *N EtFOSE*	%	92	92	94	103	108
Extracted ISTD d_3 *N MeFOSAA*	%	149	135	135	108	107
Extracted ISTD d_5 *N EtFOSAA*	%	108	113	113	95	96
Total Positive PFHxS & PFOS	µg/L	0.49	0.46	0.42	0.32	0.45
Total Positive PFOA & PFOS	µg/L	0.43	0.38	0.36	0.26	0.37
Total Positive PFAS	µg/L	0.61	0.62	0.53	0.39	0.61

PFAS in Waters Extended

Our Reference		254518-6	254518-7	254518-8	254518-9	254518-10
Your Reference	UNITS	Tank-6	Tank-7	QC38	FB13	RB13
Date Sampled		28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/10/2020	30/10/2020	30/10/2020	30/10/2020	30/10/2020
Date analysed	-	30/10/2020	30/10/2020	30/10/2020	30/10/2020	30/10/2020
Perfluorobutanesulfonic acid	µg/L	0.02	0.02	0.02	<0.01	<0.01
Perfluoropentanesulfonic acid	µg/L	0.01	0.01	0.01	<0.01	<0.01
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.08	0.07	0.09	<0.01	<0.01
Perfluoroheptanesulfonic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorooctanesulfonic acid PFOS	µg/L	0.32	0.28	0.35	<0.01	<0.01
Perfluorodecanesulfonic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorobutanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentanoic acid	µg/L	0.02	<0.02	0.02	<0.02	<0.02
Perfluorohexanoic acid	µg/L	0.05	0.05	0.06	<0.01	<0.01
Perfluoroheptanoic acid	µg/L	0.01	<0.01	0.01	<0.01	<0.01
Perfluorooctanoic acid PFOA	µg/L	0.02	0.02	0.02	<0.01	<0.01
Perfluorononanoic acid	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorodecanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorotridecanoic acid	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorotetradecanoic acid	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
4:2 FTS	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
6:2 FTS	µg/L	0.01	0.01	0.01	<0.01	<0.01
8:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
10:2 FTS	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctane sulfonamide	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
N-Methyl perfluorooctane sulfonamide	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctanesulfon amide	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
Surrogate $^{13}C_8$ *PFOS*	%	100	101	99	103	101
Surrogate $^{13}C_2$ *PFOA*	%	96	96	98	98	99
Extracted ISTD $^{13}C_3$ *PFBS*	%	93	102	97	96	103
Extracted ISTD $^{18}O_2$ *PFHxS*	%	107	109	113	109	113
Extracted ISTD $^{13}C_4$ *PFOS*	%	106	107	103	108	110
Extracted ISTD $^{13}C_4$ *PFBA*	%	74	80	74	103	107

PFAS in Waters Extended						
Our Reference	UNITS	254518-6	254518-7	254518-8	254518-9	254518-10
Your Reference		Tank-6	Tank-7	QC38	FB13	RB13
Date Sampled		28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020
Type of sample		Water	Water	Water	Water	Water
Extracted ISTD $^{13}C_3$ *PFPeA*	%	93	97	93	102	107
Extracted ISTD $^{13}C_2$ *PFHxA*	%	108	114	109	114	113
Extracted ISTD $^{13}C_4$ *PFHpA*	%	111	118	113	112	114
Extracted ISTD $^{13}C_4$ *PFOA*	%	106	110	106	107	111
Extracted ISTD $^{13}C_5$ *PFNA*	%	102	105	102	108	115
Extracted ISTD $^{13}C_2$ *PFDA*	%	118	118	119	122	123
Extracted ISTD $^{13}C_2$ *PFUnDA*	%	117	106	123	121	120
Extracted ISTD $^{13}C_2$ *PFDoDA*	%	110	90	104	111	104
Extracted ISTD $^{13}C_2$ *PFTeDA*	%	111	74	70	70	71
Extracted ISTD $^{13}C_2$ *4:2FTS*	%	133	141	137	111	115
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	138	145	147	124	137
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	157	138	155	125	137
Extracted ISTD $^{13}C_8$ *FOSA*	%	104	105	107	105	105
Extracted ISTD d_3 *N MeFOSA*	%	110	97	101	103	93
Extracted ISTD d_5 *N EtFOSA*	%	117	97	100	101	90
Extracted ISTD d_7 *N MeFOSE*	%	117	97	105	96	103
Extracted ISTD d_9 *N EtFOSE*	%	107	87	96	90	93
Extracted ISTD d_3 *N MeFOSAA*	%	105	103	112	123	125
Extracted ISTD d_5 *N EtFOSAA*	%	96	91	95	112	114
Total Positive PFHxS & PFOS	µg/L	0.41	0.36	0.44	<0.01	<0.01
Total Positive PFOA & PFOS	µg/L	0.34	0.30	0.37	<0.01	<0.01
Total Positive PFAS	µg/L	0.55	0.47	0.59	<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 Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			30/10/2020	1	30/10/2020	30/10/2020		30/10/2020	[NT]
Date analysed	-			30/10/2020	1	30/10/2020	30/10/2020		30/10/2020	[NT]
Perfluorobutanesulfonic acid	µg/L	0.01	Org-029	<0.01	1	0.02	0.02	0	98	[NT]
Perfluoropentanesulfonic acid	µg/L	0.01	Org-029	<0.01	1	0.01	0.01	0	94	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.01	Org-029	<0.01	1	0.08	0.08	0	96	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	98	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.01	Org-029	<0.01	1	0.41	0.40	2	91	[NT]
Perfluorodecanesulfonic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	99	[NT]
Perfluorobutanoic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	98	[NT]
Perfluoropentanoic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	102	[NT]
Perfluorohexanoic acid	µg/L	0.01	Org-029	<0.01	1	0.05	0.04	22	95	[NT]
Perfluoroheptanoic acid	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	98	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.01	Org-029	<0.01	1	0.02	0.02	0	98	[NT]
Perfluorononanoic acid	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	95	[NT]
Perfluorodecanoic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	102	[NT]
Perfluoroundecanoic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	102	[NT]
Perfluorododecanoic acid	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	100	[NT]
Perfluorotridecanoic acid	µg/L	0.1	Org-029	<0.1	1	<0.1	<0.1	0	101	[NT]
Perfluorotetradecanoic acid	µg/L	0.5	Org-029	<0.5	1	<0.5	<0.5	0	102	[NT]
4:2 FTS	µg/L	0.01	Org-029	<0.01	1	<0.01	<0.01	0	96	[NT]
6:2 FTS	µg/L	0.01	Org-029	<0.01	1	0.02	0.02	0	109	[NT]
8:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	0.02	0	98	[NT]
10:2 FTS	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	76	[NT]
Perfluorooctane sulfonamide	µg/L	0.1	Org-029	<0.1	1	<0.1	<0.1	0	106	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	107	[NT]
N-Ethyl perfluorooctanesulfon amide	µg/L	0.1	Org-029	<0.1	1	<0.1	<0.1	0	102	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-029	<0.05	1	<0.05	<0.05	0	102	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.5	Org-029	<0.5	1	<0.5	<0.5	0	104	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	99	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.02	Org-029	<0.02	1	<0.02	<0.02	0	102	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	89	1	98	96	2	97	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	1	93	94	1	98	[NT]

QUALITY CONTROL: PFAS in Waters Extended						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD $^{13}C_3$ *PFBS*	%		Org-029	94	1	95	99	4	100	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	100	1	107	114	6	106	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	107	1	107	108	1	106	[NT]
Extracted ISTD $^{13}C_4$ *PFBA*	%		Org-029	100	1	87	87	0	101	[NT]
Extracted ISTD $^{13}C_3$ *PFPeA*	%		Org-029	99	1	97	99	2	100	[NT]
Extracted ISTD $^{13}C_2$ *PFHxA*	%		Org-029	108	1	112	117	4	108	[NT]
Extracted ISTD $^{13}C_4$ *PFHpA*	%		Org-029	105	1	111	113	2	106	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	104	1	110	111	1	103	[NT]
Extracted ISTD $^{13}C_5$ *PFNA*	%		Org-029	103	1	105	109	4	104	[NT]
Extracted ISTD $^{13}C_2$ *PFDA*	%		Org-029	117	1	126	128	2	115	[NT]
Extracted ISTD $^{13}C_2$ *PFUnDA*	%		Org-029	110	1	121	121	0	112	[NT]
Extracted ISTD $^{13}C_2$ *PFDoDA*	%		Org-029	106	1	89	78	13	110	[NT]
Extracted ISTD $^{13}C_2$ *PFTeDA*	%		Org-029	73	1	97	65	40	127	[NT]
Extracted ISTD $^{13}C_2$ *4:2FTS*	%		Org-029	110	1	145	148	2	105	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	1	153	157	3	108	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	127	1	181	173	5	136	[NT]
Extracted ISTD $^{13}C_8$ *FOSA*	%		Org-029	105	1	110	108	2	103	[NT]
Extracted ISTD d_3 *N MeFOSA*	%		Org-029	96	1	76	77	1	108	[NT]
Extracted ISTD d_5 *N EtFOSA*	%		Org-029	90	1	95	96	1	110	[NT]
Extracted ISTD d_7 *N MeFOSE*	%		Org-029	97	1	88	82	7	104	[NT]

QUALITY CONTROL: PFAS in Waters Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d_9 *N EtFOSE*	%		Org-029	89	1	92	87	6	103	[NT]
Extracted ISTD d_3 *N MeFOSAA*	%		Org-029	113	1	149	150	1	116	[NT]
Extracted ISTD d_5 *N EtFOSAA*	%		Org-029	103	1	108	107	1	109	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

ENVIROLAB GROUP
ENVIROLAB SERVICES
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CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Email: GHDLabReports@ghd.com
sean.sparrow@ghd.com
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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required:
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required	Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS full suite (standard LOR)	Provide as much information about the sample as you can
1	Tank1		28/10/2020	water	X	
2	Tank2		28/10/2020	water	X	
3	Tank3		28/10/2020	water	X	
4	Tank4		28/10/2020	water	X	
5	Tank5		28/10/2020	water	X	
6	Tank6		28/10/2020	water	X	
7	Tank7		28/10/2020	water	X	
8	QC38		28/10/2020	water	X	
① —	QC38A		28/10/2020	water	X	Please forward to ALS
9	FB13		28/10/2020	water	X	
10	RB13		28/10/2020	water	X	

Environmental Division
Sydney
Work Order Reference
ES2038209
Telephone : + 61-2-8784 8555

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): ELS SYD	Received by (Company): ELS SYD	***Lab Use Only***	
Print Name: C-Mulenzo	Print Name: C Mulenz	Job number: 254518	Cooling: Ice / [✓ Ice pack] / None
Date & Time: 29/10/20 1000	Date & Time: 29/10/20 810	Temperature: 9.9	Security seal: [✓ Intact] / Broken / None
Signature: CM	Signature: CM	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

9.5°C JUSTIN 29/10/20 7pm

CERTIFICATE OF ANALYSIS

Work Order	: **ES2038209**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 29-Oct-2020 19:00
Order number	: 12516828	Date Analysis Commenced	: 04-Nov-2020
C-O-C number	: ----	Issue Date	: 05-Nov-2020 09:23
Sampler	: SEAN SPARROW		
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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

General Comments

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

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

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

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

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

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

			Client sample ID	**QC38A**	**----**	**----**	**----**	**----**
			Client sampling date / time	28-Oct-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2038209-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	**0.08**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.37**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	**0.02**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	**0.05**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	**0.02**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QC38A**	**----**	**----**	**----**	**----**
			Client sampling date / time	28-Oct-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2038209-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	**0.54**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	**0.45**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	**0.54**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**110**	----	----	----	----
13C8-PFOA	----	0.02	%	**99.5**	----	----	----	----

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	: **ES2038209**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Contact	: Angus Harding
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8111 6600	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 29-Oct-2020
Order number	: 12516828	Date Analysis Commenced	: 04-Nov-2020
C-O-C number	: ----	Issue Date	: 05-Nov-2020
Sampler	: SEAN SPARROW		
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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3343845)									
EB2028147-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ES2038209-001	QC38A	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.37	0.40	8.34	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.08	0.08	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3343845)									
EB2028147-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ES2038209-001	QC38A	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.02	0.02	0.00	No Limit

Sub-Matrix: **WATER**				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 3343845) - continued									
ES2038209-001	QC38A	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.02	0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.05	0.05	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3343845)									
EB2028147-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2038209-001	QC38A	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3343845)									
EB2028147-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 3343845) - continued									
EB2028147-001	Anonymous	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES2038209-001	QC38A	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 3343845)									
EB2028147-001	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
ES2038209-001	QC38A	EP231X: Sum of PFAS	----	0.01	µg/L	0.54	0.57	5.40	0% - 20%

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3343845)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	82.0	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	77.2	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.25 µg/L	78.2	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	76.4	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	94.0	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	87.2	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3343845)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	99.6	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	102	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	79.8	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	111	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	103	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	93.0	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	92.6	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	97.0	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	84.0	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	86.4	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	80.8	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3343845)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	80.0	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	89.0	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	84.0	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	113	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	114	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	84.4	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	87.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3343845)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	82.2	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	98.6	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	79.6	67.0	138

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3343845) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	74.2	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(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3343845)							
ES2038079-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	85.7	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	80.1	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	81.8	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	75.2	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	76.6	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	102	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3343845)							
ES2038079-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	102	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	102	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	87.3	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	112	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	99.9	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	85.2	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	93.8	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	102	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	97.2	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	81.8	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	78.9	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3343845)							
ES2038079-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	85.0	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	95.7	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	85.0	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	92.1	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	90.8	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	79.6	65.0	136

Sub-Matrix**: WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3343845) - continued							
ES2038079-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	84.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3343845)							
ES2038079-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	79.2	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	99.0	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	79.6	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	80.0	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2038209**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: DILARA VALIFF	Telephone	: +61 2 8784 8555
Project	: 12516828	Date Samples Received	: 29-Oct-2020
Site	:	Issue Date	: 05-Nov-2020
Sampler	: SEAN SPARROW	No. of samples received	: 1
Order number	: 12516828	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC38A	**28-Oct-2020**	**04-Nov-2020**	26-Apr-2021	✓	**04-Nov-2020**	26-Apr-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
QC38A	**28-Oct-2020**	**04-Nov-2020**	26-Apr-2021	✓	**04-Nov-2020**	26-Apr-2021	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
QC38A	**28-Oct-2020**	**04-Nov-2020**	26-Apr-2021	✓	**04-Nov-2020**	26-Apr-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
QC38A	**28-Oct-2020**	**04-Nov-2020**	26-Apr-2021	✓	**04-Nov-2020**	26-Apr-2021	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
QC38A	**28-Oct-2020**	**04-Nov-2020**	26-Apr-2021	✓	**04-Nov-2020**	26-Apr-2021	✓

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

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	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 FORM - Client

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Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
Sampler: Sean Sparrow
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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: Standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample information					Tests Required				Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS short suite (LC/MS/MS)	Monolith LEAF procedure	PFAS ASLP	Hold	Provide as much information about the sample as you can
1	12516828/Tank7/01a		18/11/2020	concrete		X			
2	12516828/Tank7/01b		18/11/2020	concrete	X				
-	12516828/Tank7/01c		18/11/2020	concrete				X	Send to Xypex NSW
3	12516828/Tank7/02a		18/11/2020	concrete		X			
4	12516828/Tank7/02b		18/11/2020	concrete	X				
-	12516828/Tank7/02c		18/11/2020	concrete				X	Send to Xypex NSW
5	12516828/Tank7/03a		18/11/2020	concrete		X			
6	12516828/Tank7/03b		18/11/2020	concrete	X				
-	12516828/Tank7/03c		18/11/2020	concrete				X	Send to Xypex NSW
7	HPA1		17/11/2020	concrete	X		X		
8	HPA2		17/11/2020	concrete	X		X		
9	HPA3		17/11/2020	concrete	X		X		
10	HPA4		17/11/2020	concrete	X		X		
11	HPA5		17/11/2020	concrete	X		X		
12	12516828/QAa		18/11/2020	concrete		X			
13	12516828/QAb		18/11/2020	concrete	X				
14	W1		18/11/2020	water	X				
15	W2		17/11/2020	water	X				
16	FD01		18/11/2020	water	X				
17	FS01		18/11/2020	water				X	
18	FB01		17/11/2020	water	X				
19	RB01		17/11/2020	water	X				
20	RB02		18/11/2020	water	X				

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Received by (Company): ELS SYD	*Lab Use Only*
Print Name:	Print Name: L. Muller	Job number: 256255
Date & Time:	Date & Time: 20/11/20 800	Temperature:
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / [✓ STD]

Cooling: Ice / [✓ Ice pack] / None
Security seal: [✓ Intact] / Broken / None

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CERTIFICATE OF ANALYSIS 256235

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	Concrete Cores and Waters
Date samples received	20/11/2020
Date completed instructions received	20/11/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/12/2020
Date of Issue	12/01/2021
Reissue Details	This report replaces R00 created on 02/12/2020 due to: revised report with additional results.

