Bulls Water Supply PFAS Investigation

October 2019

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Bulls Water Supply PFAS Investigation

Horizons Regional Council

Bulls PFAS Report - Final

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Executive Summary

Background

This report presents a summary to date of investigations being undertaken by Jacobs into the source of per- and poly-fluoroalkyl substances (PFAS) present in groundwater abstracted by the Bulls township shallow water supply wells. It follows the detection of PFAS in four of the shallow public supply wells sampled in 2018 by New Zealand Defence Force (NZDF) as part of PFAS investigations at Royal New Zealand Air Force (RNZAF) Base Ohakea. Concentrations of PFAS in the groundwater were less than the interim Ministry of Health drinking water guidelines.

Jacobs investigations comprised desktop and site walkover identification of land use activities in close proximity to Bulls that could involve the storage, use or disposal of PFAS containing products in relation to the Bulls well field, assessment of hydrogeological pathways to the well field, and water sampling with analysis for PFAS from targeted locations, to further understand the source of PFAS in the water supply wells.

PFAS Risk Profile

PFAS is a large family of manufactured chemicals which have been used in many different types of manufacturing since the 1940s, and in fire-fighting foams since the 1960s. PFOS (perfluorooctane sulfonic acid) and PFOA (perfluorooctanoic acid) are members of the PFAS family of chemicals. Importing and manufacturing fire-fighting foams containing PFOS or PFOA was effectively prohibited in New Zealand in 2006 by the Fire-Fighting Chemicals Group Standard. Both PFOS and PFOA are listed as under Stockholm Convention as persistent organic pollutants (POP). Other PFAS chemicals, including perfluorohexane sulphonate (PFHxS), are under investigation.

The release of PFAS compounds into the environment is an emerging concern globally, because these chemicals are highly persistent, bioaccumulate, can move long distances in the environment, and are linked to adverse impacts on some plants and animals.

PFAS compounds can accumulate in fish, and in the bodies of animals, particularly those that breathe air and consume fish or benthic organisms (such as dolphins, whales, seals, sea birds, and polar bears), increasing significantly in the blood and organs of animals higher up in the food chain. Laboratory studies on animals have identified negative effects on their reproductive, developmental and other systems. Because of the persistence of these chemicals, environmental exposures can occur over long time periods.

Health advice from the New Zealand Ministry of Health remains that there is no acute health risk from exposure to PFAS compounds. There is currently no consistent evidence that environmental exposures to PFAS causes adverse human health effects. Drinking water standards for PFOS + PFHxS of 0.07 µg/L and PFOA of 0.56 µg/L have been adopted in New Zealand.

Environmental Setting

The Bulls area is underlain by Late Pleistocene river deposits which form a series of paleo-river terraces that step down to the current course of the Rangitīkei River. Regional groundwater flow is expected to be west and southwest towards the coast, with local influence close to the Rangitīkei River.

Bulls' productions Wells 1 to 4 are screened within unconfined Holocene river terrace deposits (gravels) associated with the current course of the Rangitīkei River. Groundwater lies at depths between 3 m and 4 m below ground level (bgl) at a similar elevation to water in the Rangitīkei River. Well 5 appears to be completed within an older terrace and is in a confined aquifer. The maximum authorised abstraction rate from the well field is 1,700 m^3/day (combined) for the four shallow wells (Wells 1 to 4) and 1,125 m^3/day for the deep well (Well 5). The plant normally operates between 1,200 and 1,600 m^3/day with two duty bores. Groundwater treatment includes rapid sand filtration, chlorination, UV disinfection, aeration and backwash, with pH and turbidity monitoring and control prior to distribution throughout Bulls via a reticulated pipe network.

PFAS Source Investigations

The main potential sources of PFAS contamination in close proximity to the Bulls well field identified include Base Ohakea, and three potential sources within Bulls, comprising the Bulls Fire Station (storage and use of PFOS containing aqueous film forming foams (AFFF)), the former Bulls (Rangitīkei) Landfill (disposal of PFAS contaminated wastes) and the waste water treatment plant (WWTP) effluent ponds (from influent trade waste contaminated with PFAS). The site of the Skyhawk crash that occurred in 1996, also considered as potential source of the PFAS, has been investigated by NZDF and now seems unlikely to a PFAS source for the Bulls well field. A former Feltex Carpets wool scouring plant was also identified on the eastern side of the Rangitīkei River (now Kakariki Proteins) some 7.8 km upgradient of the Bulls well field.

Analytical results for groundwater samples targeting the potential source areas indicate the widespread presence of PFAS in shallow groundwater from beneath Bulls township to the Rangitīkei River and extending from at least the southern edge of the former Bulls landfill to the WWTP, a distance of about 2 km. The groundwater contains concentrations of PFOS & PFHxS between approximately 0.01 µg/L and 0.02 µg/L. The observed concentrations are low in comparison to concentrations detected in shallow groundwater within and immediately down gradient of Base Ohakea and are less than the adopted drinking water standards for PFOS & PFHxS of 0.07 µg/L and PFOA of 0.56 µg/L.

Conceptual Site Model

The analytical results for PFAS clearly show the presence PFAS compounds in groundwater associated with older formulations of AFFF that contained PFOS. PFAS in AFFF is therefore considered to be the main contaminant source.

An updated conceptual site model (CSM) has been developed which shows the area is underlain by a shallow unconfined aquifer. The Bulls Fire Station and the former Bulls Landfill overlie the shallow aquifer and are hydraulically upgradient of the Bulls well field, with potentially complete PFAS migration pathways to the well field. Drawdown during pumping to the west of the Bulls field is also shown as a potential pathway for migration of PFAS across the Rangitīkei River. No viable pathway for PFAS migration from Base Ohakea or the Bulls well field to the former Bulls Landfill has been identified.

Effluent in the RDC treatment ponds appears to be perched above the shallow aquifer, indicating the potential for leakage of impacted effluent to shallow groundwater.

An upward hydraulic gradient is assumed for the confined aquifer. Maintenance of artesian conditions in the aquifer during pumping is unknown, indicating the potential for contamination of the deeper aquifer by shallow groundwater during pumping.

Recommendations

The following additional works are recommended:

- Further assessment of Base Ohakea as a PFAS source is recommended, involving the compilation of a hydrogeological conceptual model based on lithological data for bores supplied by HRC using Leapfrog™ software and clarification in relation to pumping conditions and river flows assumed in the Base Ohakea groundwater flow model. These data may assist with further understanding hydraulic connectivity of groundwater in the shallow Holocene terrace gravels on the northern and southern side of the Rangitīkei River near the Bulls well field, and the potential for PFAS impacted groundwater to be drawn into the Bulls well field from PFAS sources at Base Ohakea.
- It appers that no further useful information is currently available from FENZ in relation to PFAS containing foam storage and management at the Bull fire station. It is recommended that FENZ be provided with the findings of this investigation.
- If possible, records of the operational history of the Bulls Landfill, including the origin and types of waste, should be obtained. This should include determination of whether the landfill accepted waste from Base

Ohakea, the Skyhawk crash site, the former Feltex Carpets wool scouring operations at Halcombe or sludge from the Bulls WWTP.

- Installation of groundwater monitoring wells at the toe and within the landfill should be considered.
- A review the construction of the WWTP ponds is recommended to assess likelihood of loses to groundwater.
- Sludge disposal practises for the WWTP ponds should also be reviewed to ensure appropriate management of potentially PFAS contaminated sludge
- Sample the discharge from the Kakariki Proteins effluent ponds, with analysis for PFAS.

Important note about your report

The sole purpose of this report prepared by Jacobs New Zealand Limited (Jacobs) is to support Horizons Regional Council to understand the source of per-and poly-fluoroalkyl Substances (PFAS) in the Bulls public water supply. The contents of the report are in accordance with the scope of services detailed in the terms of engagement between Jacobs and Horizons Regional Council (the Client).

In preparing this report, Jacobs has relied upon and presumed accurate, all information provided by the Client and any third party. Unless otherwise stated in this report, Jacobs has not attempted to verify the accuracy or completeness of any such information and Jacobs accepts no liability to the client and/or any third party for any loss and/or damage incurred as a result of any inaccurate or incomplete information.

It is imperative to note that the report only considers the likelihood of the presence of contaminants at the site at the date of the assessment. Any decisions based on the findings of the report must take into account any subsequent changes in site conditions and/or developments in legislative and regulatory requirements. Jacobs accepts no liability to the Client or any third party for any loss and/or damage incurred as a result of a change in the site conditions and/or regulatory/legislative framework since the date of the report.

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1. Introduction

1.1 Scope of Report

This report has been prepared by Jacobs New Zealand Limited (Jacobs) under contract to Horizons Regional Council (HRC). It presents a summary of investigations undertaken by Jacobs into the source of per- and poly-fluoroalkyl substances (PFAS) present in groundwater abstracted by the Bulls township water supply wells. This report updates the Progress Summary Report issued to Horizons in August 2018[1].

1.2 Background

New Zealand Defence Force (NZDF) has recently undertaken investigations of soil and water contamination by PFAS associated with the use of Aqueous Film Forming Foams (AFFF) at Royal New Zealand Airforce (RNZAF) Base Ohakea (Base Ohakea). Recent investigations have included three Stages (A, B and C) of sampling of surface waters and groundwater bores and wells within Base Ohakea and on private land adjacent to Base Ohakea. Stage A, also referred to as Stage 1, was undertaken in December 2017. Stage B and C monitoring events were undertaken in February and May 2018, respectively. The results of these monitoring events together with other on-base and off base sampling and hydrogeological assessments, have been used by NZDF to establish likely sources of PFAS within Base Ohakea and the likely extent of PFAS in groundwater. This is interpreted as a PFAS plume originating from sources within Base Ohakea, impacting shallow groundwater below an extensive area on the southern and western sides of the Rangitīkei River. The plume as interpreted by NZDF does not extend across the Rangitīkei River (PDF 2018)[2].

At the request of HRC, Rangitīkei District Council (RDC) and Manawatū District Council (MDC) (Councils), Stage B and C monitoring events included sampling of the five production wells currently used to provide reticulated water to Bulls. Sampling of the Bulls water supply was also undertaken by NZDF in March 2018. These wells lie on the northern side of the Rangitīkei River and are not part of the PFAS plume extent interpreted by NZDF. Sampling included reticulated water from a tap at Bulls Domain.

PFAS was detected by NZDF in four of the 'shallow' production well samples and the tap water sample, demonstrating PFAS contamination of groundwater on the northern side of the Rangitīkei River. Concentrations of PFAS in the groundwater were less than the interim Ministry of Health drinking water guidelines. No PFAS was detected in the deeper production well. The source of the PFAS was uncertain, however, NZDF agreed to assist Councils with determining the source of the PFAS. Part of that assistance involved testing groundwater in the vicinity of the site of the Skyhawk crash that occurred in 1996, some 9 km the north of Bulls, to determine whether firefighting foam used at the crash site could be a source of the PFAS in the Bulls water supply.

1.3 Risk Profile

PFAS is a large family of manufactured chemicals which have been used in many different types of manufacturing since the 1940s, and in fire-fighting foams since the 1960s. PFOS (perfluorooctane sulfonic acid) and PFOA (perfluorooctanoic acid) are members of the PFAS family of chemicals. Importing and manufacturing fire-fighting foams containing PFOS or PFOA was effectively prohibited in New Zealand in 2006 by the Fire-Fighting Chemicals Group Standard. Both PFOS and PFOA are listed as under Stockholm Convention as persistent organic pollutants (POP). Other PFAS chemicals, including perfluorohexane sulphonate (PFHxS), are under investigation. (EPA, 2019).

The release of PFAS compounds into the environment is an emerging concern globally, because these chemicals are highly persistent, bioaccumulate, can move long distances in the environment, and are linked to adverse impacts on some plants and animals (DEE, 2019).

PFAS compounds can accumulate in fish, and in the bodies of animals, particularly those that breathe air and consume fish or benthic organisms (such as dolphins, whales, seals, sea birds, and polar bears), increasing

[1] Jacobs 2018. Bulls Water Supply PFAS Investigation Progress Summary. Report prepared for Horizons Regional Council by Jacobs New Zealand Limited, 13 August 2018, ref IZ112200-003-NG-RPT-0001-00

[2] Pattle Delamore Partners 2018. NZDF PFAS Investigation Summary Report: RNZAF Base Ohakea Stage C –3 June 2018

significantly in the blood and organs of animals higher up in the food chain (DEE, 2019). Laboratory studies on animals have identified negative effects on their reproductive, developmental and other systems. Because of the persistence of these chemicals, environmental exposures can occur over long time periods.

Health advice from the New Zealand Ministry of Health remains that there is no acute health risk from exposure to PFAS compounds. There is currently no consistent evidence that environmental exposures to PFAS causes adverse human health effects. Drinking water standards for PFOS + PFHxS of 0.07 µg/L and PFOA of 0.56 µg/L have been adopted in New Zealand (MFE, 2019).

1.4 Objective

The overall objective of the investigations by Jacobs is to provide independent assistance to Councils to identify the sources of the PFAS contaminants detected in the Bulls water supply bores.

1.5 Scope of Work

Jacobs investigations comprised the following:

1) Desktop and site walkover identification of land use activities that could involve the storage, use or disposal of PFAS containing products in relation to the Bulls well field.
2) Site walkover inspection of the Bulls well field and surrounding areas undertaken on 15 June 2018.
3) Review of hydrological and hydrogeological information to inform a hydrogeological conceptual site model to examine pathways from potential PFAS source areas to the Bulls well field.
4) Identification of potential groundwater and surface water monitoring locations close to the Bulls well field that could be sampled to provide confirmatory and additional information on the presence and distribution of PFAS.
5) Water sampling with analysis for PFAS from targeted locations in July, September and November 2018.
6) Preparation of an interim summary report (August 2018).
7) Presentation of the interim summary report findings to HRC (November 2018).
8) Preparation of this Draft Final Report.

1.6 Information Sources

The information used to inform this report includes primary data collected by Jacobs and secondary information in the form of reports or data provided mainly by HRC or obtained by Jacobs directly from publically available sources. HRC supplied data included memos and analytical reports prepared for NZDF by Pattle Delamore Partners Ltd (PDP), some of which were obtained under the Official Information Act (OIA) and which contained redactions, and other information supplied to HRC directly by NZDF without redactions. Key information sources referenced in the text are footnoted. A bibliography is also presented in Section 7.

1.7 Report Structure

The report comprises the following structure:

- Section 2 presents a summary of the hydrogeological setting of Bulls well field.
- Section 3 presents results of a desk top based assessment of possible sources of the PFAS detected in the Bulls well field.
- Section 4 presents the sampling and analysis undertaken by Jacobs to determine the level and extent of PFAS impact and characterise potential PFAS sources close to the Bulls well field.
- Section 5 presents an initial conceptual site model.
- Conclusions and recommendations are presented in Section 6.

- Section 7 presents a listing of key reports (mainly unpublished) or published information used during the preparation of the report.
- Figures are presented in **Appendix A**. Other supporting information is presented in **Appendices B - G**.

2. Hydrogeological Setting

2.1 Regional Setting

Townsend et al (2008)[3] describe the Bulls area as underlain by Late Pleistocene river deposits comprising poorly to moderately sorted gravel with minor sand and silt underlying terraces and including minor fan deposits and loess. In the vicinity of Bulls, these alluvial deposits form a series of paleo river terraces that step down to the current course of the Rangitīkei River.

Detailed assessment of the hydrogeological setting is provided in PDP (2017a)[4], which describes four hydrogeological units:

- Unit 1: Low permeability greywacke basement rocks, which outcrop along the Ruahine ranges
- Unit 2: Marine terrace deposits, generally comprising low permeability fine grained and compacted strata, also containing some coarser grained more permeable units
- Unit 3: Marginal marine and terrestrial deposits of variable composition
- Unit 4: More recent terrestrial deposits

These units are shown on **Figure 2.1** (PDP 2017a).

Units 3 and 4 equate to geological classifications Q2 and Q1 respectively (Townsend et al 2008) and comprise heterogeneous deposits forming permeable and high yielding aquifers. Unit 3 deposits are generally restricted to the elevated river terraces either side of the Rangitīkei River, which become progressively older away from the river. Unit 4 deposits overlie Unit 3 and occur along much of the current course of the Rangitīkei River.

Regional shallow (<20 m depth) groundwater flow is to the south and southwest as shown in **Figure 2.2** (PDP, 2017a). The groundwater contours suggest that the Rangitīkei River gains groundwater in reaches upstream of Bulls. Groundwater-surface water interaction is not well defined by groundwater contours south of Bulls; however, recent modelling at Ohakea undertaken for NZDF (PDP 2017b)[5] indicates that groundwater from Ohakea discharges to surface waters, including the Rangitīkei River, with groundwater transit times of between 12 and 52 years.

[3] Townsend, D, Vonk, A and Kamp PJJ (compilers) 2008. Geology of the Taranaki Area. 1:250,000. GNS Science, 1:250,000 geological map 7.
[4] Pattle Delamore Partners 2017a. Santoft Groundwater Model Report. Report prepared for Horizons Regional Council ref C02596508, 6 October 2017.
[5] Pattle Delamore Partners 2017b. NZDF Ohakea – Groundwater Assessment and PFAS Fate Prediction. Report prepared for NZDF ref A02744103, 10 November 2017

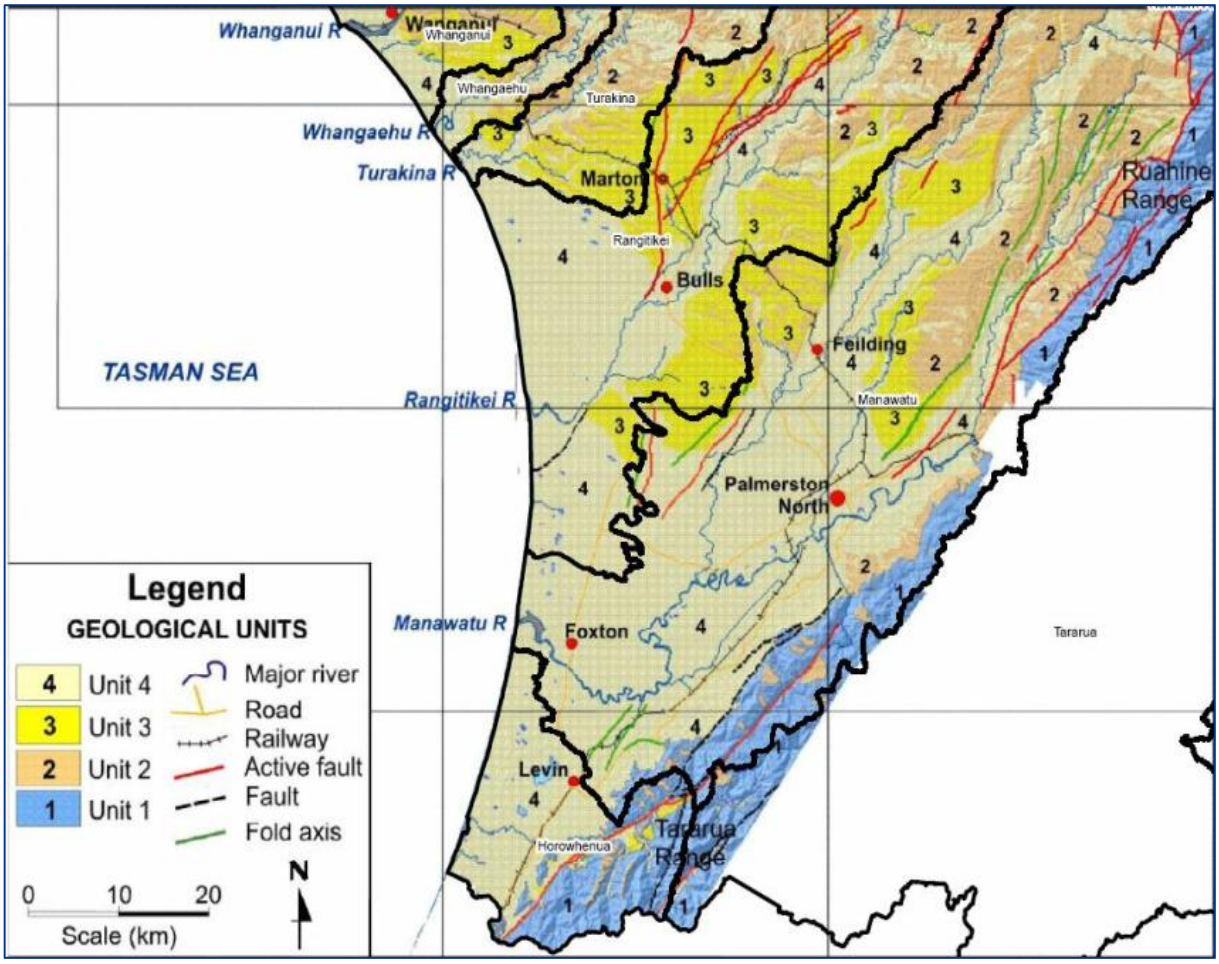

Figure 2.1: Regional Geology (from PDP, 2017a)