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Results Approved By
Simon Mills, Group R&D Manager

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Concrete Short*						
Our Reference	UNITS	256235-2	256235-4	256235-6	256235-7	256235-8
Your Reference		12516828/Tank7/01b	12516828/Tank7/02b	12516828/Tank7/03b	HPA1	HPA2
Date Sampled		18/11/2020	18/11/2020	18/11/2020	17/11/2020	17/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	25/11/2020	25/11/2020	25/11/2020	25/11/2020	25/11/2020
Date analysed	-	25/11/2020	25/11/2020	25/11/2020	01/12/2020	01/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	1.9	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1	2.0	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	0.2	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	100	102	103	99	106
Surrogate $^{13}C_2$ *PFOA*	%	99	102	97	102	99
Extracted ISTD $^{18}O_2$ *PFHxS*	%	104	99	92	70	78
Extracted ISTD $^{13}C_4$ *PFOS*	%	95	89	84	59	57
Extracted ISTD $^{13}C_4$ *PFOA*	%	88	87	85	55	61
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	89	80	78	40	43
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	97	103	103	51	52
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1	3.9	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1	2.2	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1	4.2	<0.1

PFAS in Concrete Short*

Our Reference		256235-9	256235-10	256235-11	256235-13
Your Reference	UNITS	HPA3	HPA4	HPA5	12516828/QAb
Date Sampled		17/11/2020	17/11/2020	17/11/2020	18/11/2020
Type of sample		Solid	Solid	Solid	Solid
Date prepared	-	25/11/2020	25/11/2020	25/11/2020	25/11/2020
Date analysed	-	01/12/2020	01/12/2020	01/12/2020	25/11/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	0.4	<0.1	0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.2	<0.2	0.9	<0.1
8:2 FTS	µg/kg	<0.2	<0.2	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	103	94	112	98
Surrogate $^{13}C_2$ *PFOA*	%	102	97	103	100
Extracted ISTD $^{18}O_2$ *PFHxS*	%	63	73	70	96
Extracted ISTD $^{13}C_4$ *PFOS*	%	49	54	51	74
Extracted ISTD $^{13}C_4$ *PFOA*	%	45	50	51	83
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	28	31	30	85
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	43	40	39	109
Total Positive PFHxS & PFOS	µg/kg	0.4	<0.1	0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	0.4	<0.1	0.1	<0.1
Total Positive PFAS	µg/kg	0.4	<0.1	1	<0.1

PFAS in Concrete LEAF/ASLP

Our Reference		256235-1	256235-3	256235-5	256235-7	256235-8
Your Reference	UNITS	12516828/Tank7/01a	12516828/Tank7/02a	12516828/Tank7/03a	HPA1	HPA2
Date Sampled		18/11/2020	18/11/2020	18/11/2020	17/11/2020	17/11/2020
Type of sample		Water	Water	Water	Solid	Solid
Date prepared	-	27/11/2020	27/11/2020	27/11/2020	30/11/2020	30/11/2020
Date analysed	-	27/11/2020	27/11/2020	27/11/2020	01/12/2020	01/12/2020
pH of final Leachate	pH units	[NA]	[NA]	[NA]	11.8	12.1
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.001	<0.001	<0.001	0.087	0.002
Perfluorooctanesulfonic acid PFOS	µg/L	<0.001	<0.001	<0.001	0.071	0.003
Perfluorooctanoic acid PFOA	µg/L	<0.001	<0.001	<0.001	0.0099	<0.001
6:2 FTS	µg/L	<0.001	<0.001	<0.001	0.011	0.005
8:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ PFOS	%	106	104	105	100	102
Surrogate $^{13}C_2$ PFOA	%	95	96	96	94	98
Total Positive PFHxS & PFOS	µg/L	<0.001	<0.001	<0.001	0.16	0.004
Total Positive PFOA & PFOS	µg/L	<0.001	<0.001	<0.001	0.081	0.003
Total Positive PFAS	µg/L	<0.001	<0.001	<0.001	0.18	0.01

PFAS in Concrete LEAF/ASLP

Our Reference		256235-9	256235-10	256235-11	256235-12
Your Reference	UNITS	HPA3	HPA4	HPA5	12516828/QAa
Date Sampled		17/11/2020	17/11/2020	17/11/2020	18/11/2020
Type of sample		Solid	Solid	Solid	Water
Date prepared	-	30/11/2020	30/11/2020	30/11/2020	27/11/2020
Date analysed	-	01/12/2020	01/12/2020	01/12/2020	27/11/2020
pH of final Leachate	pH units	12.1	12.0	12.1	[NA]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.003	0.002	0.005	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.011	0.002	0.005	<0.001
Perfluorooctanoic acid PFOA	µg/L	<0.001	<0.001	0.004	<0.001
6:2 FTS	µg/L	0.005	0.006	0.063	<0.001
8:2 FTS	µg/L	<0.002	<0.002	0.005	<0.002
Surrogate $^{13}C_8$ PFOS	%	100	103	101	104
Surrogate $^{13}C_2$ PFOA	%	95	96	91	94
Total Positive PFHxS & PFOS	µg/L	0.015	0.004	0.010	<0.001
Total Positive PFOA & PFOS	µg/L	0.011	0.002	0.008	<0.001
Total Positive PFAS	µg/L	0.019	0.01	0.082	<0.001

SW846-1315 LEAF Monolith					
Our Reference		256235-1	256235-3	256235-5	256235-12
Your Reference	UNITS	12516828/Tank7/01a	12516828/Tank7/02a	12516828/Tank7/03a	12516828/QAa
Date Sampled		18/11/2020	18/11/2020	18/11/2020	18/11/2020
Type of sample		Water	Water	Water	Water
Date prepared	-	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Material Description	--	concrete core	concrete core	concrete core	concrete core
Mass Before Static Elution Step	g	2,039	2,669	1,919	474.5
Mass of Sample Static Elution Step	g	2,040	2,668	1,921	476.4
Geometry and Dimensions 3D or 1D	mm D x mm H	85mm R x 95mm H	80mm R x 125mm H	75mm R x 90mm H	75mm R x 105mm H
Elutriate Liquid Type	--	UHP water	UHP water	UHP water	UHP water
Elutriate Volume Used	mL	5,950	6,500	4,900	2,450
Date analysed	-	25/11/2020	25/11/2020	25/11/2020	25/11/2020
Elutriate Final EC	µS/cm	250	280	290	280
Elutriate Final pH	pH units	11.0	11.0	11.0	11.0

PFAS in Water LOW LEVEL Short

Our Reference		256235-14	256235-15	256235-16	256235-18	256235-19
Your Reference	UNITS	W1	W2	FD01	FB01	RB01
Date Sampled		18/11/2020	17/11/2020	18/11/2020	17/11/2020	17/11/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Date analysed	-	24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluorooctanoic acid PFOA	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
8:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	106	109	108	102	99
Surrogate $^{13}C_2$ *PFOA*	%	99	98	103	100	97
Extracted ISTD $^{18}O_2$ *PFHxS*	%	96	94	96	89	96
Extracted ISTD $^{13}C_4$ *PFOS*	%	63	73	64	68	85
Extracted ISTD $^{13}C_4$ *PFOA*	%	105	106	98	99	108
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	152	125	152	111	127
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	156	107	165	98	157
Total Positive PFHxS & PFOS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Total Positive PFOA & PFOS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Total Positive PFAS	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001

PFAS in Water LOW LEVEL Short		
Our Reference		256235-20
Your Reference	UNITS	RB02
Date Sampled		18/11/2020
Type of sample		Water
Date prepared	-	24/11/2020
Date analysed	-	24/11/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.001
Perfluorooctanoic acid PFOA	µg/L	<0.001
6:2 FTS	µg/L	<0.001
8:2 FTS	µg/L	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	100
Surrogate $^{13}C_2$ *PFOA*	%	92
Extracted ISTD $^{18}O_2$ *PFHxS*	%	91
Extracted ISTD $^{13}C_4$ *PFOS*	%	81
Extracted ISTD $^{13}C_4$ *PFOA*	%	102
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	123
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	128
Total Positive PFHxS & PFOS	µg/L	<0.001
Total Positive PFOA & PFOS	µg/L	<0.001
Total Positive PFAS	µg/L	<0.001

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
INORG-125	Leaching Environment Assessment Framework (LEAF) methods of leaching using USEPA methods SW846 1313, 1314, 1315 or 1316. All eluates are filtered through 0.45um prior to analysis unless otherwise noted. Please note the 1315 is not currently designed for Organic Analyses, however, we understand that the method is being used for SVOCs in the US at present.
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.

Method ID	Methodology Summary
Org-029A	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 Concrete Short*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	256235-4
Date prepared	-			25/11/2020	2	25/11/2020	25/11/2020		25/11/2020	25/11/2020
Date analysed	-			01/12/2020	2	25/11/2020	25/11/2020		25/11/2020	25/11/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	95	90
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	102	102
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	109	93
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	<0.1	<0.1	0	104	96
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	<0.2	<0.2	0	102	84
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	101	2	100	95	5	104	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	97	2	99	95	4	104	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	103	2	104	98	6	101	105
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	91	2	95	96	1	91	87
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	108	2	88	87	1	102	104
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	102	2	89	88	1	109	102
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	131	2	97	108	11	113	121

QUALITY CONTROL: PFAS in Concrete LEAF/ASLP						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	256235-8
Date prepared	-			30/11/2020	7	30/11/2020	30/11/2020		30/11/2020	30/11/2020
Date analysed	-			01/12/2020	7	01/12/2020	01/12/2020		01/12/2020	01/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	Org-029	<0.001	7	0.087	0.093	7	110	102
Perfluorooctanesulfonic acid PFOS	µg/L	0.001	Org-029	<0.001	7	0.071	0.072	1	110	101
Perfluorooctanoic acid PFOA	µg/L	0.001	Org-029	<0.001	7	0.0099	0.011	11	103	102
6:2 FTS	µg/L	0.001	Org-029	<0.001	7	0.011	0.011	0	119	107
8:2 FTS	µg/L	0.002	Org-029	<0.002	7	<0.002	<0.002	0	102	108
Surrogate $^{13}C_8$ PFOS	%		Org-029A	101	7	100	102	2	102	100
Surrogate $^{13}C_2$ PFOA	%		Org-029A	97	7	94	98	4	98	98

Client Reference: 12516828

QUALITY CONTROL: SW846-1315 LEAF Monolith					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			24/11/2020	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Date analysed	-			25/11/2020	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: PFAS in Water LOW LEVEL Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	256235-15
Date prepared	-			24/11/2020	14	24/11/2020	24/11/2020		24/11/2020	24/11/2020
Date analysed	-			24/11/2020	14	24/11/2020	24/11/2020		24/11/2020	24/11/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	Org-029	<0.001	14	<0.001	<0.001	0	79	63
Perfluorooctanesulfonic acid PFOS	µg/L	0.001	Org-029	<0.001	14	<0.001	<0.001	0	86	73
Perfluorooctanoic acid PFOA	µg/L	0.001	Org-029	<0.001	14	<0.001	<0.001	0	85	72
6:2 FTS	µg/L	0.001	Org-029	<0.001	14	<0.001	<0.001	0	86	66
8:2 FTS	µg/L	0.002	Org-029	<0.002	14	<0.002	<0.002	0	84	69
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	104	14	106	102	4	100	107
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	98	14	99	101	2	98	98
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	90	14	96	95	1	86	90
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	68	14	63	67	6	68	66
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	97	14	105	98	7	92	97
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	109	14	152	149	2	106	122
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	96	14	156	169	8	94	97

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.

Report Comments

Core descriptions:-

(R=approximate radius, H=approximate height)

256235-1: 1 x 1/2 Core (85mm R x 95mm H), approximate surface area = 642cm2

256235-3: 1 x 1/2 Core (80mm R x 125mm H), approximate surface area = 715cm2

256235-5: 1 x 1/2 Core (75mm R x 90mm H), approximate surface area = 524cm2

256235-12: 1 x 1/8 Core (75mm R x 105mm H), approximate surface area = 475cm2

All measurements are approximates as the cores where not perfect 1/2 or 1/8 cores.

The LEAF process was a modified process i.e. one single 24 hr static elution.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS in Concrete Short: PQLs raised for 6:2FTS for samples 9 and 10 due to matrix interferences.