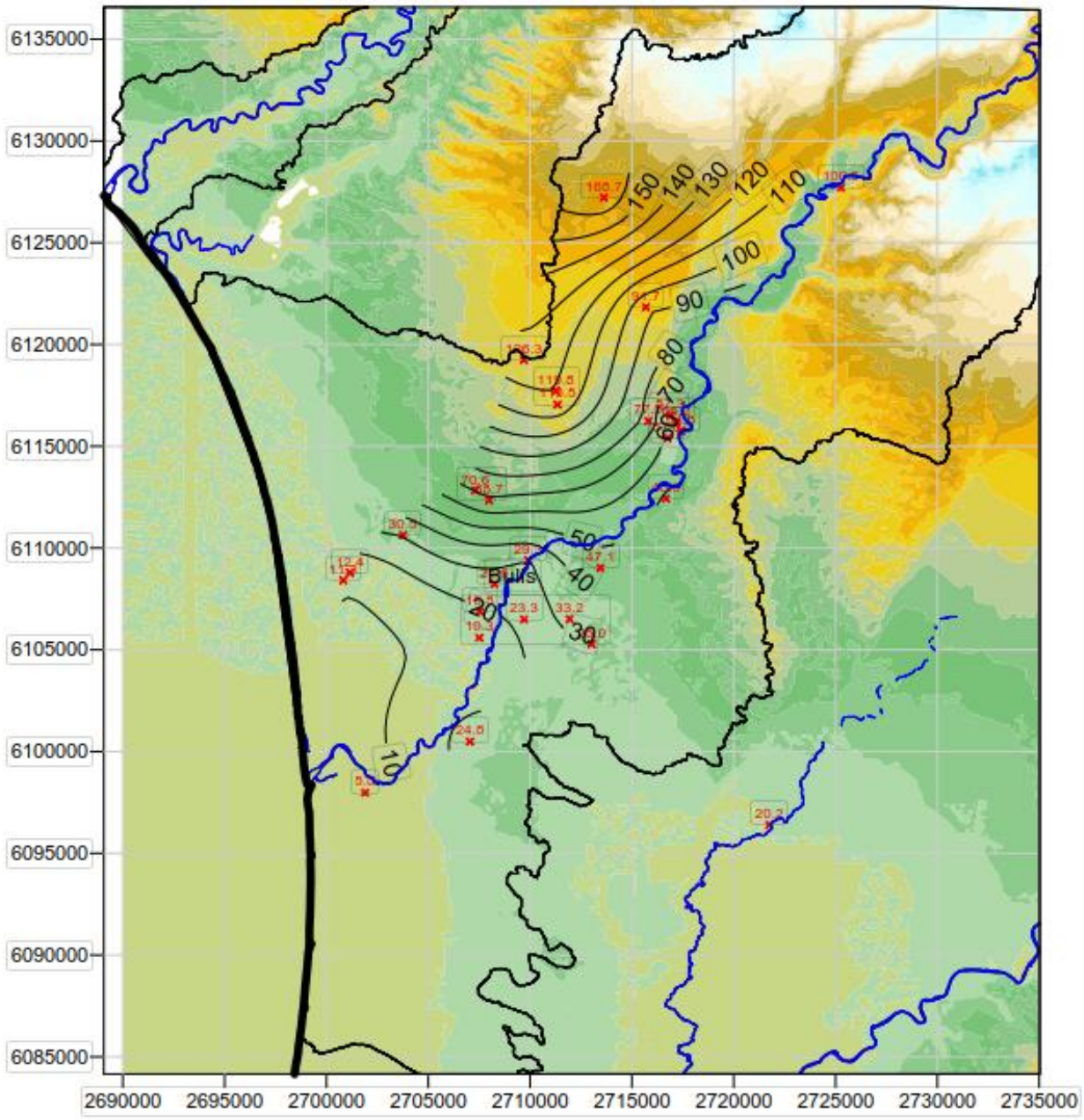

Figure 2.2: Regional Shallow Groundwater Flow (from PDP, 2017a)

2.2 Description of the Bulls Well Field

The Bulls well field comprises five production wells located close to State Highway (SH) 3, 100 m to 200 m north of the Rangitīkei River, as shown in **Figure 1** (**Appendix A**). Bulls towns centre lies approximately 1.2 km to the north; Base Ohakea is located on the southern side of the Rangitīkei River approximately 1 km southwest of the well field.

Summary details of the wells are presented in **Table 2.1**.

Table 2.1: Production Wells Summary Details (from HRC records)

Well ID (HRC)	Well Name (RDC)	NZMG E	NZMG N	Date Drilled	Completed Depth (m bgl)	Screen Interval (m)	Lithology of screened section	Authorised Abstraction (m^3/day)
313017	Well 1	2713235	6110517	Sept 1985	9.5	4.5-9.5	Gravel	1700*
313019	Well 2	2713282	6110438	Sept 1985	10	No details	Gravel	1700*
313039	Well 3	2713326	6110495	Jul 1994	11.7	8.7-11.7	Gravel	1700*
313069	Well 5	2713040	6110630	May 2006	31.6	25.6-31.6	Gravel	1125
313093	Well 4	2713217	6110574	Dec 2014	12	8.5-11.5	Gravel	1700*

* Note: Consented abstraction across all 4 shallow bores is 1,700 m^3/day

Photographs of the well headworks (Wells 1 to 4) are presented in **Appendix B**.

Wells 1 to 4 are completed within unconfined Holocene river deposits (gravels) associated with the Rangitīkei River, as shown in **Figure 2 (Appendix A)**. The upper few meters at each well generally comprises 'clay, silt or top soil'. These soils equate to Unit 4 (Q1) described by PDP (2017a). Groundwater lies at depths between 3 m to 4 m below ground level (bgl) and is reported to be at a similar elevation to water in the Rangitīkei River. Well 5 appears to be completed within an older terrace gravel, possibly equating to Unit 3 (Q3) described by PDP (2017a). The deeper well appears to be confined by peat and silt horizons. The original bore (the Well), drilled in 1960, now unused, is located at Well 4.

The well field is operated by RDC and MDC. The maximum authorised abstraction rate from the well field is 1,700 m^3/day combined for the four shallow wells (Wells 1 to 4) and 1,125 m^3/day for the deep well (Well 5). It normally operates between 1,200 and 1,600 m^3/day with two duty bores. Well selection and use is based on demand. Well 5 is not currently preferred owing to lower yield and relatively elevated iron and manganese. Recent changes have been made to the treatment process to account for this.

Groundwater is treated at the water treatment plant (WTP) located some 80 m north of Well 4 and is distributed throughout Bulls via a reticulated pipe network, as shown in **Figure 2.3**. It was reported to Jacobs that the neighbouring Riverlands/ANZCO meat processing plant utilises approximately 50% of the treated water as process water. Treatment at the WTP includes rapid sand filtration, chlorination, UV disinfection, aeration and backwash, with pH and turbidity monitoring and control[6]. The operator reported that turbidity in produced groundwater was low but sometimes increased during high flows in the Rangitīkei River, indicating some degree of hydraulic connection with the River.

[6] https://www.Rangitīkei.govt.nz/files/general/LTP-2015-2025-Asset-Management-Plan/Asset-Management-Plan-RDC-3-Waters-2015-03-27.pdf

Figure 2.3: Water Reticulation Network (from Rangitīkei District Council Asset Management Plan 3 Waters, 2014)

3. Assessment of Potential Sources of PFAS

Initial investigations by Jacobs identified three potential sources of PFAS contamination of the Bulls well field which required further assessment:

- Base Ohakea.
- Land use related sources in the vicinity of the Bulls well field.
- The Skyhawk crash site located some 9 km north of the Bulls well field.

3.1 Base Ohakea

3.1.1 Plume Configuration

There are established sources of PFAS on Base Ohakea that have impacted surface water and shallow groundwater, resulting in a PFAS plume on the southern side of the Rangitīkei River extending several km to the south and southwest of Base Ohakea in the direction of shallow groundwater flow. Impact in groundwater appears to be currently restricted to the shallow Holocene gravel aquifer, although drawdown to deeper aquifers by pumping is considered possible (PDP 2017b). Impact has also been recorded in wells upgradient of the established PFAS sources, including groundwater in the Base Ohakea water supply well (well 313096; also labelled WS2 by NZDF) which lies on the southern side of the Rangitīkei River some 840 m south west of the Bulls well field. The current conceptual site (CSM) developed for Base Ohakea by PDP shows hydraulic continuity between the shallow aquifer and the Rangitīkei River (PDP 2018a). The CSM does not extend across the Rangitīkei River.

3.1.2 Relationship to Bulls Well Field

The shallow Holocene gravel aquifer is the aquifer exploited by the four shallow wells within the Bulls well field. These wells, which have all tested positive for PFAS contaminants, are completed at a similar depth to the impacted Ohakea water supply well (313096) of between about 9.5 m and 11 m deep.

Potential primary or secondary contaminant source areas on Base Ohakea appear to lie about 1 km south west of the well field, and also to the south of the Rangitīkei River. Regionally, shallow groundwater is reported to flow to the southwest, placing the source areas at Base Ohakea hydraulically downgradient of the Bulls well field. The Rangitīkei River is also generally considered to be gaining in the vicinity of the Bulls well field, implying limited or no hydraulic connection between groundwater in Holocene deposits north and south of the River close to the well field.

The groundwater flow model developed for Base Ohakea (PDP 2017b) does not indicate hydraulic connection between Base Ohakea and the Bulls well field. It is stated that the flow model was run in steady mode including groundwater abstraction from consented bores at their annualised pumping rate based on their consent allocation and an assumed pumping rate of 35 m^3/day for other private bores. The modelling included groundwater fate and flow velocity predictions using particle tracking. It is unclear from the redacted version of the report if the modelling accounted for pumping from the Bulls well field or the shallow groundwater supply well at Base Ohakea.

Jacobs has also undertaken an initial assessment of the potential for hydraulic connectivity between shallow groundwater on the northern and southern site of the Rangitīkei River in the vicinity of the Bulls well field. The assessment indicates that the radius of influence (drawdown) as a result of pumping the four shallow wells within the Bulls well field is expected to be within a radius of 150 m of the wells[7]. The radius of influence around the deeper well (Well 5), which is in a confined aquifer, is estimated to be less than 1 m at a distance of 2 km from the pumped well and less than 0.25 m at a distance of 5 km (Zarour 2006)[8]. Similarly, in the adjacent 40 m

[7] Horizons Regional Council, 1997. Decision on Application 6903 (ATH-1997004447.00)
[8] Horizons Regional Council, 2006. Decision on Application 103868 (ATH-ATH-1997004447.00)

deep confined Riverlands/ANZCO well (313035), estimated drawdown is approximately 2 m at 2 km distance from the well and around 1 m at 5 km distance (PDP 2004)[9].

These findings indicate that direct hydraulic connection between the Bulls well field and PFAS source areas within Base Ohakea is unlikely, even under pumping conditions at the well field. However, uncertainty remains and further assessment is required.

At this stage, Base Ohakea remains a potential source of PFAS for the Bulls well field.

3.2 Land Use Related Sources in the Vicinity of the Bulls Well Field

'Table 1 Potential Sources of PFAS' taken from *Per and Poly-Fluorinated Alkyl substances (PFAS): Advice for councils* prepared by Ministry for the Environment (MfE) in 2018 is presented in **Table 3.1**. The table lists potential sources of PFAS releases to the New Zealand environment based on the manufacturing and other sectors. This information has been used as the basis for identifying industries and activities within 1-2 km of the Bulls well field that could contribute to the PFAS detected in the Bulls water supply wells.

Table 3.1: Table 1: Potential sources of PFAS (MfE 2018)

Industry and/or activity Sector (HAIL category)	Example of uses
Fire-fighting - Events and Training (F1. Airports where there has been use of firefighting foams on a regular basis. A13: Petroleum or petrochemical industries F5. Port activities)	Commercial airports, Firefighting training centres, Oil terminal and depots, chemical plants and Ports, fire suppressant systems using Class B Fluorine containing foams
Metal Plating & Etching (D3. Metal treatment or coating)	Corrosion prevention, mechanical wear reduction, aesthetic enhancement, surfactant, wetting agent/fume suppressant for chrome, copper, nickel and tin electroplating, and post-plating cleaner.
Textiles, Upholstery & Leather (A16. Skin or wool processing)	Factory or consumer-applied coatings to repel water, oil, and stains. Applications include protective clothing and outerwear, umbrellas, tents, sails, architectural materials, carpets, and upholstery.
Paper Products (A15. Printing)	Surface coatings to repel grease and moisture. Uses include non-food paper packaging (for example, cardboard, carbonless forms, masking papers) and food-contact materials (for example, pizza boxes, fast food wrappers, microwave popcorn bags, baking papers, pet food bags).
Wire Manufacturing (D3. Metal treatment or coating)	Coating and insulation.
Industrial Surfactants, Resins, Moulds, Plastics (A2. Chemical manufacture, formulation or bulk storage A17. Storage tanks or drums for fuel, chemicals or liquid waste · A13: Petroleum or petrochemical industries F8. Transport depots or yards)	Manufacture of plastics and fluoropolymers, rubber, and compression mould release coatings; plumbing fluxing agents; fluoroplastic coatings, composite resins, and flame retardant for polycarbonate.
Photolithography, Semiconductor Industry (A15. Printing B3. Electronics commercial manufacturing, reconditioning or recycling)	Photoresists, top anti-reflective coatings, bottom anti-reflective coatings, and etchants, with other uses including surfactants, wetting agents, Photo imaging-X-ray films and photo-acid generation.

[9] Pattle Delamore Partners 2004. Increase in Groundwater Abstraction: Assessment of Environmental Effects. Prepared for Riverlands Manawatū Limited Ref AJ94708, January 2004

Waste Disposal (G3. Landfill sites)	Landfills that received soil and material from the other PFAS activities listed.
Waste Water Treatment Plants (G6. Waste recycling or waste or wastewater treatment)	Sewage treatment facilities that received trade waste from industries that use PFAS
Bio-solids (G6. Waste recycling or waste or wastewater treatment)	The discharge of PFAS contaminated bio-solids to land as soil conditioner.
Aircraft Maintenance Facilities	Used in aviation hydraulic fluids
Pesticide manufacturing or formulation (A12. Pesticide manufacture)	Pesticide manufacture, (one product – lithium salt of PFOS, used as ant bait, so not widespread use in pesticides).

These potential PFAS sources were investigated mainly through the review of HRC supplied data and internet-based land use searches, including information on reticulated waste water and stormwater services within Bulls[10], and consented discharges to land (**Appendix C**). A walkover inspection of the well field and surrounding areas was also undertaken on 15 June 2018. The inspection focussed on activities upstream and adjacent to the Bulls well field.

Identified activities and industries are listed in **Table 3.2** together with an assessment of the likelihood of PFAS use or presence based on information in **Table 3.1**.

Table 3.2: Potential PFAS Sources Bulls (based on recent or current land use)

Industry	Approx. Distance from Well 4	Main Activity	Potential source of PFAS (MfE 2018)
Water Treatment Plant (SH3)	80 m N	Potable water treatment	No
Bulls Motel and Holiday Park (SH3)	150 m NNE	Accommodation	No
Keith Hay Homes (SH3)	250 m N	House construction/storage	No
Britton House Movers (SH3)	400 m N	Haulage-house moving	No
Road Runner Manufacturing (NZ) (SH3)	550 m N	Fabrication using aluminium and stainless steel	Unlikely
Central House Movers (SH3)	900 m N	Haulage-house moving	No
BP NZ service station SH3	1000 m N	Retail fuels	Unlikely
Mobil NZ service station (SH3)	1050 m N	Retail fuels	Unlikely based on MfE (2018). However, the site has a carwash and car waxes have been identified as potential sources of PFOS

[10] https://www.Rangitīkei.govt.nz/services/gis

Industry	Approx. Distance from Well 4	Main Activity	Potential source of PFAS (MfE 2018)
Bulls Volunteer Fire Station (1-9 Hammond St)	1250 m NNW	Fire and Emergency base with vehicles	Yes – potential storage of AFFF and equipment decontamination
Bulls Waste Water Treatment Plant (WWTP)	700 m W	Waste treatment via screening and ponds	Yes – potential for discharge of PFAS impacted trade waste to WWTP
Bullock Quarry (Fulton Hogan)	530 m W	Gravel quarry (previous use included concrete batching and sludge disposal)	No
Riverlands/ANZCO Manawatū Ltd	1090 m W	Meat processing (including own waste water treat plant and Biosolids disposal)	Unlikely - one off spray irrigation application onto adjacent farmland during plant upgrade. Consent expired 2010 in
Former Bulls (Rangitīkei) landfill	1540 m NE	Unlined landfill closed ~1996	Yes – potential disposal of PFAS impacted waste including used AFFF containers and contaminated soil
Landfill Transfer Station (21 Watson St)	1620 m NE	Waste transfer station	No
Steel Craft (21 Watson St)	1620 m NE	Fabrication using stainless steel	Unlikely
GJH Fibreglass (Watson St)	1620 m NE	Fibreglass products manufacture	Possible – PFAS products used in some fibreglass manufacturing processes
Advanced PVC Windows (19A Watson St)	1620 m NE	PVC door and window installers	No
Regal Haulage (Watson Street)	1700 m NE	Heavy Haulage yard including truck wash	No
Base Ohakea	1200 n SW	AFFF storage and use	Yes - known multiple sources

No textile and/or carpet manufacture or wool scouring activities, potentially significant sources of PFAS, were identified within close proximity to Bulls. However, Feltex Carpets operated a very large wool scour plant in Halcombe, on the eastern side of the Rangitīkei River off Kakariki Road, approximately 7.8 km north east of the Bulls well field, until approximately 2007. The site, now known as Kakariki Industrial Park, is currently a meat processing plant (Kakariki Proteins Ltd). Effluent ponds are present close to Rangitīkei River. Kakariki Proteins hold discharge consents for discharge of treated stickwater and washwater to land. Two registered abstraction bores are present on site.

3.3 Main Potential Source Locations

The three main potential PFAS source locations identified are shown on **Figure 3** and are discussed below.

3.3.1 Bulls Volunteer Fire Station

The Bulls volunteer fire station is located on the corner of High Street and Hammond Street some 1,250 m north northwest of the Bulls well field (**Figure 3.1**).

Figure 3.1: Bulls Fire Station

The fire station is inferred to lie hydraulically upgradient of the Bulls well field. HRC sought information from Fire and Emergency New Zealand (FENZ) via an Official Information Request dated 20 November 2018 about the storage or use of AFFF at the site. FENZ responded by letter dated 17 December 2018. In summary, FENZ reported the following in relation to the Bulls fire station:

1) It is usual for most fire appliances to carry two, 20-25 L Class B foam containers and this is the case for Bulls fire station.
2) A stocktake of Class B foam in April 2018 found that the Bulls fire station held two 20-25 L containers of Alcoseal dated 1992 and 1998. These were collected and removed from the station (date not provided).
3) Anecdotally, Class B foams known to contain PFOS or PFOA were held at and removed from the Bulls fire station at some time in the past.
4) Bulls fire station may also have held some foam from Base Ohakea.
5) There is no record of Class B foam training at the Bulls fire station.

The letter from FENZ is presented in **Appendix D**.

Current formulations of Alcoseal comprise a C6 Class B alcohol resistant film forming fluoroprotein foam. FENZ (2017) report tests of Alcoseal foam drawn from their foam stock, which showed the presence of 6:2 fluorotelomer sulphonate (6:2 FTS). Kemi (2015) reports the presence of low level concentrations of other PFAS, including PFOA at 124 ug/kg. The formulation tested by Kemi (2015) did not appear to contain PFOS. No information has been obtained about the PFAS content of older Alcoseal formulations.

No information was provided on the day to day management and disposal of used containers or unwanted foam containers.

The information places the Bulls fire station as potential source of PFAS in the Bulls water supply.

3.3.2 Waste Water Treatment Plant (WWTP)

The Bulls WWTP is located some 700 m west of the Bulls well field, inferred to be cross gradient or slightly down gradient of the Bulls well field. The WWTP includes two effluent treatment ponds. The ponds are enclosed by earth embankments and the effluent level within the ponds appears to be above ground level. This indicates perching above shallow groundwater and the potential for effluent leakage to shallow groundwater.

The WWTP is serviced by the trade waste system shown in **Figure 3.2**. It is understood that the scheme was installed in three stages from 1974 and includes sewer drains inherited from the Ministry of Defence for an Air Force housing block located in the western part of Bulls township. The entire community is serviced, including the Bulls volunteer fire station and businesses on Watsons Road. Treated effluent is discharged to the Rangitīkei River opposite the plant. Jacobs has no information on biosolids management.

The WWTP does not take waste from the Riverlands/ANZCO Manawatū abattoir, which maintains its own treatment system.

The WWTP system is not designed to capture stormwater, which is serviced by a mixture of mainly open drains with some short sections of piped reticulation, which drain to the Rangitīkei River and the Tutaenui Stream, as shown on **Figure 3.3**.

A 2012 option study undertaken by NZDF for treatment and disposal of effluent from Base Ohakea[11] considered the option of disposing effluent from Base Ohakea via drip irrigation to the Horizons Tree Nursery located immediately west of the Bulls well field between SH3 and the quarry. Jacobs understands from recent correspondence between NZDF and Horizons in relation to renewal of the Base Ohakea effluent discharge consent, that wastewater (and stormwater) from Base Ohakea may be contaminated with PFAS as a result of the use of AFFF. Jacobs further understands that the proposal to dispose of effluent from Base Ohakea to the Bulls Tree Nursery was not undertaken. A second option which included upgrade of the Bulls treatment plant to accept effluent from Base Ohakea and the Riverlands/ANZCO plant, was also not actioned.

[11] NXDF Defence Shared Services. Report for Concept Design of Land Based Effluent Disposal Systems Options Assessment, Feb 2012.

Figure 3.2: Bulls Waste Water Treatment Scheme Layout (from Rangitīkei District Council Asset Management Plan 3 Waters, 2014)

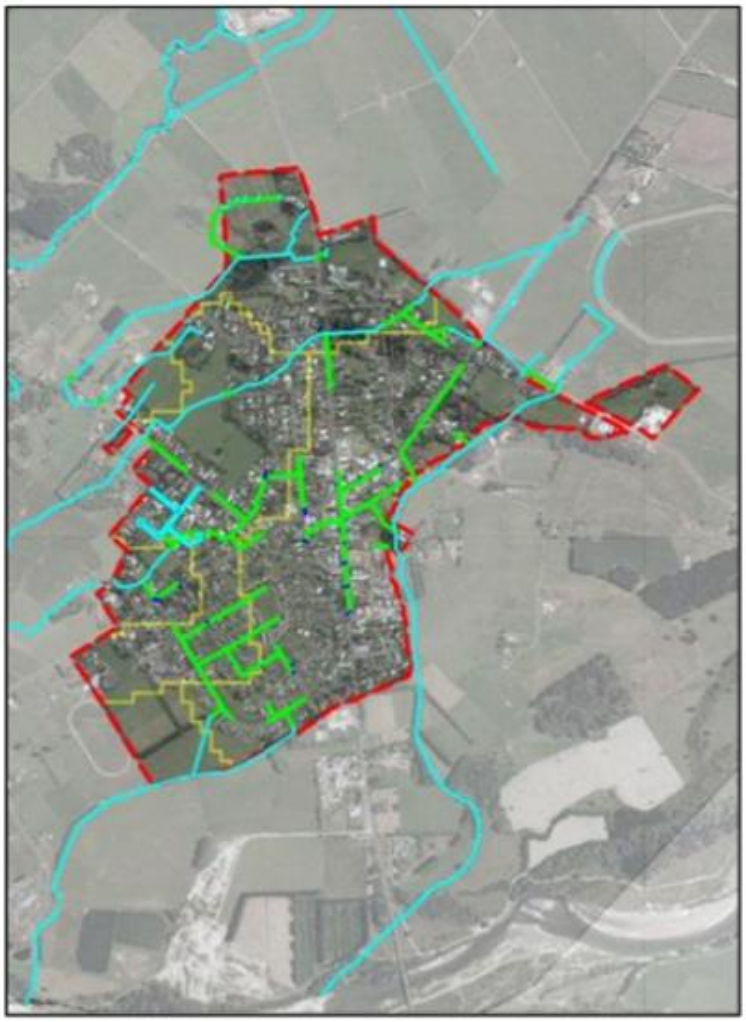

Figure 3.3: Bulls Stormwater Layout (from Rangitīkei District Council Asset Management Plan 3 Waters, 2014)

3.3.3 Former Bulls Landfill

The former Bulls (Rangitīkei) Landfill is located on Watson Street, approximately 1,500 m northeast and upgradient of the Bulls well field (**Figure 3**, **Appendix A**). Resource consent applications for leachate discharge from the landfill[12,13] describe it as located on an alluvial plain forming an extension of an upper terrace (Q2), with the waste extending the terrace over the lower river plain (Q1). The landfill is unlined. Hydraulic connectivity to the Bulls well field in shallow groundwater is considered to be likely.