CHAIN OF CUSTODY FORM - Client

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Client: GHD Pty Ltd
Contact Person: Sean Sparrow
Project Mgr: Dilara Valiff
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Client Project Name/Number/Site etc (ie report title): 12516828
PO No.: 12516828
Envirolab Quote No. :
Date results required: Standard
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Additional report format: esdat / equis /
Lab Comments:

Sample Information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	PFAS short suite (LC/MS/MS)	Monolith LEAF procedure	PFAS ASLP	Hold												Provide as much information about the sample as you can
1	12516828/Tank4/01a		24/11/2020	concrete		X														
2	12516828/Tank4/01b		24/11/2020	concrete	X															
NR	12516828/Tank4/01c		24/11/2020	concrete				X												Send to Xypex NSW
3	12516828/Tank4/02a		24/11/2020	concrete		X														
4	12516828/Tank4/02b		24/11/2020	concrete	X															
NR	12516828/Tank4/02c		24/11/2020	concrete				X												Send to Xypex NSW
5	12516828/Tank4/03a		24/11/2020	concrete		X														
6	12516828/Tank4/03b		24/11/2020	concrete	X															
NR	12516828/Tank4/03c		24/11/2020	concrete				X												Send to Xypex NSW
7	12516828/Tank1/01a		24/11/2020	concrete		X														
㉓ ~~NR~~	12516828/Tank1/01b		24/11/2020	concrete	X															
NR	12516828/Tank1/01c		24/11/2020	concrete				X												Send to Xypex NSW
8	12516828/Tank1/02a		24/11/2020	concrete		X														
9	12516828/Tank1/02b		24/11/2020	concrete	X															
NR	12516828/Tank1/02c		24/11/2020	concrete				X												Send to Xypex NSW
10	12516828/Tank1/03a		24/11/2020	concrete		X														
11	12516828/Tank1/03b		24/11/2020	concrete	X															
NR.	12516828/Tank1/03c		24/11/2020	concrete				X												Send to Xypex NSW
12	HPB1		24/11/2020	paver	X		X													
13	HPB2		24/11/2020	paver	X		X													
14	HPB3		24/11/2020	paver	X		X													
15	HPB4		24/11/2020	paver	X		X													
16	HPB5		24/11/2020	paver	X		X													
17	HPB/QA		24/11/2020	paver	X		X													
18	W3		24/11/2020	water	X															
19	FD02		24/11/2020	water	X															
20	FS02		24/11/2020	water				X												
21	FB02 (03)		24/11/2020	water	X															
22.	RB03		24/11/2020	water	X															

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):
Print Name:
Date & Time:
Signature:

Received by (Company): ELS Syd
Print Name: R. Chazeen
Date & Time: 26/11/2020 8.30
Signature:

Lab Use Only
Job number: 256757
Cooling: Ice / [✓ Ice pack] / None
Temperature: 23.6/9.7
Security seal: [✓ Intact] / Broken / None
TAT Req - SAME day / 1 / 2 / 3 / 4 / STD

Concrete temp 23.6°
Water sample temp 9.7°

Issue date: 7 October 2019

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CERTIFICATE OF ANALYSIS 256750

Client Details

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

Sample Details

Your Reference	**12516828**
Number of Samples	Concrete Cores, pavers and Waters
Date samples received	26/11/2020
Date completed instructions received	02/12/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	18/12/2020
Date of Issue	12/01/2021
Reissue Details	This report replaces R00 created on 18/12/2020 due to: revised report with additional results.

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Results Approved By
Simon Mills, Group R&D Manager

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Concrete Short*						
Our Reference		256750-2	256750-4	256750-6	256750-9	256750-11
Your Reference	UNITS	12516828/Tank4/ 01b	12516828/Tank4/ 02b	12516828/Tank4/ 03b	12516828/Tank1/ 02b	12516828/Tank1/ 03b
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020
Date analysed	-	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	3.4	2.5	<0.1	2.0	0.7
Perfluorooctanesulfonic acid PFOS	µg/kg	28	38	0.2	9.3	0.5
Perfluorooctanoic acid PFOA	µg/kg	0.8	0.7	<0.1	0.4	<0.1
6:2 FTS	µg/kg	1.3	1.1	<0.1	2.2	<0.1
8:2 FTS	µg/kg	1	2.5	<0.2	2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	92	98	98	98	96
Surrogate $^{13}C_2$ *PFOA*	%	107	101	101	103	105
Extracted ISTD $^{18}O_2$ *PFHxS*	%	62	63	71	64	73
Extracted ISTD $^{13}C_4$ *PFOS*	%	62	57	66	57	70
Extracted ISTD $^{13}C_4$ *PFOA*	%	51	54	58	54	59
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	47	48	50	49	57
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	43	46	48	48	54
Total Positive PFHxS & PFOS	µg/kg	32	41	0.2	11	1.2
Total Positive PFOS & PFOA	µg/kg	29	39	0.2	9.7	0.5
Total Positive PFAS	µg/kg	35	45	0.2	15	1.2

PFAS in Concrete Short*

Our Reference		256750-12	256750-13	256750-14	256750-15	256750-16
Your Reference	UNITS	HPB1	HPB2	HPB3	HPB4	HPB5
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Date analysed	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	44	71	55	23	0.2
Perfluorooctanesulfonic acid PFOS	µg/kg	140	190	150	65	3.7
Perfluorooctanoic acid PFOA	µg/kg	4.8	12	7.6	2.7	0.1
6:2 FTS	µg/kg	1.6	1.1	2.1	7.3	3.8
8:2 FTS	µg/kg	2.0	2.0	1	2.0	1
Surrogate $^{13}C_8$ *PFOS*	%	105	109	102	105	104
Surrogate $^{13}C_2$ *PFOA*	%	105	108	107	103	101
Extracted ISTD $^{18}O_2$ *PFHxS*	%	77	109	108	71	105
Extracted ISTD $^{13}C_4$ *PFOS*	%	94	91	96	92	99
Extracted ISTD $^{13}C_4$ *PFOA*	%	70	64	62	60	103
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	69	61	62	53	123
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	97	85	88	64	120
Total Positive PFHxS & PFOS	µg/kg	180	260	200	88	4.0
Total Positive PFOS & PFOA	µg/kg	140	200	160	68	3.9
Total Positive PFAS	µg/kg	190	280	220	100	9.4

PFAS in Concrete Short*			
Our Reference		256750-17	256750-23
Your Reference	UNITS	HPB/QA	12516828/Tank1/01b
Date Sampled		24/11/2020	24/11/2020
Type of sample		Solid	Solid
Date prepared	-	11/12/2020	10/12/2020
Date analysed	-	11/12/2020	10/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	7.8	1.9
Perfluorooctanesulfonic acid PFOS	µg/kg	16	18
Perfluorooctanoic acid PFOA	µg/kg	1.0	0.3
6:2 FTS	µg/kg	1	2.2
8:2 FTS	µg/kg	0.5	0.8
Surrogate $^{13}C_8$ *PFOS*	%	102	100
Surrogate $^{13}C_2$ *PFOA*	%	105	104
Extracted ISTD $^{18}O_2$ *PFHxS*	%	87	58
Extracted ISTD $^{13}C_4$ *PFOS*	%	77	51
Extracted ISTD $^{13}C_4$ *PFOA*	%	77	47
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	82	42
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	92	45
Total Positive PFHxS & PFOS	µg/kg	24	20
Total Positive PFOS & PFOA	µg/kg	18	18
Total Positive PFAS	µg/kg	27	23

PFAS in Concrete LEAF/ASLP

Our Reference		256750-1	256750-3	256750-5	256750-7	256750-8
Your Reference	UNITS	12516828/Tank4/01a	12516828/Tank4/02a	12516828/Tank4/03a	12516828/Tank1/01a	12516828/Tank1/02a
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Date analysed	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.75	0.064	0.024	0.032	0.024
Perfluorooctanesulfonic acid PFOS	µg/L	0.56	0.66	0.13	0.16	0.069
Perfluorooctanoic acid PFOA	µg/L	0.065	0.015	0.006	0.007	0.005
6:2 FTS	µg/L	0.057	0.026	0.005	0.018	0.007
8:2 FTS	µg/L	0.083	0.027	0.01	0.01	0.01
Surrogate $^{13}C_8$ PFOS	%	92	98	102	98	100
Surrogate $^{13}C_2$ PFOA	%	92	92	93	94	101
Total Positive PFHxS & PFOS	µg/L	1.3	0.72	0.15	0.19	0.093
Total Positive PFOA & PFOS	µg/L	0.63	0.68	0.13	0.16	0.074
Total Positive PFAS	µg/L	1.5	0.79	0.17	0.23	0.12

PFAS in Concrete LEAF/ASLP

Our Reference		256750-10	256750-12	256750-13	256750-14	256750-15
Your Reference	UNITS	12516828/Tank1/03a	HPB1	HPB2	HPB3	HPB4
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Date analysed	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020
pH of final Leachate	pH units	[NA]	11.5	11.7	11.4	11.7
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.042	2.1	3.7	2.6	0.90
Perfluorooctanesulfonic acid PFOS	µg/L	0.16	5.0	3.8	4.5	1.6
Perfluorooctanoic acid PFOA	µg/L	0.009	0.18	0.32	0.23	0.090
6:2 FTS	µg/L	0.025	0.058	0.032	0.056	0.21
8:2 FTS	µg/L	0.034	0.039	0.02	0.023	0.02
Surrogate $^{13}C_8$ PFOS	%	98	109	100	115	103
Surrogate $^{13}C_2$ PFOA	%	95	101	100	106	102
Total Positive PFHxS & PFOS	µg/L	0.21	7.0	7.5	7.1	2.5
Total Positive PFOA & PFOS	µg/L	0.17	5.1	4.1	4.7	1.7
Total Positive PFAS	µg/L	0.27	7.3	7.9	7.4	2.8

PFAS in Concrete LEAF/ASLP			
Our Reference		256750-16	256750-17
Your Reference	UNITS	HPB5	HPB/QA
Date Sampled		24/11/2020	24/11/2020
Type of sample		Solid	Solid
Date prepared	-	11/12/2020	11/12/2020
Date analysed	-	11/12/2020	11/12/2020
pH of final Leachate	pH units	9.6	11.5
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.011	0.22
Perfluorooctanesulfonic acid PFOS	µg/L	0.064	0.24
Perfluorooctanoic acid PFOA	µg/L	0.006	0.024
6:2 FTS	µg/L	0.11	0.020
8:2 FTS	µg/L	0.02	0.005
Surrogate $^{13}C_8$ PFOS	%	96	109
Surrogate $^{13}C_2$ PFOA	%	102	104
Total Positive PFHxS & PFOS	µg/L	0.075	0.46
Total Positive PFOA & PFOS	µg/L	0.069	0.26
Total Positive PFAS	µg/L	0.20	0.51

SW846-1315 LEAF Monolith						
Our Reference		256750-1	256750-3	256750-5	256750-7	256750-8
Your Reference	UNITS	12516828/Tank4/01a	12516828/Tank4/02a	12516828/Tank4/03a	12516828/Tank1/01a	12516828/Tank1/02a
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Solid	Solid	Solid	Solid	Solid
Date prepared	-	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020
Material Description	--	half cores	half cores	half cores	half cores	half cores
Mass Before Static Elution Step	g	1,849	1,242	1,972	1,084	1,318
Mass of Sample Static Elution Step	g	1,905	1,246	1,982	1,088	1,325
Geometry and Dimensions 3D or 1D	mm D x mm H	70mm (R) x 93mm (H)	70mm (R) x 60mm (H)	75mm (R) x 100mm (H)	70mm (R) x 60mm (H)	75mm (R) x 60mm (H)
Elutriate Liquid Type	--	UHP water	UHP water	UHP water	UHP water	UHP water
Elutriate Volume Used	mL	4,400	3,330	4,950	3,330	3,670
Date analysed	-	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020
Elutriate Final EC	µS/cm	270	360	450	430	390
Elutriate Final pH	pH units	10.9	11.2	11.3	11.3	11.3

SW846-1315 LEAF Monolith		
Our Reference		256750-10
Your Reference	UNITS	12516828/Tank1/03a
Date Sampled		24/11/2020
Type of sample		Solid
Date prepared	-	09/12/2020
Material Description	--	half cores
Mass Before Static Elution Step	g	1,260
Mass of Sample Static Elution Step	g	1,265
Geometry and Dimensions 3D or 1D	mm D x mm H	70mm (R) x 70mm (H)
Elutriate Liquid Type	--	UHP water
Elutriate Volume Used	mL	3,650
Date analysed	-	10/12/2020
Elutriate Final EC	µS/cm	380
Elutriate Final pH	pH units	11.3

PFAS in Water LOW LEVEL Short					
Our Reference		256750-18	256750-19	256750-21	256750-22
Your Reference	UNITS	W3	FD02	FB02	RB03
Date Sampled		24/11/2020	24/11/2020	24/11/2020	24/11/2020
Type of sample		Water	Water	Water	Water
Date prepared	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Date analysed	-	11/12/2020	11/12/2020	11/12/2020	11/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	<0.001	<0.001	<0.001	<0.001
Perfluorooctanoic acid PFOA	µg/L	<0.001	<0.001	<0.001	<0.001
6:2 FTS	µg/L	<0.001	<0.001	<0.001	<0.001
8:2 FTS	µg/L	<0.002	<0.002	<0.002	<0.002
Surrogate $^{13}C_8$ *PFOS*	%	100	100	100	102
Surrogate $^{13}C_2$ *PFOA*	%	85	82	92	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%	93	87	95	103
Extracted ISTD $^{13}C_4$ *PFOS*	%	83	80	82	94
Extracted ISTD $^{13}C_4$ *PFOA*	%	109	107	103	108
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	136	129	113	122
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	131	119	122	140
Total Positive PFHxS & PFOS	µg/L	<0.001	<0.001	<0.001	<0.001
Total Positive PFOA & PFOS	µg/L	<0.001	<0.001	<0.001	<0.001
Total Positive PFAS	µg/L	<0.001	<0.001	<0.001	<0.001

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
INORG-125	Leaching Environment Assessment Framework (LEAF) methods of leaching using USEPA methods SW846 1313, 1314, 1315 or 1316. All eluates are filtered through 0.45um prior to analysis unless otherwise noted. Please note the 1315 is not currently designed for Organic Analyses, however, we understand that the method is being used for SVOCs in the US at present.
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.