During operation, waste was tipped over the edge of the upper terrace and compacted onto the lower terrace, effectively extending the upper terrace by about 20 m, as shown in **Figure 3.4**. The current landform (July 2018) is shown on **Figure 3.5**.

Three monitoring wells were installed at the toe the landfill; Bore 1 in 1994 and Bores 2 and 3 in 1995. The bore logs are presented in **Appendix E**.

It is understood that the landfill was closed and capped with 150 mm of 'soil and topsoil' in approximately 1996 (**Appendix E**). Bore 1 was reportedly destroyed during the capping process and the resource consent was

[12] Royds Consulting 1994. Resource Management Act 1991 Application for Resource Consents Bulls Landfill. Prepared for Rangitīkei District Council, September 1994
[13] Royds Consulting 1995. Update to the Assessment of Hydrogeology and Impact of Leachate at the Bulls Landfill, July 1995.

varied to allow monitoring from Bores 2 and 3 (renamed Bu2 (HRC 313095) and Bu3 (HRC 313097)). Bore Bu2 is shown on **Figure 3.4**. The land immediately southwest of the former landfill is currently planted in pine trees.

Jacobs note that the routine landfill monitoring reports prepared for consent compliance indicate the area of the landfill as the planted area, rather than the actual filled area forming the modified terrace. A standpipe and headworks, indicative of a well or bore, were also noted near the toe of the landfill by Jacobs, as indicated on **Figure 3.5**. This bore is not listed on HRC bore records and its origin and viability as a monitoring well are uncertain.

No information has been obtained or appears to be available on types of waste disposed of to the landfill. However, it is inferred that the landfill would have been used as the local 'tip' for Bulls township and environs. In this capacity, disposal of waste from Bulls fire station is a possibility.

Figure 3.4: Former Bulls Landfill Area of Fill

Figure 3.5: Former Bulls Landfill Current Landform

3.4 Skyhawk Crash Site

The 1996 Skyhawk crash occurred on 20 June 1996, some 9 km north of the Bulls wellfield, as shown by **Figure 3.6** and in the plan presented in **Appendix D**. PDP (2018b) documents that the crash was attended by fire crews from NZDF (assumed to be from Base Ohakea). It has not been confirmed that AFFF was used at the crash site it but considered to be possible owing to the historic use of PFAS containing AFFF by NZDF (PDP 2018b). The crash site appears to be located hydraulically upgradient of the Bulls well field and over Holocene river terrace deposits. Shallow groundwater connectivity with the Bulls well field is considered to be possible.

PDP (2018b) also presents the results of groundwater monitoring undertaken for NZDF between May and July 2018 to assess the presence of PFAS in groundwater close to the crash site. Seven shallow groundwater wells located in southerly direction (down gradient) from the crash site and one deeper bore to the north of the crash site were sampled. PDP (2018b) states that sampling targeted shallow wells and only those bores where land owner permission was granted. It appears however, that four of the seven downgradient wells were less than 15 m deep (i.e. shallow), with the remaining three wells between 55 m and 107 m deep. No soil samples were obtained from the crash site.

No PFAS compounds were detected above the level of reporting (LOR) in any of the groundwater samples collected. These results indicate that the Skyhawk crash site is unlikely to be a current source of PFAS at the Bulls well field.

PDP (2018b) is presented in **Appendix F**. Laboratory reports as received were not presented in the report.

Figure 3.6: Skyhawk Crash site and well locations (from NZDF)

4. Sampling and Analysis

4.1 Sampling Events

Sampling was by undertaken by Jacobs in July, September and November 2018 in accordance with the Jacobs Sampling and Analysis Plan (SAP)[14] and updates.

The data quality objectives were to:

- Determine the presence or absence (less than 0.005 µg/L) of PFAS in groundwater at selected shallow groundwater bores located in the vicinity of Bulls well field.
- Allow comparison of analytical results with results obtained by NZDF for the Bulls water supply wells (as reported by NZDF).

The analytical suite included the compounds listed in **Table 4.1** and both linear and branched isomers of PFOS and PFAS (reported as total PFOS and total PFOA). The analytical suite was based on a list of target compounds analysed by NZDF for the investigation of contamination of the Bulls water supply wells and groundwater within, and in the vicinity of, Base Ohakea. The target analytical detection limit for water and groundwater samples was 0.001 µg/L.

Table 4.1: Key Target Analytes

Abbreviation	Compound Name	Abbreviation	Compound Name
PFOS	Perfluorooctane sulfonate	PFBS	Perfluorobutane sulfonate
PFOA	Perfluorooctanic acid	PFBA	Perfluorobutanoic acid
6:2 FtS	6:2 Fluorotelomer sulfonate	PFHxA	Perfluorohexanoic acid
8:2 FtS	8:2 Fluorotelomer sulfonate	PFHxS	Perfluorohexane sulfonate
PFHpA	Perfluoroheptoanoic acid	PFPeA	Perfluoropetanoic

Sampling locations were selected to provide lateral spread of information targeting the potential PFAS source areas close to the Bulls well field and to provide comparison with analytical results obtained by NZDF. Potential groundwater sampling locations were initially selected based on HRC bore information, which indicated the presence of some 20 potential well locations on the northern side of the Rangitīkei River, both up and down gradient of the Bulls well field. However, most of these wells could not located. Groundwater sampling therefore utilised four wells, in addition to two wells within the Bulls well field, augmented by surface water sampling. Samples of treated and untreated effluent associated with the Bull WWTP were also obtained.

Proposed and final sampling locations are shown on **Table 4.2** (July 2108), **Table 4.3** (September 2018) and **Table 4.4** (November 2018). Sampling locations are shown on **Figure 4 (Appendix A)**. No wells were present within the Horizons Tree Nursery, although the infrastructure associated with a historic irrigation system was observed on the property.

[14] Bulls water Supply PFAS Investigation Sampling and Analysis Plan. Prepared by Jacobs, ref IZ112200-0002-NG-GUI-0001/00, 3 July 2018

Table 4.2 : Proposed and Completed Sampling Locations July 2018

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
313045	JGW1-313045	10.4	7.4-10.4	Listed as public supply well	Well appears to be upgradient of well field	Not found, coordinates likely to be incorrectly entered into database
313029	JGW2-313029	15.6	Unknown (assume 1.5 m above bottom of hole)	Rangitīkei Catchment Board?	Downgradient of well field, close to Rangitīkei River, down gradient of tree nursery	Not found
313033	JGW3-313033	6.1	Unknown	Rangitīkei Catchment Board?	Downgradient of well field, close to Rangitīkei River, down gradient of tree nursery	Not found
313031	JGW4-313031	9.4	Unknown	Rangitīkei Catchment Board?	Downgradient of well field, close to Rangitīkei River, down gradient of tree nursery	Not found
313010	JGW5-313010	13.1	Unknown	RDC	On private land 197 Parewainui Rd? Downgradient of Bulls township.	Not found. Land owner has no knowledge of bore
313097	JGW6-313097	8	3-8 m	Former landfill monitoring well Bu3	Determine if landfill leachate contains PFAS (landfill as contaminant source)	Sampled 6 July 2018. Low flow sampling
313095	JGW7-313095	7.3	2.5-7 m	Former landfill monitoring well Bu2	Determine if landfill leachate contains PFAS (landfill as contaminant source)	Sampled 6 July 2018. Low flow sampling
313088	JGW8-313088	6	Unknown	Bullock Co.	Quarry, close to waste water treatment ponds.	Sampled from well head works sampling tap on 12 July 2018
313093	JGW9-313093	12	Unknown	RDC	Public Supply Well 4. NZDF GW39. Compare Jacobs results with NZDF results	Sampled from well head works sampling tap on 12 July 2018
Bulls Domain Toilets	JGW10			Tap sample	Public Supply at Bulls Domain. NZDF GW48. Compare Jacobs results with NZDF results	Sampled from male bathroom tap on 12 July 2018
Bulls Domain Toilets	JGW10 Dup			Duplicate of JGW10	QA sample	Sampled from Male bathroom tap on 12 July 2018. QA

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
313095	JG11-313095			Duplicate of JGW7-313095	QA sample	Sampled 6 July 2018
	JGW12			Rinsate Bu2	QC sample	Collected 6July 2018
	JGW13			Rinsate	QC sample	Not collected
Rinse water	JGW14			Confirm status of potable rinse water	QC – Testing to be decided on receipt of groundwater results	Not collected
313069	JGW15	31.6	Unknown	RDC	Public Supply Well 5. NZDF GW38. Compare Jacobs results with NZDF results	Sampled from sampling tap at the WTP 12 July 2018
WWTP	JGW16			Discharge from WWTP pond to drain	Determine if effluent impacted by PFAS	Collected with Mighty Gripper 12 July 2018

Table 4.3: Proposed and Completed Sampling Locations September 2018

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
313097	JGW17-313097	8	3-8 m	Former landfill monitoring well Bu3	Determine if landfill leachate contains PFAS (landfill as contaminant source)	Sample taken
313095	JGW18-313095	7.3	2.5-7 m	Former landfill monitoring well Bu2	Determine if landfill leachate contains PFAS (landfill as contaminant source)	Sample taken
WWTP (discharge)	JGW19			Discharge from WWTP pond to drain	Determine if effluent impacted by PFAS	Sampled taken
Upgradient landfill well	JGW20	Unknown	Unknown	Former landfill monitoring well (upgradient)	Determine if groundwater upgradient of landfill contains PFAS	Not viable. Less than 3 m deep, no groundwater
WWTP (influent)	JGW21			Influent entering WWTP	Determine if influent impacted by PFAS	Sample taken
WWTP (influent)	JGW21 (dup)			Influent entering WWTP	QC sample	Sample taken

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
313005	JGW22	14	Unknown	Well located at Bulls School	Additional sample location within Bulls for further investigation	Not sampled. No well present
Stream sample	JGW23			Domain Stream, near bridge at domain entrance	Additional sample location within Bulls for further investigation	Sample taken
Drain sample	JGW24		N/A	Artificial drain adjacent to and north of Rangitikei River	Additional sample location within Bulls for further investigation	Sample taken
313095	JGW25-313095	Unknown	Unknown	Duplicate of JGW22-313005 Bulls School	Intra-lab QA sample	Not sampled
313095	JGW26	Unknown	Unknown	Duplicate of JGW18 (Bu2)	Inter-lab QA sample (Eurofins Australia)	Not sampled
	JGW27			Rinsate	QC sample	Sample not taken
	JGW28			Rinsate	QC sample	Sample taken
Stream	JGW29			Surface water at Bulls School	No well available	Sample taken
Drain	JGW30			Surface water in drain at toe of Bulls landfill	No well available	Sample taken
	JGW31			Rinsate JGW17 (Bu3)	QC sample	Sample taken
	Trip Blank 04			Trip blank	QA sample	Included with effluent samples
	Trip Blank 05			Trip blank	QA sample	Included with water samples

Table 4.4: Proposed and Completed Sampling Locations November 2018[1]