Method ID	Methodology Summary
Org-029A	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 Concrete Short*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	256750-4
Date prepared	-			11/12/2020	2	10/12/2020	10/12/2020		10/12/2020	10/12/2020
Date analysed	-			11/12/2020	2	10/12/2020	10/12/2020		10/12/2020	10/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	2	3.4	2.8	19	100	108
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	2	28	26	7	109	##
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	2	0.8	0.7	13	99	107
6:2 FTS	µg/kg	0.1	Org-029	<0.1	2	1.3	1.2	8	115	126
8:2 FTS	µg/kg	0.2	Org-029	<0.2	2	1	1	0	93	91
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	95	2	92	102	10	107	105
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	2	107	102	5	96	104
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	103	2	62	59	5	101	59
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	103	2	62	52	18	94	48
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	103	2	51	52	2	104	49
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	117	2	47	47	0	112	43
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	2	43	42	2	113	42

QUALITY CONTROL: PFAS in Concrete Short*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	17	11/12/2020	11/12/2020		[NT]	[NT]
Date analysed	-			[NT]	17	11/12/2020	11/12/2020		[NT]	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	[NT]	17	7.8	7.4	5	[NT]	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	[NT]	17	16	18	12	[NT]	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	[NT]	17	1.0	0.9	11	[NT]	[NT]
6:2 FTS	µg/kg	0.1	Org-029	[NT]	17	1	1.0	0	[NT]	[NT]
8:2 FTS	µg/kg	0.2	Org-029	[NT]	17	0.5	0.5	0	[NT]	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	[NT]	17	102	106	4	[NT]	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	[NT]	17	105	102	3	[NT]	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	[NT]	17	87	89	2	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	[NT]	17	77	76	1	[NT]	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	[NT]	17	77	79	3	[NT]	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Concrete 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]	17	82	87	6	[NT]	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	[NT]	17	92	100	8	[NT]	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Concrete LEAF/ASLP					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	256750-13
Date prepared	-			11/12/2020	12	11/12/2020	11/12/2020		11/12/2020	11/12/2020
Date analysed	-			11/12/2020	12	11/12/2020	11/12/2020		11/12/2020	11/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	Org-029	<0.001	12	2.1	1.9	10	105	44
Perfluorooctanesulfonic acid PFOS	µg/L	0.001	Org-029	<0.001	12	5.0	4.7	6	108	139
Perfluorooctanoic acid PFOA	µg/L	0.001	Org-029	<0.001	12	0.18	0.18	0	105	107
6:2 FTS	µg/L	0.001	Org-029	<0.001	12	0.058	0.051	13	109	100
8:2 FTS	µg/L	0.002	Org-029	<0.002	12	0.039	0.035	11	99	95
Surrogate $^{13}C_8$ PFOS	%		Org-029A	106	12	109	105	4	107	108
Surrogate $^{13}C_2$ PFOA	%		Org-029A	100	12	101	101	0	101	105

QUALITY CONTROL: SW846-1315 LEAF Monolith					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			09/12/2020	[NT]	[NT]	[NT]	[NT]	09/12/2020	[NT]
Date analysed	-			10/12/2020	[NT]	[NT]	[NT]	[NT]	10/12/2020	[NT]

Client Reference: 12516828

QUALITY CONTROL: PFAS in Water LOW LEVEL Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	256750-19
Date prepared	-			11/12/2020	18	11/12/2020	11/12/2020		11/12/2020	11/12/2020
Date analysed	-			11/12/2020	18	11/12/2020	11/12/2020		11/12/2020	11/12/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.001	Org-029	<0.001	18	<0.001	<0.001	0	98	90
Perfluorooctanesulfonic acid PFOS	µg/L	0.001	Org-029	<0.001	18	<0.001	<0.001	0	95	83
Perfluorooctanoic acid PFOA	µg/L	0.001	Org-029	<0.001	18	<0.001	<0.001	0	94	79
6:2 FTS	µg/L	0.001	Org-029	<0.001	18	<0.001	<0.001	0	93	77
8:2 FTS	µg/L	0.002	Org-029	<0.002	18	<0.002	<0.002	0	96	82
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	99	18	100	101	1	97	103
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	102	18	85	84	1	97	83
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	96	18	93	90	3	94	86
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	75	18	83	78	6	79	87
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	98	18	109	108	1	101	111
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	110	18	136	133	2	99	128
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	136	18	131	125	5	137	132

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.

Report Comments

PFAS in Soil Short - Please note that the analysis of PFAS in concrete and paver is not covered by NATA accreditation.

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS_S_SHORT ## Percent recovery is not possible to report due to the high concentration of the analyte in the sample. However an acceptable recovery was obtained for the LCS.

Core descriptions:-

(R=approximate radius, H=approximate height)

256750-1: 1 x 1/2 Core (70mm R x 93mm H), approximate surface area = 488cm2

256750-3: 1 x 1/2 Core (70mm R x 60mm H), approximate surface area = 370cm2

256750-5: 1 x 1/2 Core (75mm R x 100mm H), approximate surface area = 562cm2

256750-7: 1 x 1/2 Core (70mm R x 60mm H), approximate surface area = 370cm2

256750-8: 1 x 1/2 Core (75mm R x 60mm H), approximate surface area = 408cm2

256750-10: 1 x 1/2 Core (70mm R x 70mm H), approximate surface area = 406cm2

All measurements are approximates as the cores where not perfect 1/2 cores.

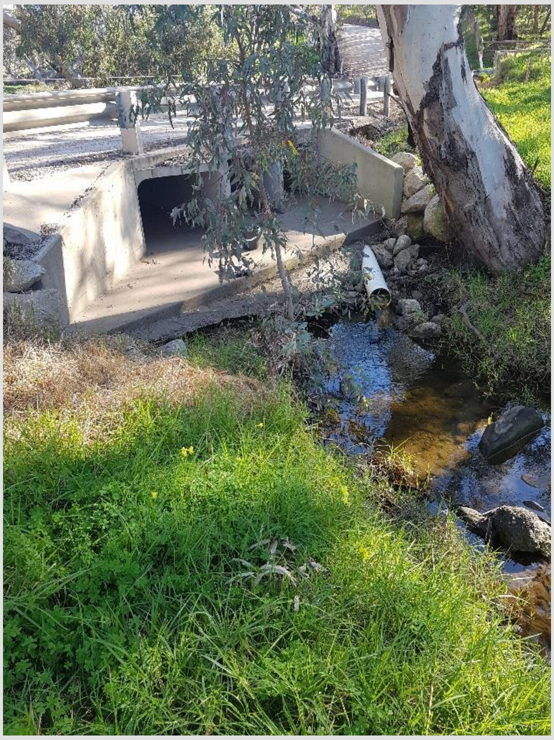
The LEAF process was a modified process i.e. one single 24 hr static elution.

Appendix L – Photo Log

Photograph	Details
 	**Date:** May 2020 **Description:** Image 1: Hotpad B covered with concrete pavers. Concrete paved Hotpad A in background. Image 2: close up of Hotpad B
	**Date:** May 2020 **Description:** Concrete core and borehole SB05 on Hotpad A
	**Date:** May 2020 **Description:** Soil from bore SB07, located between Dawesley Creek and the CFS State Training Centre

Photograph	Details
	**Date:** July 2020 **Description:** DC-UP02 surface water sampling location, located at Moore Road, Harrogate
	**Date:** May 2020 **Description:** Surface water sampling from Creek_5, located on Dawesley Creek to the west of CFS State Training Centre

Photograph	Details
	**Date:** August 2020 **Description:** Creek surface water and sediment sampling at DC02A located at 294 Pyrites Rd, Brukunga, south of the CFS site
	**Date:** May 2020 **Description:** Creek surface water and sediment sampling at DC06A located at 16 Hawthorn St, Dawesley
	**Date:** July 2020 **Description:** Dawesley Creek surface water and sediment sampling at DC10 located at 483 Ironstone Range Rd, Petwood

Photograph	Details
	**Date:** July 2020 **Description:** NC02 Nairne Creek surface water sampling location, located at Ironstone Range Road, Petwood
	**Date:** July 2020 **Description:** MBC02 Mt Barker Creek surface water sampling location, situated off of Blue Wren Lane, Wistow

Photograph	Details
	**Date:** July 2020 **Description:** DC16 Dawesley Creek surface water sampling, located in road easement off of Éclair Mine Road south of the South Eastern Freeway
	**Date:** August 2020 **Description:** DC17A Dawesley Creek surface water sampling location, on 430D Callington Road south of the South Eastern Freeway

Photograph	Details
	**Date:** July 2020 **Description:** Bremer River surface water sampling locations BR01 (left) and BR02 (right)
	**Date:** September 2020 **Description:** Bremer River surface water sampling location BR02_1C

Photograph	Details
	**Date:** September 2020 **Description:** Bremer River surface water sampling location BR02_2A
	**Date:** September 2020 **Description:** Bremer River surface water sampling location BR03_1A
	**Date:** September 2020 **Description:** Bremer River surface water sampling location BR03_2C

Photograph	Details
	**Date:** September 2020 **Description:** Mt Barker Creek surface water sampling location MBC01_1B
	**Date:** September 2020 **Description:** Mt Barker Creek surface water sampling location MBC01_2A
	**Date:** September 2020 **Description:** Mt Barker Creek surface water sampling location MBC02_1B

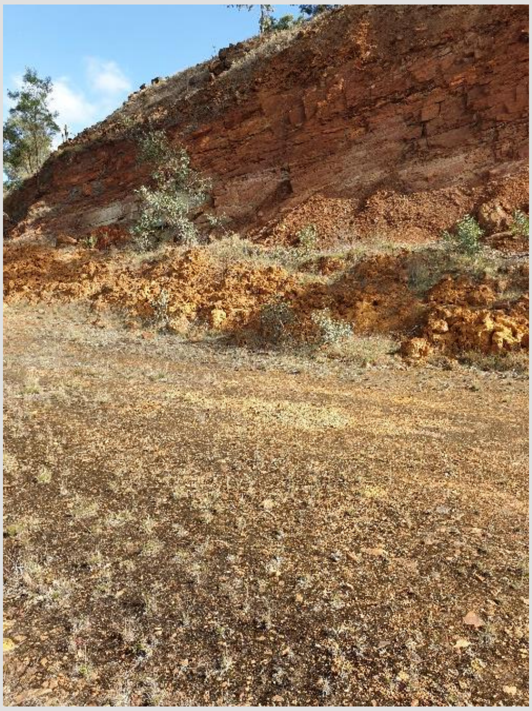
Photograph	Details
	**Date:** September 2020 **Description:** Mt Barker Creek surface water sampling location MBC02_2A
	**Date:** July 2020 **Description:** Bremer River surface water sampling location DC18, located beneath Callington-Strathalbyn Road bridge across Bremer River.

Photograph	Details
	**Date:** June 2020 **Description:** Installation of groundwater well GW07 on road verge at 260 Pyrites Rd, Brukunga; well finished with gatic cover.
	**Date:** June 2020 **Description:** Installation of groundwater monitoring well C04a on private land at Lot 54 Pyrites Rd, Brukunga; well finished with standpipe

Photograph	Details
	**Date:** June 2020 **Description:** Private groundwater bore located at 16 Hawthorne St, Dawesley, sample Hawthorn1
	**Date:** June 2020 **Description:** Private Groundwater bore KAN26 located at 203 Peggy Buxton Rd, Brukunga. Well was covered with top soil and was found using metal detector.

Photograph	Details
	**Date:** August 2020 **Description:** Private bore 6627-5944 located on 296 Pyrites Rd, Brukunga
	**Date:** September 2020 **Description:** Private bore 6627-5944 located on 296 Pyrites Rd, Brukunga
	**Date:** September 2020 **Description:** Soil sampling from disused vegetable garden located on 296 Pyrites Rd, Brukunga

Photograph	Details
	**Date:** September 2020 **Description:** Private bore 6627-11131 located on 483 Ironstone Range Rd, Petwood
	**Date:** May 2020 **Description:** Sludge disposal area on DEM Brukunga Pyrite mine (elevated shelf near centre of mine site), located to the south-west of the CFS site
	**Date:** May 2020 **Description:** Soil core from borehole SW03, located in the sludge disposal area

Photograph	Details
	**Date:** May 2020 **Description:** Northern bench of DEM Brukunga Pyrite mine, historically used as a sludge disposal area, located to the north-west of the CFS site
 	**Date:** May 2020 **Description:** Sludge disposal area along Southern bench of DEM Brukunga Pyrite mine

Photograph	Details
	**Date:** May 2020 **Description:** Sludge drying ponds at DEM Brukunga mine to the south-east of Water Treatment Plant (WTP)
	**Date:** July 2020 **Description:** Seepage sampling location WW02, located at seepage collection point ‘V-notch’ on bottom side of tailings dam east of Pyrites Rd.

Photograph	Details
	**Date:** July 2020 **Description:** Seepage sampling location WW07, located in most south-eastern corner (closest to sludge disposal area) of the Southern Pit off of West Hill Rd (on mine site).

Appendix M – Climate Data

Daily Maximum Temperature (degrees Celsius)

MOUNT BARKER

Station Number: 023733 · State: SA · Opened: 1861 · Status: Open · Latitude: 35.07°S · Longitude: 138.85°E · Elevation: 359 m

2020	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	28.8		28.6	17.9	14.4	12.0	18.2	18.5	17.2	24.0	23.4	*20.0*
2nd	32.8	23.3	19.4	24.1	17.2	14.9	11.9	20.1	18.0			*21.4*
3rd	38.2	18.9	18.3	24.0	13.5	12.3	12.0		15.9	*27.8*	*32.1*	*26.8*
4th		22.6	24.9	17.6	16.9	15.5	15.1	12.1	16.0	25.0	16.7	*29.8*
5th		24.5	18.1	17.2	18.7	16.2	15.9	11.8	18.7	15.0	15.6	*19.8*
6th		27.9	23.4	17.4	19.2	14.5	11.0	10.2	22.2	15.2	18.3	*20.0*
7th		25.7	22.3	17.7	19.0	12.2	10.6	7.3	25.5	10.7	19.8	*17.2*
8th		31.0	22.6	18.7	15.4	11.9	13.6	9.2	16.2	14.0	25.1	*21.6*
9th		29.7	22.8	21.8	14.1	14.0	14.8	12.6	18.6	19.5	30.0	*27.0*
10th		30.9	28.5	20.9	16.2	15.9	14.8	15.0	21.5	22.6	33.8	*22.4*
11th		24.7	32.4	18.9	16.2	16.3	10.6	12.0	25.7	22.8	22.4	*27.0*
12th	27.7	19.1	31.7	17.4	17.0	17.7	12.6	13.3	21.6	27.4	16.0	*32.5*
13th	35.4	30.7	19.9	24.0	12.7	13.4	16.1	13.4	13.4	24.1	16.2	*28.9*
14th	34.5	24.7	19.2	28.3	12.1	12.6	15.4	14.8	17.6	29.0	27.3	*33.4*
15th	28.3	18.2	21.5	26.1	14.4	15.5	15.8	16.2	19.5	26.1	33.8	*25.0*
16th	21.3	22.4	26.5	19.1	17.4	15.3	16.1	15.9	22.4	19.2	20.5	*26.2*
17th	22.4	32.2	31.0	17.1	18.8	13.4	18.1	15.8	15.0	17.2	24.9	
18th	28.9	23.0	30.0	17.7	19.4	16.6	15.2	12.3		16.5	31.6	
19th	21.0	20.6	30.8	20.5	19.4	15.7	13.7	13.5	*21.8*	19.5	32.6	
20th		19.4	23.2	19.3	13.4	11.8	14.1	13.0	23.9	23.0	25.0	
21st	*25.4*	21.9	25.6	22.0	12.2	14.4	11.6	11.7	16.5	23.4	34.0	
22nd	24.3	25.8	20.0	21.4	13.8	12.7	10.6	11.9	14.2	21.4	29.7	
23rd	19.9	32.3	21.0	20.4	14.4	14.6	14.2	13.5		17.3	21.0	
24th	22.4	33.4	19.7	21.2	11.8	11.6	16.5	12.4		14.8	26.2	
25th	26.8	28.6	19.2	23.8	13.6	16.0	17.8	14.3	*11.8*	13.4	31.4	
26th	27.4	20.9	22.6	20.7	15.1	14.9	18.1	18.5	13.3	16.3	30.4	
27th	28.4	21.6	27.3	18.0	14.9	15.7	13.7	17.6	13.8	17.5	37.9	
28th	31.2	24.4	29.7	19.0	15.8	15.9	14.4	19.4	19.0	22.9	29.7	
29th	36.7	23.4	24.4	15.4	17.2	13.0	17.3	21.9	17.2	18.8	21.6	
30th	41.0		22.7	12.9	19.7	14.5	16.3	13.4	15.3	14.0	29.8	
31st	34.6		24.9		12.4		17.6	13.3		15.0		
Highest daily	41.0	33.4	32.4	28.3	19.7	17.7	18.2	21.9	25.7	29.0	37.9	*33.4*
Lowest daily	19.9	18.2	18.1	12.9	11.8	11.6	10.6	7.3	*11.8*	10.7	15.6	*17.2*
Monthly mean	29.0	25.1	24.3	20.0	15.7	14.4	14.6	14.2	18.2	19.8	26.1	

Quality control: 12.3 Done & acceptable, *12.3* Not quality controlled or uncertain, *12.3* Precise date unknown

Product code: IDCJAC0010 reference: 69847740

Australian Government
Bureau of Meteorology

Daily Maximum Temperature (degrees Celsius)

MOUNT BARKER

Station Number: 023733 · State: SA · Opened: 1861 · Status: Open · Latitude: 35.07°S · Longitude: 138.85°E · Elevation: 359 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	27.3	26.8	24.7	20.5	16.6	13.8	12.9	14.2	16.6	19.6	22.7	25.2
Highest monthly mean	32.1	31.7	30.1	25.4	20.2	18.3	15.5	20.6	19.8	25.5	28.5	30.5
Lowest monthly mean	23.2	22.0	20.8	16.4	13.5	11.7	10.8	11.4	3.4	15.7	19.3	20.2
Highest daily	44.5	43.0	40.7	36.0	28.9	24.2	23.8	27.2	31.1	35.3	40.6	42.5
Date of highest daily	24th 2019	2nd 2014	6th 1986	10th 2018	8th 2013	8th 2005	29th 1975	30th 2007	26th 1987	21st 2014	30th 1962	20th 2019
Lowest daily	14.4	15.5	13.7	9.8	8.6	6.9	6.8	6.7	7.8	9.0	10.0	11.7
Date of lowest daily	3rd 1970	3rd 2005	21st 2001	26th 1982	27th 2000	1st 1989	28th 1998	11th 1960	26th 1970	2nd 1967	1st 1994	1st 1966

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 10 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-airtemp-data.shtml.

Product code: IDCJAC0010 reference: 69847740 Created on Fri 18 Dec 2020 00:09:54 AM AEDT

Australian Government
Bureau of Meteorology

Daily Minimum Temperature (degrees Celsius)

MOUNT BARKER

Station Number: 023733 · State: SA · Opened: 1861 · Status: Open · Latitude: 35.07°S · Longitude: 138.85°E · Elevation: 359 m

2020	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	8.0	14.6	12.1	10.0	6.5	5.2	7.2	7.7	2.3	4.0	8.2	*14.1*
2nd	9.0	11.0	10.9	7.6	9.5	6.5	6.0	6.5	11.4	15.0	8.7	*9.7*
3rd	11.0	12.3	8.5	10.5	8.5	8.9	7.0	8.4	9.4			*5.5*
4th	17.0	6.6	10.1	9.5	9.1	2.0	5.4	3.0	8.0	*15.5*	*12.0*	*7.5*
5th		9.0	13.7	9.8	4.8	1.0	7.5	-1.2	9.0	6.9	6.4	*16.9*
6th		11.4	12.5	8.8	7.3	4.5	6.9	0	4.9	6.0	5.5	*11.0*
7th		14.3	10.2	11.7	13.2	4.8	7.4	4.1	13.3	5.2	7.6	*9.0*
8th		15.7	8.7	7.7	11.3	0	0.3	4.6	13.1	6.5	5.8	*8.5*
9th		15.2	10.0	6.0	6.5	0	3.0	5.3	7.0	8.0	7.6	*6.3*
10th		16.0	8.3	7.0	4.0	-0.3	6.0	2.5	4.0	7.2	14.9	*11.1*
11th		13.9	11.4	11.4	5.0	-0.6	5.8	5.8	11.8	4.4	11.6	*7.6*
12th		14.5	15.5	9.2	6.4	3.1	6.0	9.5	11.0	9.2	12.0	*11.6*
13th	10.5	15.5	16.7	3.7	5.2	8.8	6.0	10.1	7.4	10.1	8.2	*19.4*
14th	12.4	16.6	8.6	8.4	7.1	7.7	3.1	8.8	6.8	10.0	8.0	*21.4*
15th	14.2	14.6	7.4	13.4	1.0	9.6	0.8	8.2	2.6	15.5	13.5	*16.2*
16th	13.7	13.6	5.6	12.0	2.0	11.1	3.5	7.2	8.6	10.1	12.0	*13.5*
17th	9.0	11.1	12.5	8.3	2.5	7.5	2.2	4.1	10.9	9.0	5.5	*13.1*
18th	12.0	12.8	18.5	8.5	4.7	6.1	8.0	8.5	10.5	7.7	8.4	
19th	13.5	12.4	19.6	7.3	8.9	9.5	9.5	6.9		3.5	16.0	
20th	13.0	9.6	13.5	12.0	5.0	8.4	4.5	7.0	*13.2*	4.5	11.9	
21st		11.6	12.4	8.4	5.0	7.2	4.1	6.2	8.9	7.9	11.9	
22nd	*14.0*	8.5	11.4	9.0	7.8	7.7	6.4	3.7	8.5	10.0	15.4	
23rd	12.0	7.8	8.0	9.0	6.8	7.6	3.4	4.3	7.5	12.9	13.0	
24th	10.5	13.0	10.8	11.7	8.6	8.0	5.0	0.6		9.0	9.9	
25th	13.4	12.2	8.0	9.4	6.0	4.6	3.9	-1.0		6.5	10.2	
26th	15.2	12.7	5.3	13.6	5.1	5.1	3.2	1.5	*3.6*	5.9	12.3	
27th	14.5	6.5	6.4	6.5	9.5	3.2	2.6	10.6	2.2	8.9	13.6	
28th	9.4	12.6	8.4	8.8	9.1	1.9	0.6	3.3	2.8	5.0	15.8	
29th	9.6	12.2	16.1	10.1	4.0	3.4	2.7	6.8	4.2	8.3	10.7	
30th	17.7		10.9	5.4	8.3	6.0	5.8	10.5	9.9	10.0	9.0	
31st	27.0		8.0		8.8		2.8	5.3		9.7		
Highest daily	27.0	16.6	19.6	13.6	13.2	11.1	9.5	10.6	13.3	*15.5*	16.0	*21.4*
Lowest daily	8.0	6.5	5.3	3.7	1.0	-0.6	0.3	-1.2	2.2	3.5	5.5	*5.5*
Monthly mean	13.0	12.3	11.0	9.2	6.7	5.3	4.7	5.4	7.9	8.4	10.5	

Quality control: 12.3 Done & acceptable, *12.3* Not quality controlled or uncertain, *12.3* Precise date unknown

Product code: IDCJAC0011 reference: 69847809

Australian Government
Bureau of Meteorology

Daily Minimum Temperature (degrees Celsius)

MOUNT BARKER

Station Number: 023733 · State: SA · Opened: 1861 · Status: Open · Latitude: 35.07°S · Longitude: 138.85°E · Elevation: 359 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	11.9	12.0	10.5	8.4	6.8	5.2	4.6	5.0	5.9	7.3	9.0	10.5
Highest monthly mean	14.9	15.2	13.8	11.4	10.1	8.7	7.4	7.2	9.5	10.3	12.6	13.4
Lowest monthly mean	8.9	9.1	7.4	4.9	3.9	1.7	1.9	2.3	2.8	4.7	6.5	5.4
Highest daily	28.0	28.6	25.9	23.4	17.6	15.6	15.2	15.0	18.4	21.5	25.6	26.0
Date of highest daily	29th 2009	12th 1977	4th 2004	17th 2019	11th 1987	9th 1995	28th 1985	16th 2001	28th 2014	10th 1997	26th 1997	7th 2015
Lowest daily	2.6	3.3	1.7	-1.1	-3.7	-4.4	-5.6	-3.6	-1.8	-1.2	-1.1	1.7
Date of lowest daily	31st 1992	1st 1961	3rd 1964	16th 1963	19th 1973	15th 1959	10th 1959	8th 1963	26th 1976	15th 1970	2nd 1960	7th 1961

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 10 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-airtemp-data.shtml.

Product code: IDCJAC0011 reference: 69847809 Created on Fri 18 Dec 2020 00:11:39 AM AEDT

Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

2020	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	0	38.4	0	0	*5.0*	*21.0*	*0*	*0*	*0*	*1.0*	*0*	*4.4*
2nd	0	↓	3.0	8.6	*7.4*	*1.8*	↓	*0*	*0*	*0*	*0*	*0*
3rd	0	6.6	0	0	↓	*2.6*	*28.8*	*0*	*1.0*	*0*	*0*	*0*
4th	0	0	1.8	10.2	*0.6*	*0*	*2.6*	*1.4*	*0*	↓	*0*	*0*
5th	↓	0	0.6	0	*0*	*0*	*0*	*0*	*0*	↓	*1.6*	*0*
6th	5.2	0	0.8	7.0	*0*	*0*	*0*	*0*	*0*	*29.2*	*0*	↓
7th	0	0	0	0	*0*	*0*	*0*	*0.8*	*0*	*3.6*	*0.8*	*7.8*
8th	0	2.6	0	0	*4.4*	*0*	*0*	*39.0*	*0*	*17.2*	*0*	
9th	0	0	0	0	*20.0*	*0*	*0*	↓	*0*	*0*	*0*	
10th	0	0	0	0	↓	*0*	*0.4*	*5.8*	*0*	*0*	*0*	
11th	2.6	0	0	0	*2.4*	*0*	*0.4*	*0*	*0*	*0*	*5.0*	
12th	0	1.2	0	0	*0*	*0*	↓	*3.6*	*0*	*0*	*1.4*	
13th	0	1.0	1.2	0	*4.6*	*1.2*	*11.2*	↓	*0*	*0*	*2.6*	
14th	0	0	0	0	*1.0*	↓	*0*	*4.8*	*0*	*0*	*0*	
15th	0	5.2	0	0	*0*	*26.2*	*0*	*0.4*	*9.0*	*0*	↓	
16th	0	0	0	0.4	*0*	*0*	*0*	↓	*0*	↓	*0.6*	
17th	0	1.8	0	0	*0*	*2.2*	*0*	*0.8*	*0*	*4.4*	*0*	
18th	0	0	0	0	*0*	*0*	*0*	*2.2*	*4.2*	*0*	*0*	
19th	↓	0	0	↓	*0*	*0*	↓	*17.8*	*0*	*0*	*0*	
20th	24.2	0	0	3.0	*6.6*	*0*	*2.4*	*4.6*	↓	*0*	*0*	
21st	5.0	0	0	0	↓	↓	*0*	*15.8*	*10.4*	*0*	*0.2*	
22nd	0	0	0	0	*6.4*	*26.2*	*0*	*3.8*	*3.0*	*0*	↓	
23rd	8.0	0	0.6	0	*8.0*	*4.0*	*0*	↓	*11.6*	*3.2*	*4.8*	
24th	0	0	0.4	4.2	*0*	*0.4*	*0*	*3.0*	*0*	*0.6*	*0*	
25th	0	0	0	0	↓	*0*	*0*	*0*	*14.0*	*0*	*0*	
26th	0	0	0	↓	*3.4*	*0.6*	↓	*0*	*4.4*	*3.2*	*0*	
27th	0	0.8	0	20.8	*0*	*0*	*1.0*	*0*	↓	*4.2*	*0*	
28th	0	0	0	0	*0*	*0*	*0*	*0*	*0.2*	*1.2*	*1.4*	
29th	0	0	0	7.0	*0.8*	*0*	*0*	*0*	*0*	*0*	*0*	
30th	0		0	10.4	*0*	*0*	*0*	↓	*9.8*	*28.0*	*0*	
31st	0		0		↓		*0*	*1.2*		*2.4*		
Highest daily	8.0	38.4	3.0	10.4	*20.0*	*4.0*	*2.6*	*39.0*	*14.0*	*28.0*	*5.0*	*4.4*
Monthly Total	45.0	57.6	8.4	71.6	*70.6*	*86.2*	*46.8*	*105.0*	*67.6*	*98.2*	*18.4*	

↓ This day is part of an accumulated total
Quality control: 12.3 Done & acceptable, *12.3* Not completed or unknown

Product code: IDCJAC0009 reference: 69847480

Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	25.4	25.8	28.1	51.6	73.3	87.5	93.5	89.2	75.5	57.2	37.1	32.2
Median	18.6	15.3	19.2	42.6	65.6	84.2	89.2	86.9	70.0	53.4	32.8	25.3
Highest daily	120.7	134.9	86.4	73.4	62.2	61.8	81.8	54.6	58.6	64.8	64.5	58.8
Date of highest daily	25th 1941	18th 1946	6th 1910	18th 1938	10th 1911	7th 1994	13th 1918	26th 1963	29th 2016	31st 1997	18th 1964	18th 1992

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml.