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
GW monitoring bores	JGW28N	~12	~9-12 m	Former petrol station monitoring bore. Depth of monitoring and screen depths are indicative only. Well not recorded on HRC bore record.	Determine if groundwater west of the landfill contains PFAS	Sample taken
Stream sample	JGW29N			Surface water body likely fed by springs/groundwater inflows	Determine if surface water down-gradient of the landfill contains PFAS	Sample taken
Stream sample	JGW30N			Surface water body fed by springs/groundwater inflows	Determine if surface water down-gradient of the landfill contains PFAS	Sample taken-location moved downstream owing to lack of water at proposed location
Stream sample	JGW31N			Surface water body likely fed by springs/groundwater inflows	Determine if surface water down-gradient of the landfill contains PFAS	Sample not taken. No flow in stream No defined stream channel observed
Stream sample	JGW32			Surface water body fed likely by springs/groundwater inflows	Determine if surface water down-gradient of the landfill contains PFAS	Sample not taken. No flow in stream No defined stream channel observed
WWTP (influent)	JGW33			Influent entering WWTP	Determine if effluent impacted by PFAS	Sample taken from manhole (upstream of previous sample)
	JGW34			Duplicate of JGW28	QA sample	Sample not taken.
	JGW35			Rinsate collected prior to sampling bore sample JGW28	QC sample	Sample taken WL dip meter following pre-sampling decontamination procedures
	JGW36			Rinsate collected prior to sampling JGW28	QC sample	Sample taken Rinsate of bailer after pre-sampling decontamination procedures

Bore ID	Sample ID	Depth (m)	Screen Depth (m)	Notes	Purpose	Notes
	JGW37			Trip blank per chilly bin	QA sample	Included with water samples
	JGW38			Trip blank per chilly bin	QA sample	Included with effluent sample
Stream Sample	JGW39			Same location as JGW24	Comparative sample	Lower flow than when previously sampled
Seep Sample	JGW40			From seepage face Bulls Domain	Determine if water upgradient of Bulls Domain is impacted with PFAS	Additional location identified in the field

1: Sample number duplication occurred between the sampling in September and November 2018. Letter N has been added in the text to samples collected in November.

Sampling was undertaken by trained Jacobs staff in accordance with Jacobs SOP for PFAS sampling, including clean hands- dirty hands protocol, as applicable to the project and data quality objectives.

Samples were collected into laboratory supplied containers and hand delivered to the laboratory by Jacobs.

Analysis was undertaken by AsureQuality Limited, Lower Hutt. Laboratory reports as received are presented in **Appendix G**.

4.2 Analytical Results

4.2.1 All PFAS

PFAS was detected at four groundwater well sampling locations, five surface water sampling locations and in the influent and effluent of the Bulls WWTP, addition to the Bulls Domain tap sample, which is reticulated water from the Bulls Well field. A range of PFAS compounds were detected. These detections are shown in following figures in **Appendix A**:

Figure 5: Concentrations of PFAS in all primary samples (including Ohakea water supply well for comparison)

Figure 6: Concentrations of PFAS in groundwater and surface water samples (including Ohakea water supply well for comparison)

Figure 7: Compositional Analysis of PFAS in groundwater and surface water samples (including Ohakea water supply well for comparison)

Figure 8: Concentrations of PFAS in WWTP influent and effluent samples (including Bullock water supply well for comparison)

Figure 9: Compositional Analysis of PFAS in WWTP influent and effluent samples (including Bullock water supply well for comparison).

The following points are noted:

- A wide range of the targeted PFAS compounds characteristic of AFFF were detected,
- PFOS and PFHxS were present in all samples containing PFAS. These compounds are common indicators of older formulations of AFFF containing PFOS.

- The PFAS composition in groundwater at WS2 (Base Ohakea water supply well for comparison (PDP 2018b)), landfill monitoring bore Bu2, the Bullocks well and WSW Well 4 containing relatively high amounts of PFOS, PFHxS and PFPeA, and appear to be very similar in composition.
- Surface water composition also appears similar to groundwater, although the surface waters tend to contain PFNA.
- GW at the former BP site recorded only PFOS and PFHxS. However, the concentrations detected were almost an order of magnitude lower than in the other groundwater samples, and other PFAS compounds could be present at concentrations below the LOR.
- The highest concentration of total PFAS was recorded in the WWTP effluent from July, which also showed the greatest number of PFAS compounds of any sample.
- The two WWTP effluent samples appear to have very similar relative composition, although individual and total concentrations varied, with total PFAS in the sample from September about 70% lower than the total PFAS recorded in July. The relative concentration of PFOS and PFHxS were also much less than in the water samples and recorded relatively high concentrations of PFHpA compared to the water samples.
- PFOS, PFHxS, PFHxA and PFOA only were detected in the influent sample collected in November. The total PFAS concentration was approximately 50% of the total concentration for the effluent sample from September and an order of magnitude lower than the total PFAS for the July result.

4.2.2 PFOS, PFHxS and PFOA

The analytical results for PFOS, PFHxS and PFOA for the primary samples (excluding QA/QC samples) are summarised on **Table 4.5**. The results are also shown on **Figure 10 (Appendix A)** for total PFAS and PFOS + PFHxS, (including Base Ohakea water supply well for comparison) (sum PFOS and PFHxS).

The following points are noted:

4.2.2.1 Landfill Monitoring wells

- PFAS were detected in landfill monitoring well Bu2 from both sampling events, at similar concentrations, with PFOS + PFHxS at 0.016 and 0.22 µg/L and PFOA at (0.0042 and 0.007 µg/L).
- No PFAS was detected in landfill monitoring well Bu3.

4.2.2.2 Water Supply Wells

- PFOS + PFHxS (0.016 µg/L) and PFOA (0.0011 µg/L) were detected in Well 4 (NZDF GW39) at levels similar to concentrations detected previously by NZDF.
- No PFAS was detected in Well 5 (NZDF GW38), which is consistent with the results recorded by NZDF.

4.2.2.3 Domain Tap (reticulated supply)

- PFOS + PFHxS (0.0080 µg/L) were detected in Well 4 (NZDF GW39) at levels similar to concentrations detected previously by NZDF. No PFOA was recorded.

4.2.2.4 Bullock Well

- PFOS + PFHxS (0.022 µg/L) and PFOA (0.0018 µg/L) were detected in Bullock well sample. This well has not previously been sampled and analysed for PFAS.

4.2.2.5 JGW28N former BP Service Station Well

- PFOS + PFHxS (0.0031 µg/L) was detected in monitoring well present at the former BP service station located in Bridge Street Bulls. No PFOA was detected. This well has not previously been sampled and analysed for PFAS.

4.2.2.6 Waste Water Treatment Plant Influent

- No PFAS was detected in the WWTP influent in September. The LOR achieved by the laboratory was 0.10 µg/L compared with the analysis objective LOR of 0.001 µg/L, owing to matrix interference.
- PFOS + PFHxS (0.0091 µg/L) and PFOS (0.0017 µg/L) were detected in the WWTP influent in November. PFOS. The sampling location in November was upgradient of the sampling location used in July.

4.2.2.7 Waste Water Treatment Plant Effluent

- PFOS + PFHxS was detected at similar concentrations in the WWTP effluent in July and September (0.0066 µg/L and 0.0068 µg/L). PFOA was detected at 0.0011 µg/L in July and less than LOR in September.

4.2.2.8 Surface Water

- No PFAS was detected in the surface water drain at the toe of the Bulls landfill (JGW30), the sample at the Domain bridge (JGW23) or the stream at Bulls School (JGW29) in the northern part of Bulls.
- PFOS + PFHxS were detected in all surface water samples hydraulically down gradient of the Bulls landfill. The highest concentration was recorded in JGW29N (0.026 µg/L), similar to concentration detected in the landfill monitoring bore Bu2 and the Bullock well. PFOA was recorded at two locations (0.0016 and 0.0023 µg/L).
- No PFOS, PFHxS or PFOA were detected in the seep sample from the base of the former river terrace in Bulls Domain. However, trace levels of 6:2 FTS and 8:2 FTS (0.0025 and 0.0024 µg/L, respectively, were detected.

4.2.3 Quality Assurance

- No PFAS was detected in trip blanks or the rinsate blanks.
- Primary and duplicate sample results for PFOS, PFHxS and PFOA agree within a maximum relative percentage difference (RPD) of 12%.
- There is good agreement between results obtained by Jacobs and NZDF at common sampling locations.

4.3 Discussion

Analytical results for PFOS + PFHxS are shown at the sampling locations on **Figure 11 (Appendix A)**.

The analytical results indicate the widespread presence of PFAS in shallow groundwater beneath part of Bulls township and extending from at least the southern edge of the former Bulls landfill to the Rangitīkei River to at least the WWTP, a distance of about 2 km. The groundwater contains concentrations of PFOS + PFHxS between approximately 0.01 µg/L and 0.02 µg/L. The observed concentrations are low in comparison to concentrations detected in shallow groundwater within and immediately down gradient of Base Ohakea (PDP 2018b) and similar to concentrations detected in the Base Ohakea water supply well. The concentrations are less than the adopted interim drinking water standards for PFOS & PFHxS of 0.07 µg/L and PFOA of 0.56 µg/L.

The estimated approximate extent of the PFOS + PFHxS plume is shown in **Figure 12 (Appendix A)**.

Table 4.5: Laboratory results.

Sample Name	JGW6-313097	JGW17-313097	JGW7-313095	JGW18-313095	JGW09-313093	JGW08-313088	JGW15-313069
Description	**Landfill Monitoring Well**	**Landfill Monitoring Well**	**Landfill Monitoring Well**	**Landfill Monitoring Well**	**Bulls Water Supply Well No. 4 (NZDF GW39)**	**Bullock Quarry Bore**	**Bulls Water Supply Well No.5 (NZDF GW38)**
Laboratory Reference	18-180684-1	18-241085-1	18-180684-2	18-241085-2	18-184106-1	18-184106-5	18-184106-3
Local Name	Bu3	Bu3	Bu2	Bu2	Well 1 (~10 m)	Bullock	Well 5 (~31 m)
Date:Time Sampled	6-Jul-18	24-Sep-18	6-Jul-18	24-Sep-18	12-Jul-18	12-Jul-18	12-Jul-18
Results (ug/L)							
Total Perfluorohexanesulfonic acid (T-PFHxS)	<0.0010	<0.0010	**0.0083**	**0.012**	**0.0047**	**0.011**	<0.0010
Total Perfluorooctanesulfonic acid (T-PFOS)	<0.0010	<0.0010	**0.0076**	**0.0096**	**0.011**	**0.011**	<0.0010
Sum of PFOS & PFHxS	<0.0010	<0.0010	**0.016**	**0.022**	**0.016**	**0.022**	<0.0010
Perfluorooctanic acid (PFOA)	<0.0010	<0.0010	**0.0042**	**0.007**	**0.0011**	**0.0018**	<0.0010
Sample Name	**JGW10**	**JGW28N**	**JGW16**	**JGW19**	**JGW21**	**JGW33**	**JGW23**
Description	**Bulls Domain (NZDF GW48)**	**Groundwater**	**Waste water Treatment Plant**	**Waste water Treatment Plant**	**Waste water Treatment Plant**	**Waste water Treatment Plant Influent**	**Surface Water**
Laboratory Reference	18-184106-2	18-300506-1	18-184106-4	18-241064-1	18-241064-2		18-241085-3
Local Name	Bulls Domain Tap	Town Centre Former Petrol Station	Effluent	Effluent	Influent	Influent	Bulls Domain Stream at Bridge
Date:Time Sampled	12-Jul-18	29-Nov-18	12-Jul-18	24-Sep-18	24-Sep-18	29-Nov-18	24-Sep-18
Results (ug/L)							
Total Perfluorohexanesulfonic acid (T-PFHxS)	**0.0043**	**0.0017**	**0.003**	**0.0031**	<0.10	**0.0038**	<0.0010
Total Perfluorooctanesulfonic acid (T-PFOS)	**0.0037**	**0.0014**	**0.0019**	**0.0037**	<0.10	**0.0053**	<0.0010
Sum of PFOS & PFHxS	**0.0080**	**0.0031**	**0.0066**	**0.0068**	<0.10	**0.0091**	<0.0010
Perfluorooctanic acid (PFOA)	<0.0010	<0.0010	**0.0011**	<0.0010	<0.10	**0.0017**	<0.0010
Sample Name	**JGW24**	**JGW29**	**JGW30**	**JGW29N**	**JGW30N**	**JGW39**	**JGW40**
Description	**Surface Water**	**Surface Water**	**Surface Water**	**Surface water**	**Surface Water**	**Surface Water**	**Surface Water**
Laboratory Reference	18-241085-4	18-241085-5	18-241085-6	18-300506-2	18-300506-3	18-300506-7	18-300506-8
Local Name	SH1 Bridge Drain	Bulls School Stream	Toe of Former Landfill	Bulls Domain Stream behind Marae	Bulls Domain Stream Downstream	Bridge Drain north of Rangitikei River ~location JGW24	Seep face Bulls Domain
Date:Time Sampled	24-Sep-18	24-Sep-18	24-Sep-18	29-Nov-18	29-Nov-18	29-Nov-18	29-Nov-18
Results (ug/L)							
Total Perfluorohexanesulfonic acid (T-PFHxS)	**0.0053**	<0.0010	<0.0010	**0.0091**	**0.0013**	**0.0014**	<0.0010
Total Perfluorooctanesulfonic acid (T-PFOS)	**0.0090**	<0.0010	<0.0010	**0.017**	**0.0056**	**0.0060**	<0.0010
Sum of PFOS & PFHxS	**0.0140**	<0.0010	<0.0010	**0.026**	**0.0069**	**0.0074**	<0.0010
Perfluorooctanic acid (PFOA)	**0.0016**	<0.0010	<0.0010	**0.0023**	<0.0010	<0.0010	<0.0010