Product code: IDCJAC0009 reference: 69847480 Created on Fri 18 Dec 2020 00:01:09 AM AEDT

Australian Government
Bureau of Meteorology

Monthly Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1884	36.3	4.3	70.1	31.8	247.2	127.5	13.8	92.7	93.7	57.9	9.3	40.4	825.0
1885	5.1	46.1	14.8	48.3	48.2	113.2	68.8	102.9	56.6	49.3	13.4	34.0	600.7
1886	41.9	15.8	5.1	37.9	31.2	24.4	145.3	133.1	96.4	76.7	16.6	4.8	629.2
1887	15.7	32.0	13.3	41.4	75.7	166.8	142.2	47.5	101.5	68.5	98.4	30.2	833.2
1888	20.3	2.3	16.9	5.1	67.8	152.7	130.6	74.8	43.1	12.5	14.3	25.3	565.7
1889	105.5	20.0	13.2	187.4	105.2	190.0	46.2	160.7	75.7	84.9	46.3	10.2	1045.3
1890	42.4	32.4	16.9	17.6	35.7	171.3	160.1	157.0	64.8	118.3	71.0	14.7	902.2
1891	21.8	2.1	23.1	46.0	11.5	53.9	98.2	68.9	50.5	107.9	46.2	67.4	597.5
1892	38.4	2.5	24.5	33.3	60.5	84.8	96.2	112.3	126.1	115.7	26.3	46.5	767.1
1893	6.2	0.5	19.4	84.1	173.8	119.6	83.6	78.6	145.9	54.6	64.2	18.3	848.8
1894	28.0	3.2	80.9	53.2	42.0	107.1	98.4	101.9	69.8	83.5	3.4	76.7	748.1
1895	15.7	2.3	42.9	111.7	25.5	101.7	156.6	100.3	86.1	33.2	3.3	15.0	694.3
1896	37.5	27.6	11.4	142.7	57.6	95.5	82.4	61.0	42.1	35.8	12.2	32.5	638.3
1897	12.6	51.2	14.1	16.7	105.2	72.8	67.6	139.9	84.4	16.0	7.4	0.5	588.4
1898	0.0	57.5	15.2	65.8	89.9	176.6	121.7	52.0	41.4	93.7	52.5	14.0	780.3
1899	38.6	25.6	31.8	46.8	62.0	138.9	35.2	54.3	62.7	37.3	51.6	12.7	597.5
1900	19.7	1.0	82.2	95.2	74.6	134.5	44.5	174.0	69.4	35.1	24.1	4.6	758.9
1901	34.2	5.1	12.2	39.4	34.5	180.3	74.6	48.2	83.4	82.4	22.9	16.0	633.2
1902	16.8	33.0	63.6	13.7	34.3	138.3	66.5	60.2	54.0	66.0	15.0	77.5	638.9
1903	19.3	28.1	50.3	96.6	57.2	97.4	106.6	83.9	147.7	28.8	87.0	24.1	827.0
1904	98.8	26.9	15.5	61.5	67.5	90.6	75.4	71.6	23.3	46.6	24.0	0.5	602.2
1905	45.3	9.4	4.1	156.0	67.4	111.4	117.5	53.4	106.4	111.7	13.3	0.6	796.5
1906	1.5	2.8	84.3	25.4	71.4	134.5	120.2	124.1	106.5	75.5	87.9	43.7	877.8
1907	2.6	12.2	21.9	48.9	67.5	72.5	76.2	98.8	58.5	39.5	71.4	17.6	587.6
1908	7.7	11.0	61.6	33.5	134.0	105.8	62.7	72.0	120.6	64.2	9.9	7.4	690.4
1909	20.5	21.6	20.9	143.6	130.5	110.6	125.5	171.3	65.9	96.3	79.8	17.3	1003.8
1910	5.1	0.6	200.6	20.3	111.8	91.6	131.1	74.2	79.0	76.7	39.9	58.4	889.3
1911	13.9	105.5	24.9	18.5	143.5	85.2	83.0	43.6	76.8	31.6	9.7	28.3	664.5
1912	3.8	21.6	27.0	17.7	15.1	67.7	103.3	62.2	172.9	28.4	51.7	33.7	605.1
1913	5.1	53.1	65.5	34.0	30.9	13.4	52.6	86.9	85.9	66.5	29.0	46.7	569.6
1914	22.2	29.5	13.4	75.7	60.5	18.2	51.2	13.9	24.0	9.4	41.0	20.1	379.1
1915	9.7	1.3	6.1	53.6	77.3	223.9	78.4	128.6	148.5	24.7	15.7	1.3	769.1
1916	14.0	7.9	9.4	50.7	24.7	180.5	111.0	117.2	96.5	65.6	74.8	29.9	782.2
1917	13.3	51.5	69.6	28.6	153.8	116.1	217.8	112.2	157.0	98.6	34.4	34.8	1087.7
1918	10.6	9.7	23.7	41.6	73.0	88.4	158.8	76.2	26.9	64.4	7.6	12.2	593.1
1919	7.4	68.8	18.9	2.3	72.9	53.6	69.6	78.0	107.2	62.3	6.4	41.4	588.8
1920	6.3	4.6	24.9	20.8	72.7	145.9	69.1	126.0	61.1	82.7	65.5	40.2	719.8
1921	48.8	17.1	76.1	26.0	85.6	59.2	77.2	53.1	114.6	53.7	80.7	21.8	713.9
1922	78.0	4.3	8.4	59.4	74.0	92.5	130.6	90.5	42.0	73.1	4.9	85.2	742.9
1923	8.1	2.1	0.0	0.0	213.9	192.1	106.3	82.4	151.1	62.1	20.3	82.3	920.7
1924	35.1	44.6	42.8	31.8	80.1	112.1	18.4	67.9	102.0	96.9	42.0	4.6	678.3
1925	11.7	34.8	11.2	35.1	117.7	40.8	45.3	58.3	132.1	22.8	34.8	1.3	545.9
1926	2.1	20.9	2.0	70.7	124.0	47.9	83.6	116.5	67.1	80.4	12.6	41.4	669.2
1927	17.3	56.7	17.7	16.6	123.3	57.4	83.5	169.7	29.5	23.6	67.2	40.8	703.3
1928	27.0	60.2	40.1	21.1	50.3	126.9	111.7	18.8	57.5	113.5	12.0	4.6	643.7
1929	21.3	6.6	14.4	17.4	41.3	125.3	72.2	58.0	79.3	33.4	50.2	118.0	637.4
1930	3.1	22.3	4.7	43.8	19.6	45.1	118.0	135.6	89.8	92.8	29.2	15.2	619.2
1931	35.0	5.1	26.7	36.3	82.5	107.4	125.6	78.0	115.3	24.7	20.7	7.1	664.4

Quality control: 12.3 Done & acceptable, *12.3* Not completed or unknown

Australian Government
Bureau of Meteorology

Monthly Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1932	1.8	41.5	33.3	129.9	44.5	146.8	158.8	116.6	47.2	62.4	15.4	9.9	808.1
1933	85.9	3.1	28.3	68.2	179.4	35.8	58.6	92.7	149.2	30.8	13.4	34.3	779.7
1934	22.4	8.9	19.5	63.3	2.1	39.6	36.8	104.0	100.6	77.3	83.9	32.8	591.2
1935	34.0	9.5	43.5	73.9	38.5	104.0	109.7	110.4	112.2	62.9	24.3	16.0	738.9
1936	47.3	21.8	13.3	60.9	56.0	66.4	80.0	59.3	30.7	90.5	14.8	45.0	586.0
1937	84.9	9.9	19.5	44.1	60.0	42.1	51.0	123.0	87.6	32.5	36.0	56.1	646.7
1938	20.1	44.1	4.4	129.7	11.1	71.3	66.3	92.6	31.2	23.9	28.7	8.7	532.1
1939	38.9	91.5	24.0	42.5	64.2	120.0	53.9	147.7	22.5	38.2	110.4	8.6	762.4
1940	36.5	10.1	15.8	99.5	40.3	26.3	102.6	34.6	49.9	23.1	32.4	31.2	502.3
1941	195.8	11.0	42.2	40.2	26.9	33.8	78.2	40.8	141.7	39.3	16.0	18.6	684.5
1942	35.9	8.2	2.2	79.1	151.4	117.4	89.1	117.6	113.2	34.3	52.7	16.1	817.2
1943	35.6	41.1	6.9	61.5	30.7	66.1	95.3	114.2	75.1	36.8	30.4	21.2	614.9
1944	3.6	15.8	4.9	44.3	128.5	14.0	88.4	15.0	18.6	59.2	62.1	32.5	486.9
1945	30.9	43.6	6.2	13.9	52.6	47.9	34.5	104.6	92.5	87.9	56.2	45.2	616.0
1946	38.9	156.9	62.5	35.9	67.8	67.2	136.9	58.9	46.6	32.4	50.2	62.5	816.7
1947	5.2	80.0	87.6	70.1	28.8	50.7	148.8	98.4	78.3	98.5	41.3	43.1	830.8
1948	6.2	17.8	10.2	96.6	54.7	29.1	89.1	103.8	18.3	109.0	79.0	42.3	656.1
1949	6.9	73.5	3.6	13.0	58.8	45.8	77.5	38.0	27.6	145.4	63.0	4.6	557.7
1950	2.6	28.1	45.7	27.1	95.7	41.4	50.3	71.1	55.1	68.6	16.8	12.7	515.2
1951	27.2	24.0	2.1	56.2	159.9	75.0	183.3	131.1	20.7	117.2	14.2	57.0	867.9
1952	50.2	7.4	1.5	67.8	123.7	68.2	78.9	66.6	58.5	62.5	94.5	22.9	702.7
1953	24.9	14.7	2.1	34.5	55.3	171.5	91.3	73.8	84.0	41.4	36.6	70.1	700.2
1954	19.4	9.3	14.7	95.4	42.7	73.4	49.2	37.2	37.3	66.2	39.3	29.6	513.7
1955	3.8	73.9	14.0	61.3	158.6	159.6	49.9	178.9	36.6	58.5	65.5	31.0	891.6
1956	12.7	9.2	42.7	90.7	100.1	179.3	114.8	110.2	78.9	53.4	25.7	9.2	826.9
1957	0.0	1.3	8.9	40.4	28.0	34.2	94.6	57.0	59.0	44.8	48.5	10.5	427.2
1958	6.6	2.5	26.9	14.7	151.2	17.2	98.2	98.3	113.7	90.7	9.2	15.7	644.9
1959	9.2	26.9	47.8	4.8	25.2	12.8	46.8	81.8	53.6	43.3	22.9	48.8	423.9
1960	11.2	66.2	10.2	88.5	215.2	49.4	79.2	38.4	97.3	21.1	51.8	15.5	744.0
1961	8.4	15.3	10.4	102.7	30.1	52.4	95.7	73.8	46.7	12.2	39.2	13.7	500.6
1962	24.4	20.4	26.9	10.1	122.5	73.5	43.7	77.6	44.2	125.0	17.1	64.9	650.3
1963	56.7	6.8	3.3	85.4	77.3	96.3	119.9	114.1	77.5	10.0	10.8	0.3	658.4
1964	10.1	7.6	6.1	71.5	28.3	106.7	213.9	68.8	87.8	83.7	99.0	19.5	803.0
1965	4.8	0.0	9.2	42.6	70.5	48.8	52.9	67.7	50.8	22.1	57.5	20.3	447.2
1966	7.5	23.1	35.8	13.7	62.7	60.2	113.0	58.9	102.4	33.1	25.7	78.9	615.0
1967	14.9	27.6	5.0	6.5	18.7	16.4	97.4	67.0	43.8	28.6	1.5	18.7	346.1
1968	71.4	30.7	45.3	79.4	142.5	114.0	100.4	142.5	45.4	109.2	73.9	41.0	995.7
1969	12.5	175.2	26.6	40.4	67.1	22.2	88.2	58.3	66.9	9.1	37.0	39.9	643.4
1970	100.3	0.0	36.3	143.6	49.7	99.5	68.9	147.0	97.3	13.8	37.7	53.0	847.1
1971	7.3	10.9	45.0	180.3	88.9	53.0	34.6	142.6	102.5	63.5	60.2	36.1	824.9
1972	60.6	31.6	2.8	30.5	33.8	61.6	109.7	113.4	47.5	47.6	18.0	37.1	594.2
1973	17.3	70.1	28.5	59.8	65.6	103.7	79.8	102.6	110.2	90.1	33.1	79.2	840.0
1974	82.4	80.6	14.6	108.6	92.0	45.6	168.8	69.8	144.6	126.8	10.3	21.3	965.4
1975	29.2	3.8	57.2	32.2	119.0	23.7	112.4	82.6	74.6	137.0	25.3	10.2	707.2
1976	20.2	68.0	6.8	24.0	28.9	57.2	32.8	57.4	54.2	132.4	43.0	33.5	558.4
1977	61.9	13.0	40.6	29.6	79.6	86.1	47.6	45.8	64.9	40.8	46.8	13.6	570.3
1978	6.8	7.6	25.3	60.6	66.9	119.9	133.2	102.3	107.7	26.4	33.8	31.9	722.4
1979	30.7	50.0	27.2	74.4	63.6	16.7	75.9	98.1	161.6	86.4	42.2	22.2	749.0

Quality control: 12.3 Done & acceptable, *12.3* Not completed or unknown

Australian Government
Bureau of Meteorology

Monthly Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	5.5	1.2	1.9	54.6	57.8	114.4	77.2	43.6	50.4	99.4	44.8	25.3	576.1
1981	44.3	15.6	59.8	1.8	63.6	197.4	179.0	179.9	32.8	26.8	39.5	17.0	857.5
1982	14.6	3.2	48.4	69.8	49.3	50.1	28.5	21.2	43.0	27.4	6.4	9.2	371.1
1983	14.6	0.0	104.0	97.6	88.8	31.8	120.2	88.4	77.8	61.4	30.4	24.8	739.8
1984	48.2	4.6	71.6	41.4	45.4	25.6	123.4	184.2	62.8	19.0	41.8	5.6	673.6
1985	9.4	7.2	84.2	66.0	81.0	68.2	54.8	97.4	88.8	33.2	20.2	19.6	630.0
1986	5.6	0.4	0.6	80.6	60.4	33.6	139.8	107.8	76.0	87.2	10.8	100.4	703.2
1987	25.2	35.6	18.8	20.0	111.6	118.6	96.2	78.4	23.4	63.2	6.4	68.6	666.0
1988	17.0	20.0	15.2	16.6	137.6	85.8	89.2	52.4	68.4	26.0	47.0	45.8	621.0
1989	3.6	3.2	6.8	33.4	97.4	87.8	114.2	103.0	69.6	57.4	46.6	16.2	639.2
1990	3.0	12.6	0.0	49.4	22.2	122.0	93.2	101.2	46.0	44.8	14.6	50.4	559.4
1991	13.6	0.0	5.2	62.8	13.6	101.2	86.2	164.8	100.0	4.2	32.6	12.8	597.0
1992	8.0	17.2	75.8	50.8	64.6	60.0	71.0	153.0	160.6	86.4	91.4	167.4	1006.2
1993	34.8	6.6	20.8	0.0	33.6	50.0	110.2	67.6	70.8	53.8	26.0	48.6	522.8
1994	26.2	11.0	0.0	22.4	60.2	127.8	31.8	26.1	38.6	50.8	54.2	11.4	460.5
1995	26.2	24.4	12.0	44.2	75.2	101.2	212.0	35.2	33.5	47.6	21.8	14.6	647.9
1996	32.4	12.6	27.6	41.8	18.2	153.6	91.5	145.4	134.2	30.6	8.2	19.6	715.7
1997	22.8	16.8	5.0	5.8	45.2	39.2	30.8	102.6	71.0	68.8	51.6	27.8	487.4
1998	19.2	18.4	11.8	91.4	20.8	93.2	104.4	38.1	45.1	51.0	37.0	11.8	542.2
1999	18.6	3.2	75.0	6.0	85.2	75.6		44.2	85.6	46.9	48.4	41.8	
2000	10.2	121.4	23.6	56.6	86.8	84.0	109.0	104.0	65.4	84.8	24.2	8.2	778.2
2001	7.2	9.6	40.6	38.8	92.6	77.8	52.6	96.2	113.0	84.4	61.8	35.2	709.8
2002	24.4	5.6	17.8	14.8	67.0	67.2	82.8	47.6	58.0	31.4	42.8	22.4	481.8
2003	11.0	44.0	10.2	38.0	104.8	115.2	77.8	128.4	70.0	66.2	12.2	37.4	715.2
2004	11.6	9.2	23.8	10.6	51.8	150.4	93.2	92.0	40.4	9.6	57.8	50.2	600.6
2005	22.0	36.4	11.2	8.4	6.8	172.4	48.6		76.2	108.6	78.8	43.8	
2006	34.2	26.2	42.2	57.0	56.4	33.2	122.0	21.2	56.6	1.8	18.8	29.3	498.9
2007	32.6	5.0	29.8	94.8	68.4	81.6	96.4	27.4	42.6	32.4	32.8	40.2	584.0
2008	9.8	10.8		61.4	49.4	65.0	90.0		34.2	7.4	14.8	37.4	
2009	0.2	1.0	31.0	70.2	52.6	84.4	154.4	93.2	85.2	52.6	50.0	21.9	696.7
2010	16.0	*4.4*	19.0	41.6	64.0	63.0	78.6	168.2	114.0	47.4	41.4	115.6	773.2
2011	16.6	72.4	78.0	13.0	59.0	71.8	90.0	59.4	72.8	36.8	20.6	37.8	628.2
2012	15.0	14.6	65.0	34.6	98.4	138.6	67.0	88.5	46.8	25.2	15.6	9.8	619.1
2013	14.2	15.2	10.4	30.2	38.6	151.0	148.8	91.2	70.4	46.2	26.4	20.6	663.2
2014	19.4	104.0	19.4	36.8	52.0	128.6	138.4	27.0	29.2	*7.2*	20.6	12.4	595.0
2015	51.0	1.8	7.6	87.6	87.0	26.4	74.0	64.0	39.0	11.2	19.2	12.0	480.8
2016	45.8	23.2	37.6	11.6	114.2		172.0	71.8	183.0	104.2	32.6	*118.8*	
2017	35.4	33.0	19.0	52.4	33.4	16.4	157.6	184.2	71.2	28.2	54.2	38.0	723.0
2018	14.2	11.2	14.8	33.4	68.4	61.0	75.6	103.8	*19.2*	21.0	73.0	39.6	535.2
2019	0.6	11.2	5.8	4.8	*99.2*	66.0	93.6	83.0	46.2	18.2	20.8	*5.0*	454.4
2020	*45.0*	*57.6*	*8.4*	*71.6*	*70.6*	*86.2*							