5. Conceptual Site Model

An updated conceptual site model (CSM) based on the assessment to date is presented in **Figure 13 (Appendix A)**. The CSM comprises a generalised cross-sectional sketch of the hydrogeological environment in relation to potential PFAS source areas in close proximity to Bulls. The section runs approximately SW to NE between the water supply well at Base Ohakea (bore 313096) on the southern side of the Rangitīkei River to the Bulls School bore (313005) located near the northern end of Bulls township and the former Bulls Landfill on Watson Street.

The geological profile has been simplified as three units:

- The unconfined aquifer supplying the Bulls well field, the Bullock bore and the Ohakea water supply well, comprising mainly gravel up to about 12 m thick, which is assumed to form a continuous aquifer beneath Bulls and the surrounding area. The Rangitīkei River is assumed to be formed within the shallow aquifer and to be in hydraulic continuity with the aquifer.
- A confining layer comprising peat, clay and silt, approximately 10 m thick.
- A confined aquifer supplying the Bulls well field deep well (Well 5) and bores such as the Rangitīkei/ANZCO bore. Upward hydraulic gradient is assumed for the confined aquifer.

The CSM shows the following:

- Bulls Fire Station and the former Bulls Landfill overlie the shallow unconfined aquifer, hydraulically upgradient of the Bulls well field. The pathway for migration of PFAS present in soil and groundwater at these locations to the Bulls well field is therefore potentially complete.
- The drawdown cones associated with abstraction at the Ohakea water supply well and the Bullock well potentially overlap, providing a pathway for migration of PFAS across the Rangitīkei River. The Ohakea water supply well and the Bullock well both contain PFAS, with concentrations in the Bullock well higher than in the Ohakea supply well.
- No viable pathway for PFAS migration from Base Ohakea or the Bulls well field to monitoring bore Bu2 at the former Bulls Landfill is evident.
- No viable pathway for PFAS migration from Base Ohakea, the Bulls well field or the Bulls landfill to the monitoring bore at the former BP service station (JGW28N) is evident.
- Effluent in the WWTP treatment ponds appears to be perched above the shallow aquifer, indicating the potential for leakage of impacted effluent to shallow groundwater. Both the effluent and shallow groundwater close to the effluent ponds contain PFAS. However, concentrations of PFOS, PFHxS and PFOA in the effluent are less than concentrations in nearby shallow groundwater, indicating that the effluent is not a primary source of PFAS to groundwater.
- Upward hydraulic gradient is assumed for the confined aquifer. Maintenance of artesian conditions in the aquifer during pumping is unknown, indicating the potential for contamination of the deeper aquifer by shallow groundwater during pumping (as suggested by PDP 2017b).

6. Conclusions and Recommendations

6.1 Conclusions

The analytical results for PFAS clearly show the presence PFAS compounds in groundwater associated with older formulations of AFFF that contained PFOS. PFAS in AFFF is therefore considered to be the main contaminant source.

Three main potential sources of the PFAS in shallow groundwater and surface water in the vicinity of the Bulls well field have been identified:

- Bulls Volunteer Fire Station: related to the documented storage of PFAS containing AFFF, potentially resulting in losses to the ground and transport in groundwater. No details have been obtained on AFFF storage and use and disposal at the site and no viable monitoring well immediately down gradient of the fire station has been identified. However, PFAS has been detected in groundwater at the former service station (JGW28N) located approximately 230 m north east of the fire station, which could be linked to the previous storage and use of PFOS containing AFFF.
    - Bulls fire station is therefore considered to be a potential source of PFAS contamination to groundwater and surface water.
- Former Bulls Rangitīkei) landfill: related to the presence of PFAS in former landfill monitoring bore Bu2, which is located upgradient of the well field and directly downgradient of the former landfill, which indicates a source of PFAS in leachate from the former landfill or from a source upgradient of the former landfill. Landfill monitoring well Bu3 does not appear to lie directly down gradient of the former landfill. The absence of PFAS in groundwater at this well may be the result of the well location being slightly cross gradient of the former landfill. The potential deposition of PFAS contaminated wastes, including PFAS contaminated soil and empty AFFF containers, resulting in contamination of leachate and transport in groundwater, is possible. No information has been obtained on the nature of the wastes disposed at the landfill.
    - The former Bulls landfill is considered to be a likely source of the PFAS detected in groundwater and surface water in the vicinity of the Bulls well field.
- Base Ohakea: related to pumping induced migration of PFAS in groundwater from known source areas to the Bulls well field. Base Ohakea as a source of PFAS does not easily explain the presence of PFAS in former landfill monitoring well Bu2 or in the former service station well (JGW28N).
    - The hydraulic connection between Base Ohakea and the well field is currently uncertain.

The former Feltex operated wool scouring plant identified on the eastern side of the Rangitīkei River is a potential source of PFAS; however, the use of PFAS has not been confirmed and its hydraulic connection to the Bulls well field appears to be unlikely.

The maximum concentration of the sum PFOS + PFHxS in groundwater is approximately 30% of the interim New Zealand Drinking Water Standard (0.07 µg/L) and concentrations of PFAS in the plume are low compared to concentrations directly down gradient of known primary source areas in Ohakea. This could indicate low concentrations in the source area(s) and/or dilution during transport in groundwater between the source area(s) and the monitoring locations.

The absence of PFAS in deep production Well 5 is consistent with the presence of potential confining layers between shallow and deeper groundwater. However, NZDF has noted the potential for pumping to transport contaminants from shallow to deeper groundwater. The shallow wells within the well field are currently used in preference to Well 5 owing yield and quality issues, but this could change in the future.

The presence of PFAS in the WWTP effluent perched above shallow aquifer indicates a PFAS source(s) from Bulls in the influent and the potential for effluent leakage to shallow groundwater. Sludge within the ponds is also potentially contaminated by PFAS.

6.2 Recommendations

The following recommended additional works are proposed:

6.2.1 Base Ohakea

Further assessment of Base Ohakea as a PFAS source is recommended, involving the compilation of a hydrogeological conceptual model based on lithological data for bores supplied by HRC using Leapfrog™ software and clarification in relation to pumping conditions and river flows assumed in the Base Ohakea groundwater flow model. This may be able to be achieved by interrogating the model understood to have been prepared for NZDF by PDP of the site, depending on the domain of the model built.

These data may assist with further understanding hydraulic connectivity of groundwater in the shallow Holocene terrace gravels on the northern and southern side of the Rangitīkei River near the Bulls well field, and the potential for PFAS impacted groundwater to be drawn into the Bulls well field from PFAS sources at Base Ohakea.

6.2.2 Bulls Fire station

It appears that no further useful information is currently available from FENZ in relation to PFAS containing foam storage and management at the Bull fire station. It is recommended that FENZ be provided with the findings of this investigation.

6.2.3 Former Bulls Landfill

Obtain records of the operational history of the Bulls Landfill, including the origin and types of waste. This should include determination of whether the landfill accepted waste from Base Ohakea, the Skyhawk crash site, the former Feltex Carpets wool scouring operations at Halcombe or sludge from the Bulls WWTP.

Install groundwater monitoring wells at the toe and within the landfill. Additional wells closer to the waste would assist with confirming the landfill as a source, and plume delineation.

6.2.4 WWTP

Review the construction of the ponds to assess likelihood of loses to groundwater.

Determine sludge disposal practises to assess previous disposal routes for sludge and to ensure appropriate management of potentially PFAS contaminated sludge.

6.2.5 Other

Sample the discharge from the Kakariki Proteins effluent ponds, with analysis for PFAS.

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Appendix A. Figures

Legend

Bulls WTP Production Wells

N

0 20 40 60 80 m

Bulls PFAS Study
Bulls Well Field
Production Wells

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Bulls PFAS Investigation

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FIGURE NO
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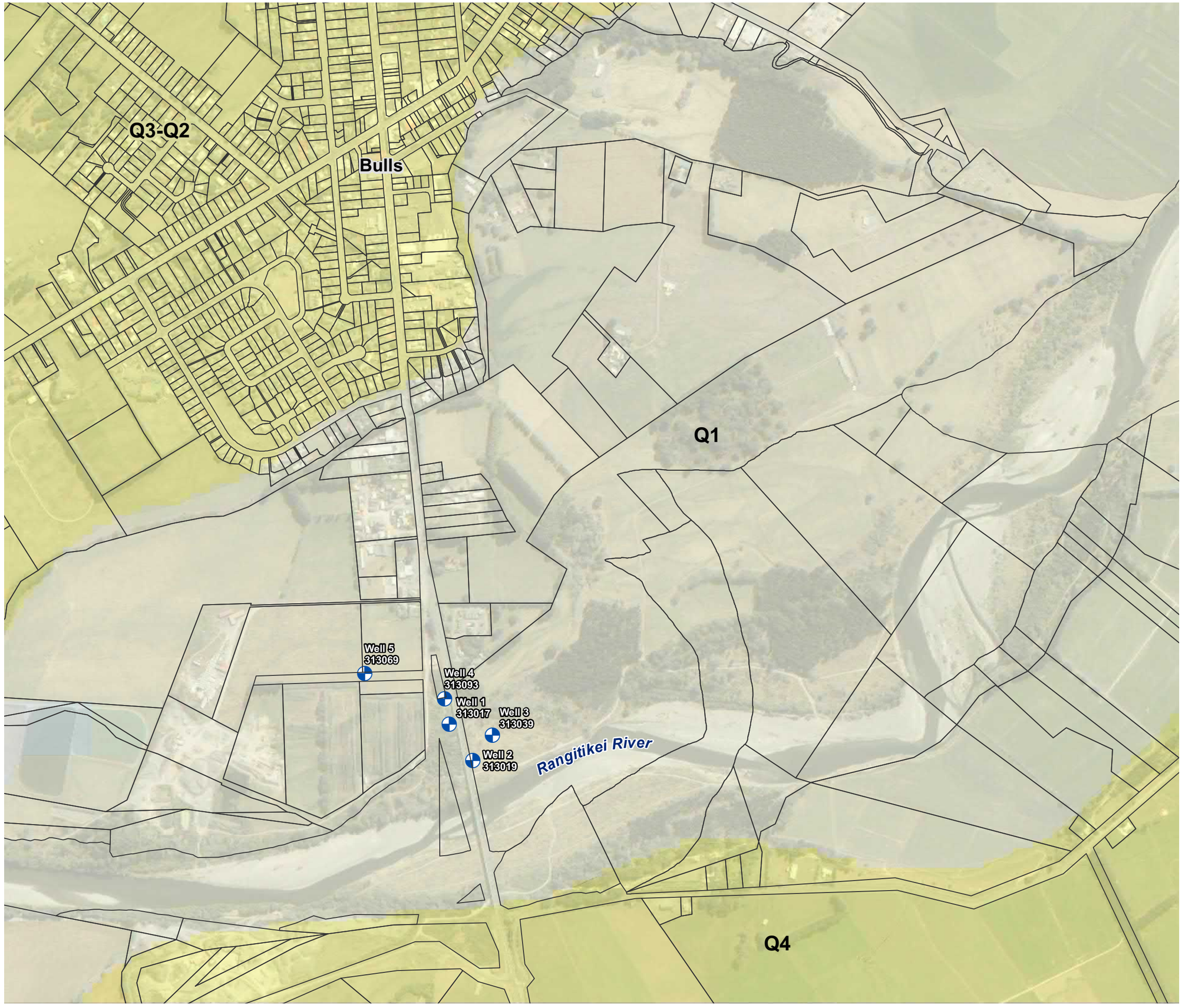