Quality control: 12.3 Done & acceptable, *12.3* Not completed or unknown

Australian Government
Bureau of Meteorology

Prepared using Climate Data Online, Bureau of Meteorology http://www.bom.gov.au/climate/data.
Contact us using details on http://www.bom.gov.au/climate/how/contacts.shtml.

Monthly Rainfall (millimetres)

NAIRNE

Station Number: 023739 · State: SA · Opened: 1884 · Status: Open · Latitude: 35.04°S · Longitude: 138.91°E · Elevation: 370 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	25.4	25.8	28.1	51.6	73.3	87.5	93.9	89.1	75.5	56.9	37.3	32.2	675.3
Lowest	0.0	0.0	0.0	0.0	2.1	12.8	13.8	13.9	18.3	1.8	1.5	0.3	346.1
5th percentile	2.5	0.9	2.1	5.7	18.6	18.0	34.6	27.3	23.9	9.9	7.2	4.6	457.8
10th percentile	3.8	2.1	4.2	12.4	26.3	27.8	46.4	39.1	32.0	18.6	10.1	7.2	500.8
Median	18.6	15.3	19.2	42.6	65.6	84.2	89.2	85.4	70.2	53.0	33.0	25.3	657.2
90th percentile	49.4	66.9	67.6	96.6	131.9	153.1	148.8	146.5	129.1	106.1	73.4	66.2	848.6
95th percentile	78.9	80.1	78.7	129.7	154.8	177.3	162.7	168.7	148.7	116.1	84.7	80.0	910.5
Highest	195.8	175.2	200.6	187.4	247.2	223.9	217.8	184.2	183.0	145.4	110.4	167.4	1087.7

Statistics calculated over the period 1961-1990

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	27.3	24.9	28.8	57.6	70.8	73.1	96.8	91.6	72.3	58.1	34.0	33.9	669.2
Lowest	3.0	0.0	0.0	1.8	18.7	16.4	28.5	21.2	23.4	9.1	1.5	0.3	346.1
5th Percentile	4.1	0.0	1.2	8.1	24.9	19.2	33.6	44.6	37.4	11.0	6.4	7.2	405.3
10th percentile	5.4	0.4	2.7	13.3	28.8	23.5	42.8	51.7	43.7	13.6	9.9	10.1	495.3
Median	15.9	12.8	26.0	52.0	66.2	64.9	95.9	85.5	67.7	46.2	35.4	25.0	654.3
90th percentile	62.8	68.2	61.0	103.3	119.3	118.7	142.7	143.0	107.9	125.2	57.8	69.6	848.1
95th percentile	77.4	75.9	78.5	127.8	130.8	121.1	174.4	165.1	129.1	129.9	67.7	79.1	916.8
Highest	100.3	175.2	104.0	180.3	142.5	197.4	213.9	184.2	161.6	137.0	99.0	100.4	995.7

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml.

Product code: IDCJAC0001 reference: 63951059 Created on Mon 20 Jul 2020 10:53:40 AM AEST

Appendix N – Section 83A Notification

Site contamination – Section 83A notification form

EPA
South Australia

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: 61 8111 6672

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): SA Country Fire Service State Training Centre

Owner(s) (please include contact details where known):
SA Country Fire Service

Occupier(s) (where different to owner):

Street address(es) (include lot or street number):
28 Pyrites Road, Brukunga SA 5252

Certificate(s) of title (current):
CT 5825/147

Location, nature and extent

Has a potentially contaminating activity been undertaken at the site, please describe…Yes……………………………..

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):.21/10/2019, 26/02/2020…..

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

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

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)? 2957.................

What are the environmental values of groundwater for the site?

☑ Drinking water ☐ Primary industries (irrigation and general water uses)

☑ Recreation and aesthetics

☐ Aquatic ecosystems (marine)

☑ Aquatic ecosystems (fresh)

☐ Primary industries (aquaculture)

☐ Primary industries (agriculture)

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

☐ Soil/soil vapour ☑ Groundwater

Maximum depth:..28.35...............m bgl Targeted aquifer(s):..Q1..............................

What is the depth to groundwater (where known)? Unknown..........m bgl

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

If yes, please provide details of measured thickness (in metres):.The scope of work is limited to PFAS................

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):..CT6053/276...

An accurate scaled site plan showing sampling locations has been included. ☐

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:..	Is the site subject to a current site contamination audit? ● Yes ○ No If yes, please specify the EPA reference number for the audit: Dr Ruth Keogh..................

Declaration

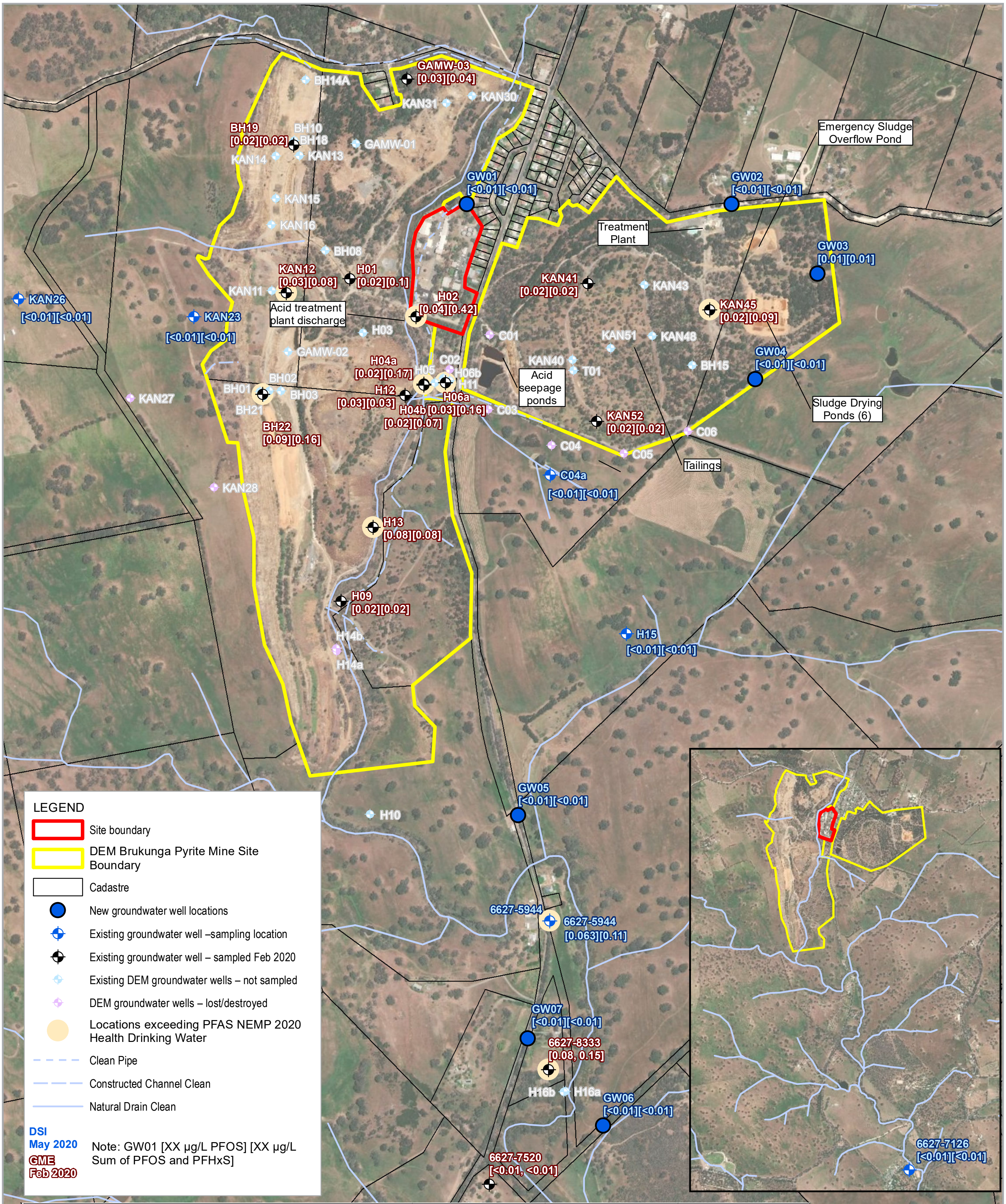
It is an offence to provide false or misleading information to the Authority. Maximum penalties range from $30,000 for a natural person, to $60,000 for a body corporate, pursuant to section 119 of the Environment Protection Act 1993.

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: 14/09/2020	Date:

---

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



	PFOS (µg/L)	PFOA (µg/L)	PFOS + PFHxS (µg/L)
NHMRC 2019 Recreational Water PFAS Guidelines		10	2
PFAS NEMP 2020 Freshwater 99%	0.00023	19	
PFAS NEMP 2020 Health Drinking Water		0.56	0.07

Paper Size ISO A4

0 200 400

Metres

N

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

GHD

SA Country Fire Service
CFS Brukunga State Training Centre
DSI

Project No. 12516828
Revision No. I
Date 28 Aug 2020

Groundwater concentrations plan

FIGURE 12a

N:\AU\Adelaide\Projects\33\12516828\GIS\Maps\Deliverables\DSI_MayJune _2020\12516828_Z028_GroundwaterExceedancePlan_Fig12a_I.mxd

Data source: Golder Associates (2013) Plan BRUKUNGA MINE REHABILITATION PROGRAM, HYDROGEOLOGICAL INVESTIGATION LOCATIONS, Aerial imagery - Google Earth & esri 2020 (Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community); General topo - DPTI 2015; Waterways - DEWNR 2014. Created by: dschmidt

Table 9
Groundwater Analytical Results

			Inorganics	PFAS in Waters Short								
			Total Dissolved Solids	Perfluorohexane sulfonic acid (PFHxS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	PFAS (Sum of Total)	Sum of PFHxS and PFOS	Sum of US EPA PFAS (PFOS + PFOA)*
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			5	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
NHMRC 2019 Recreational Water PFAS Guidelines						10				2	
PFAS NEMP 2020 Freshwater 99%					0.00023	19					
PFAS NEMP 2020 Health Drinking Water						0.56				0.07	
Location Code	**Date**	**Field ID**									
6627-5944	17/08/2020	6627-5944		0.047 ^*	0.063 ^*	0.050 ^*	0.001 ^	<0.005 ^*	0.15 ^*	0.110 ^*	0.068 ^*
6627-8333	12/02/2020	6627-8333	2,100	0.07	0.08	<0.01	<0.01	<0.01	0.15	0.15	0.08
6627-7126	19/06/2020	Hawthorn 1		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
6627-7520	10/03/2020	6627-7520		<0.01	<0.01 [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
BH19	12/02/2020	BH19	24,000	<0.01	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
BH22	12/02/2020	BH22	13,000	0.07	0.09	0.1	<0.01	<0.01	0.25	0.16	0.18
GAMW-03	12/02/2020	GAMW-03	1,000	0.02	0.03	<0.01	0.02	<0.01	0.06	0.04	0.03
H01	12/02/2020	H01		0.03	0.02	<0.01	<0.01	<0.01	0.05	0.05	0.02
H02	12/02/2020	H02	5,600	0.38	0.04	0.02	<0.01	<0.01	0.44	0.42	0.06
H04a	12/02/2020	H04a	18,000	0.15	0.02	0.02	<0.01	<0.01	0.19	0.17	0.04
H04b	12/02/2020	H04b	7,600	0.04	0.02	<0.01	<0.01	<0.01	0.07	0.07	0.02
H06a	12/02/2020	H06a	17,000	0.12	0.03	0.02	<0.01	<0.01	0.17	0.16	0.05
H09	12/02/2020	H09	4,700	<0.01	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
H12	12/02/2020	H12	140,000	<0.01	0.03	<0.02	<0.02	<0.01	0.03	0.03	0.03
H13	12/02/2020	H13	150,000	<0.01	0.08	<0.02	<0.02	<0.01	0.08	0.08	0.08
KAN12	12/02/2020	KAN12	11,000	0.05	0.03	0.04	<0.01	<0.01	0.12	0.08	0.07
KAN41	12/02/2020	KAN41	18,000	<0.01	0.02	<0.01	0.04	<0.01	0.06	0.02	0.02
KAN45	12/02/2020	KAN45	5,800	0.06	0.02	0.02	<0.01	<0.01	0.11	0.09	0.05
KAN52	12/02/2020	KAN52	18,000	<0.01	0.02	<0.01	<0.01	<0.01	0.02	0.02	0.02
GW01	15/06/2020	GW01		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW02	15/06/2020	GW02		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW03	16/06/2020	GW03		<0.01	0.01	<0.01	<0.01	<0.02	0.01	0.01	0.01
GW04	16/06/2020	GW04		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW05	15/06/2020	GW05		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW06	15/06/2020	GW06		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
GW07	16/06/2020	GW07		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
H15	16/06/2020	H15		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
KAN23	15/06/2020	KAN23		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
C04a	16/06/2020	C04a		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
KAN26	19/06/2020	KAN26		<0.01	<0.01 [#]	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01

^ Trace level analysis; EQL = 0.0002 µg/L for PFHxS, PFOS, PFOA and sums; EQL = 0.0004 µg/L or 0.005 µg/L for 6:2 FTS and 8:2 FTS

* Higher value adopted from QA/QC analysis

[#] PFOS concentration below the standard LOR (0.01 µg/L) may potentially exeed the PFAS NEMP 2020 freshwater 99% protection level of 0.00023 µg/L

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CERTIFICATE OF ANALYSIS 249198

Client Details

Client	GHD Pty Ltd
Attention	Sean Sparrow
Address	GPO Box 2052, Adelaide, SA, 5001

Sample Details

Your Reference	**12516828**
Number of Samples	5 Water, 2 Sediment
Date samples received	18/08/2020
Date completed instructions received	18/08/2020

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	21/08/2020
Date of Issue	21/08/2020

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Results Approved By
Manju Dewendrage, Chemist
Phalak Inthakesone, Organics Development Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

PFAS in Water TRACE Short

Our Reference		249198-1	249198-2	249198-4	249198-6	249198-7
Your Reference	UNITS	6627-5944	DC02A	QC30	TB09	RB09
Date Sampled		17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.037	0.070	0.039	<0.0002	<0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	0.049	0.058	0.043	<0.0002	<0.0002
Perfluorooctanoic acid PFOA	µg/L	0.0046	0.0092	0.0047	<0.0002	<0.0002
6:2 FTS	µg/L	0.001	<0.0004	0.001	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	111	102	101	108	108
Surrogate $^{13}C_2$ *PFOA*	%	111	111	114	109	108
Extracted ISTD $^{18}O_2$ *PFHxS*	%	126	126	128	129	135
Extracted ISTD $^{13}C_4$ *PFOS*	%	64	61	64	78	111
Extracted ISTD $^{13}C_4$ *PFOA*	%	112	100	112	120	131
Extracted ISTD$^{13}C_2$ *6:2FTS*	%	#	#	#	177	194
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	178	#	189	118	#
Total Positive PFHxS & PFOS	µg/L	0.086	0.13	0.082	<0.0002	<0.0002
Total Positive PFOS & PFOA	µg/L	0.054	0.067	0.047	<0.0002	<0.0002
Total Positive PFAS	µg/L	0.092	0.14	0.088	<0.0002	<0.0002

PFAS in Soils Short			
Our Reference		249198-3	249198-5
Your Reference	UNITS	DC02AS	QC30S
Date Sampled		17/08/2020	17/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	21/08/2020	21/08/2020
Date analysed	-	21/08/2020	21/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/kg	1.2	1.0
Perfluorooctanesulfonic acid PFOS	µg/kg	34	26
Perfluorooctanoic acid PFOA	µg/kg	0.2	0.2
6:2 FTS	µg/kg	<0.1	<0.1
8:2 FTS	µg/kg	<0.2	<0.2
Surrogate $^{13}C_8$ *PFOS*	%	98	108
Surrogate $^{13}C_2$ *PFOA*	%	99	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	91	84
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	74
Extracted ISTD $^{13}C_4$ *PFOA*	%	91	85
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	122	116
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	188	162
Total Positive PFHxS & PFOS	µg/kg	35	27
Total Positive PFOS & PFOA	µg/kg	34	26
Total Positive PFAS	µg/kg	35	27

Moisture			
Our Reference		249198-3	249198-5
Your Reference	UNITS	DC02AS	QC30S
Date Sampled		17/08/2020	17/08/2020
Type of sample		Sediment	Sediment
Date prepared	-	21/08/2020	21/08/2020
Date analysed	-	24/08/2020	24/08/2020
Moisture	%	42	39

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. 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 Water TRACE Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	249198-2
Date prepared	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	1	0.037	0.039	5	86	87
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	1	0.049	0.043	13	96	76
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	1	0.0046	0.0048	4	96	102
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	0.001	0.001	0	103	115
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	1	<0.0004	<0.0004	0	106	70
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	103	1	111	100	10	101	101
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	103	1	111	113	2	101	110
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	119	1	126	118	7	111	120
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	81	1	64	65	2	83	61
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	119	1	112	118	5	107	108
Extracted ISTD$^{13}C_2$ *6:2FTS*	%		Org-029	142	1	#	#		112	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	108	1	178	183	3	87	#

QUALITY CONTROL: PFAS in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/08/2020	3	21/08/2020	21/08/2020		21/08/2020	[NT]
Date analysed	-			21/08/2020	3	21/08/2020	21/08/2020		21/08/2020	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-029	<0.1	3	1.2	1.2	0	93	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-029	<0.1	3	34	39	14	91	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-029	<0.1	3	0.2	0.2	0	97	[NT]
6:2 FTS	µg/kg	0.1	Org-029	<0.1	3	<0.1	<0.1	0	101	[NT]
8:2 FTS	µg/kg	0.2	Org-029	<0.2	3	<0.2	<0.2	0	95	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-029	100	3	98	97	1	94	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-029	105	3	99	104	5	103	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-029	110	3	91	102	11	109	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-029	100	3	88	90	2	107	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-029	105	3	91	92	1	105	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-029	114	3	122	152	22	102	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-029	128	3	188	#		124	[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.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2028971**
Client : **GHD PTY LTD**
Contact : GHD LAB REPORTS
Address : 2/11 VICTORIA SQUARE
ADELAIDE SA, AUSTRALIA 5000
Telephone : ----
Project : 12516828
Order number : 12516828
C-O-C number : ----
Sampler : SEAN SPARROW
Site :
Quote number : EN/005
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Angus Harding
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61 2 8784 8555
Date Samples Received : 18-Aug-2020 17:30
Date Analysis Commenced : 20-Aug-2020
Issue Date : 25-Aug-2020 12:06

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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, 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.
- EP231X: Poor matrix spike recoveries due to matrix interferences.
- 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: **SOIL** (Matrix: **SOIL)**			*Client sample ID*	**QC30AS**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028971-002**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**66.4**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0018**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0403**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0002**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0002**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0421**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0425**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**96.5**	----	----	----	----
13C8-PFOA	----	0.0002	%	**85.5**	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Client sample ID*	**QC30A**	**----**	**----**	**----**	**----**
			Client sampling date / time	17-Aug-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2028971-001**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	**0.008**	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	**0.047**	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	**0.063**	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	**0.006**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	**0.019**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	**0.002**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	**0.005**	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231P: PFAS Sums								
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	**0.110**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L	**0.150**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	**108**	----	----	----	----
13C8-PFOA	----	0.002	%	**103**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

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

Sub-Matrix: **WATER**

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

Appendix O – 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 extent, nature and concentrations of PFAS in various media on- and off-site has not been determined.

Step 2: Identify the principal study question

The objectives of this environmental investigation were to:

- To assess the nature and extent of PFAS impacts associated with historical site activities; on-site in groundwater, surface water, soil and on infrastructure (e.g. concrete slabs) as well as off-site in groundwater, surface water, sediment and sludge stockpiles.
- Identify and assess any potential risks to human health and the environment from PFAS site contamination arising from historical site activities, in the context of continued industrial use of the site and for relevant land uses for any affected off-site properties.
- Provide appropriate information to revise the conceptual site model (CSM) and to prepare a Remediation Options Assessment and Site Remediation Plan.

Step 3: Inputs to the decision

The following inputs are required for the decision:

- Quantitative and qualitative data gained through groundwater, surface water, sediment, soil, infrastructure (e.g. concrete slabs) and sludge stockpile sampling, analytical works and observations during investigations.
- Anecdotal information provided by CFS and DEM.

Step 4: Boundaries of the study

Spatial boundaries of this investigation were defined laterally by the extent of sampling locations as shown in Figure 4 to Figure 8 and vertically by the maximum depth of soil bores and groundwater wells. The temporal boundaries ranged from the date of acceptance of this work until the final day of fieldwork.

Step 5: Decision rules

Analytical data were assessed against the criteria adopted from relevant guidance or developed based on reference site data 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)	1/20 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
Duplicates (Inter-Laboratory)	1/20 samples	

Data quality indicator	Frequency	Data quality acceptance criteria
		sample, but below the PQL for the corresponding primary or duplicate sample, RPDs were not calculated.
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 10 samples or fewer	Laboratory duplicate samples should have RPD's within the NEPM acceptance criteria of ±30%. 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%.
Trip 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 20 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	Non PFAS organics (14 days) 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) Inorganics (6 months)
LORs appropriate and consistent	All samples	All samples
Comparability	All samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples

Data quality indicator	Frequency	Data quality acceptance criteria
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 samples	-
Data from critical samples is considered valid	-	Critical samples valid
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 CFS staff based on the historic use of PFAS containing firefighting foam on site. The sampling plan was based upon the Sampling and Analysis Quality Plan (GHD 2020c) 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 Custodies (COCs)
- Documenting the calibration and use of field equipment

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

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 2013 Schedule B2 requirements and included the analyses of the following types of samples in Table 2.

Table 2 Field QA/QC sample details

Field QA/QC sample type	Details
Intra-Laboratory Duplicate (Blind)	Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the primary project laboratory. Blind duplicates provide an indication of the analytical precision of the laboratory but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity.
Inter-Laboratory Duplicate (Split)	Inter-Laboratory Duplicate (Split) samples are two separate samples collected at the same location and analysed by two separate laboratories to 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.

GHD adopts the AS4482.1 acceptance criteria of 30% and 50% RPD for field duplicates of inorganics and organics, respectively. 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, trip blank and rinsate sample results and Relative Percentage Difference (RPD) calculations are presented 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 G.

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)
- 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 QA/QC sample	Details	
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.

Primary samples

A total of 218 primary samples were collected, submitted and analysed as part of the environmental investigation. A total of 70 field QC samples were collected and analysed as part of the investigation. The target frequency for analysis of field QC samples is one replicate pair per 20 primary samples (10%). In this instance, the frequency was acceptable.

Water

A total of 11 RPD exceedances were observed for the water samples as summarized in Table 1 below:

Table 1 – Summary of Water Sample RPD Exceedances

Primary Sample ID	Analyte	Primary Sample Value (µg/L)	QC Sample ID	QC Sample Value (µg/L)	RPD
DC05	Sum of PFHxS & PFOS	0.13	QC12 QC12	2.7 3.21	182 184
	PFAS (sum)	0.13	QC12	2.9	183
DC06	Sum of PFHxS & PFOS	0.24	QA16	0.14	53
	PFAS (sum)	0.24	QA16	0.14	53

DC08	Sum of PFHxS & PFOS	0.14	QA20A	0.24	53
	PFAS (sum)	0.14	QA20A	0.28	67
DC19	PFAS (sum)	0.029	QC29A	0.049	51
MBC02	PFAS (sum)	0.0090	QC28A	0.0210	80
DC17A	PFHxS	0.0064	QC29A	0.0120	61
MBC01_2A	PFOS	0.0041	QC35A	0.0070	52

The RPD non-conformances noted between the water primary and duplicate pairs were in most cases considered to be exaggerated by the low concentrations of PFAS being assesses. As such, the calculated RPD values are not considered to indicate integrity issues.

Where an RPD non-conformance was identified the highest results was adopted for the purpose of this assessment.

Sediment

A total of 23 RPD exceedances were observed for the sediment samples as summarized in Table 2 below:

Table 2 – Summary of Sediment Sample RPD Exceedances

Analyte	Primary Sample ID	Primary Sample Value (µg/kg)	QC Sample ID	QC Sample Value (µg/kg)	RPD
PFHxS	DC09S	1.3	QA25AS	0.0005	200
PFOS	DC05	7	QC11	3.5	67
	DC05	7	QC11A	4.3	48
	Creek_6	160	QC13	290	58
	Creek_6	160	QC13A	500	103
	DC09S	22	QA25S	37	51
	DC09S	22	QA25AS	0.0142	200
PFOA	Creek_6	3.2	QC13	5.1	46
	Creek_6	3.2	QC13A	5.5	53
PFOS	DC05	7.3	QC11	3.5	70
	DC05	7.3	QC11A	4.3	52
	Creek_6	210	QC13	340	47
	Creek_6	210	QC13A	540	88
	DC09S	23	QA25S	38	49

	DC09A	23	QA25AS	0.0147	200
PFOS + PFOA	DC05	7.0	QC11	3.5	67
	Creek_6	160	QC13	300	61
	Creek_6	160	QC13A	510	104
	DC09S	22	QA25S	37	51
PFAS	DC05	7.3	QC11	3.5	70
	Creek_6	210	QC13	350	50
	Creek_6	210	QC13A	540	88
	DC09S	24	QA25S	39	48

For the majority of the sediment exceedances the discrepancies are considered to be due to the heterogeneous nature of the samples. Where RPD exceedances are derived from values which are low this is due to the low concentrations of the reported analytes exaggerating the RPD. As such, the calculated RPD values are not considered an indicator of poor integrity of results.

Where an RPD non-conformance was identified the highest results was adopted for the purpose of this assessment.

Soil

A total of 8 RPD exceedances were observed for the soil samples as summarized in Table 3 below:

Table 3 – Summary of Soil Sample RPD Exceedances

Analyte	Primary Sample ID	Primary Sample Value (µg/kg)	QC Sample ID	QC Sample Value (µg/kg)	RPD
PFOS	SB04_0-0.2	19	QA05	13	38
	SB04_0-0.2	19	QA05A	28	38
PFOA	SB04_0-0.2	2	QA05A	3.1	43
8:2 FTS	SB04_0-0.2	2.9	QA05A	10.8	115
PFHxS + PFOS	SB04_0-0.2	24	QA05	15	46
	SB04_0-0.2	24	QA05A	32.4	30
PFOS + PFOA	SB04_0-0.2	21	QA05	14	40
PFAS	SB04_0-0.2	29	QA05	18	47

All of the soil RPD exceedances are between the same parent sample and two QC samples. The RPD discrepancies are considered to be due to the heterogeneous nature of the sample. Where a higher value was reported for a QC result, this was adopted for reporting purposes. These exceedances are therefore not considered to impact the integrity of the results.

Where an RPD non-conformance was identified the highest results was adopted for the purpose of this assessment.

Rinsate

Nineteen rinsate samples were analysed as part of this investigation. No sample exceeded the laboratory LOR for the analytes tested, therefore indicating that there was no evidence of cross contamination during sample collection.

Field Blank

Eight (8) field blank samples were analysed as part of this investigation. No sample exceeded the laboratory LOR for the analytes tested, therefore indicating that there was no evidence of cross contamination during sample collection.

Trip Blank

Ten (10) trip blank samples were analysed as part of this investigation. No sample exceeded the laboratory LOR for the analytes tested, therefore indicating that there was no evidence of cross contamination during sample collection.

Recommended holding times (RHT) compliance

RHT 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 RHTs except for the two non-compliances reported by ALS for analysis of the interlaboratory duplicate samples:

- extraction for moisture content of soil sample QC02a exceeded holding times of 14 days
- extraction for pH analysis of water sample QA21a exceeded holding times of one day.

The above exceedances are not considered to be significant to impact the integrity of the analytical results.

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 K. This data has met specified requirements for this investigation.

Overall Assessment of Data Quality

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

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