Legend

Land Parcels

Bulls WTP Production Wells

NZ 1:250K Geological Units

Key name - OIS2 (Late Pleistocene) river deposits
Simple name - Late Pleistocene river deposits
Main rock name - gravel
Stratigraphic age - Q3-Q2

NZ 1:250K Geological Units

Key name - OIS1 (Holocene) river deposits
Simple name - Holocene river deposits
Main rock name - gravel
Stratigraphic age - Q1

NZ 1:250K Geological Units

Key name - OIS4 (Late Pleistocene) river deposits
Simple name - Late Pleistocene river deposits
Main rock name - gravel
Stratigraphic age - Q4

N

0 100 200 300 400 m

Bulls PFAS Study
Geology - QMAP 1:250k

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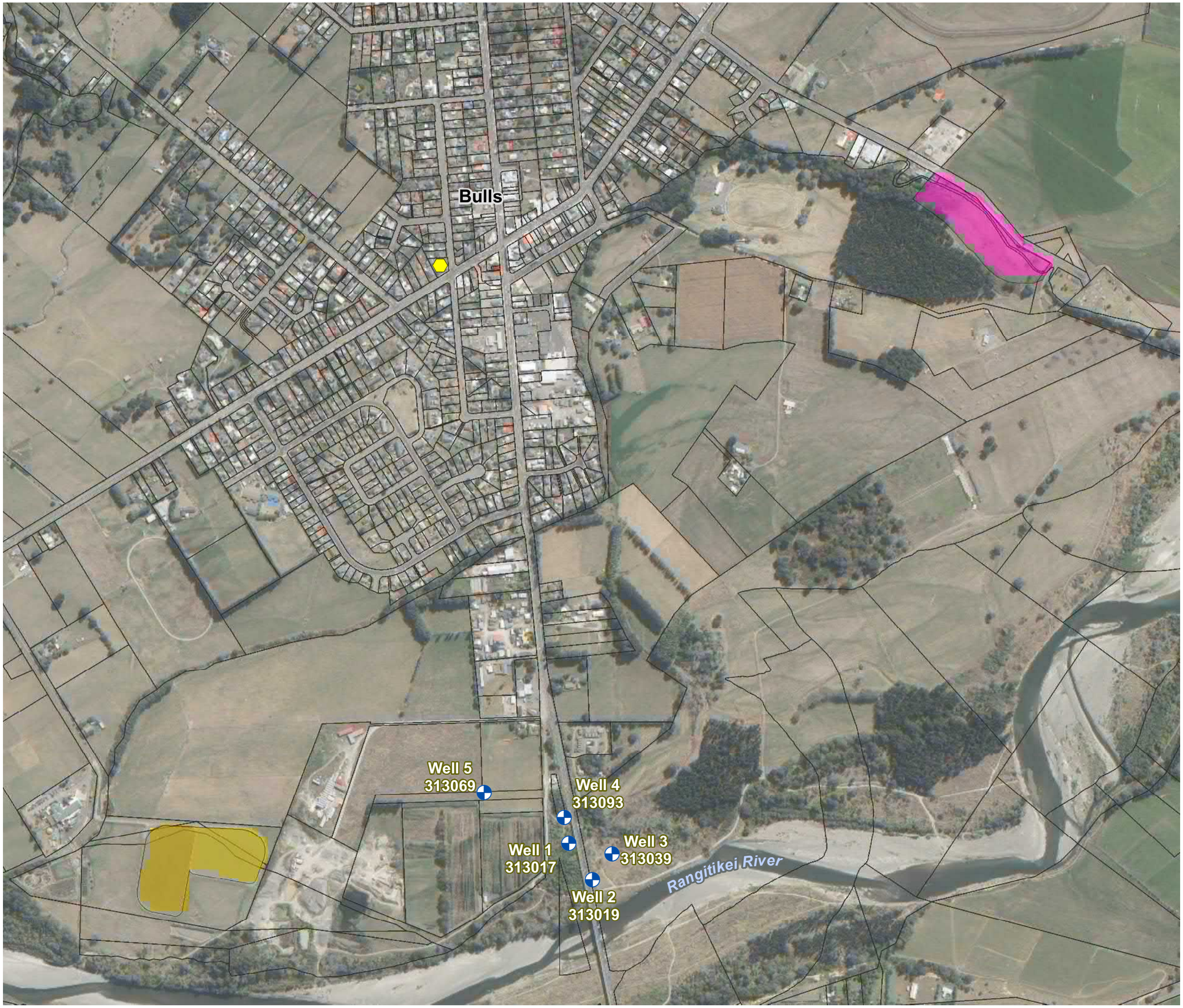

Legend

- Bulls Volunteer Fire Brigade
- Bulls WTP Production Wells

Potential Contamination Sources

- Aproximate Landfill Extent
- WWTP
- Land Parcels

N

0 100 200 300 m

Bulls PFAS Study
Potential PFAS Source
Main Locations Identified

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J:\IE\Projects\02_New Zealand\IZ112200\06 Spatial\MXD\IZ112200 - Figure 3 - Potential PFAS Locations.mxd

JGW29
JGW40
JGW28N
JGW10
JGW23
Bulls
JGW30
JGW6
JGW7
JGW17
JGW18
JGW29N
JGW30N
JGW15
JGW33
JGW21
JGW09
JGW24
JGW39
JGW16
JGW19
Rangitikei River
JGW08
313096

Legend

- Ohakea Base Water Supply Well
- Potable Network Sample (Tap)
- Surface Water
- SW/WWTP Grab Sample
- Bore Sampled
- Other Bores (not sampled)
- Streams
- Land Parcels

N

0 100 200 300 m

Bulls PFAS Study
Sampling Locations

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Figure 5: PFAS Concentrations All Primary Samples Where PFAS Detected (inludes Base Ohakea water suppy well (PDP 2018b)) Units ug/L

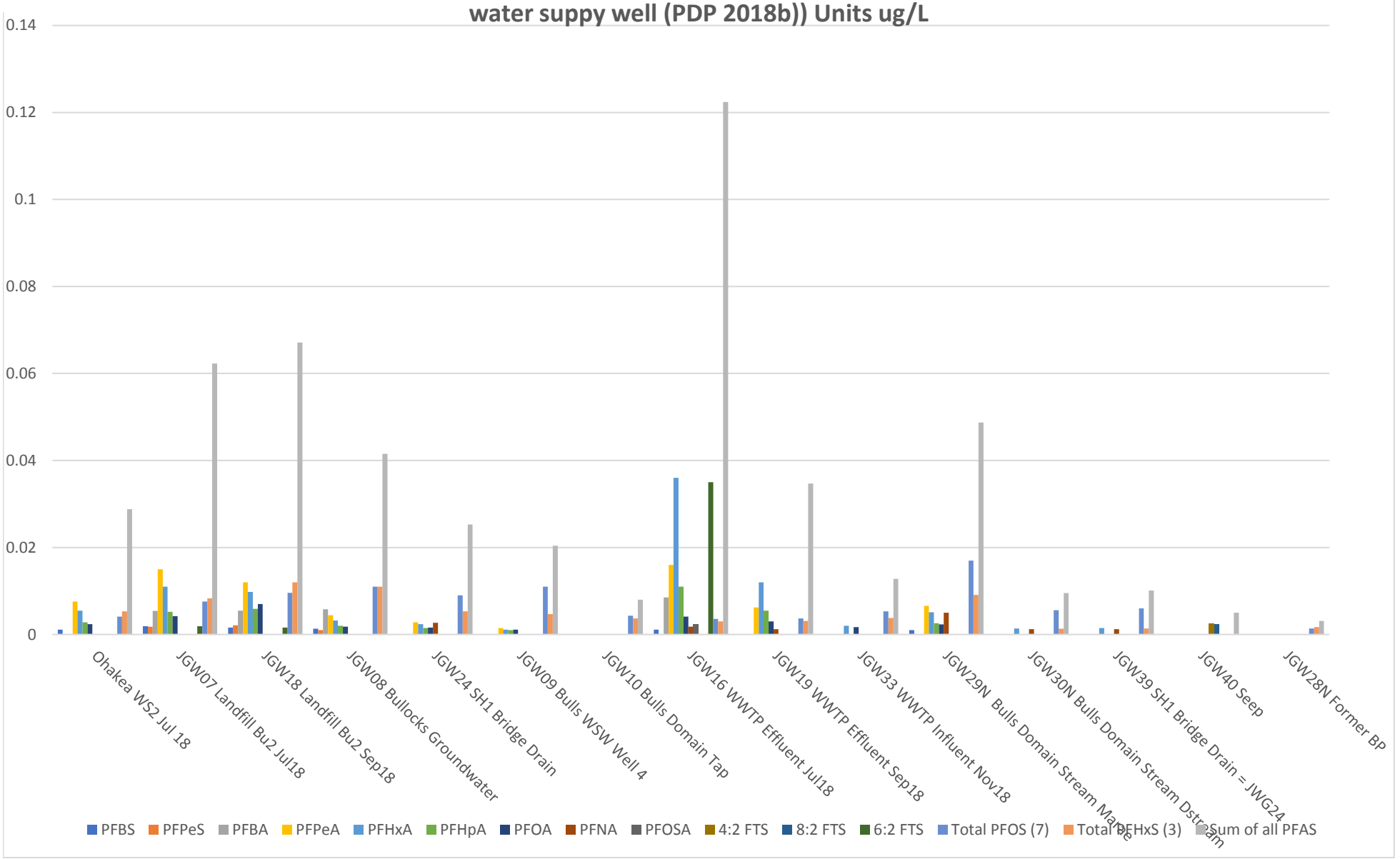

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Figure 6: PFAS Concentrations in Groundwater and Surface Water Samples Units ug/L

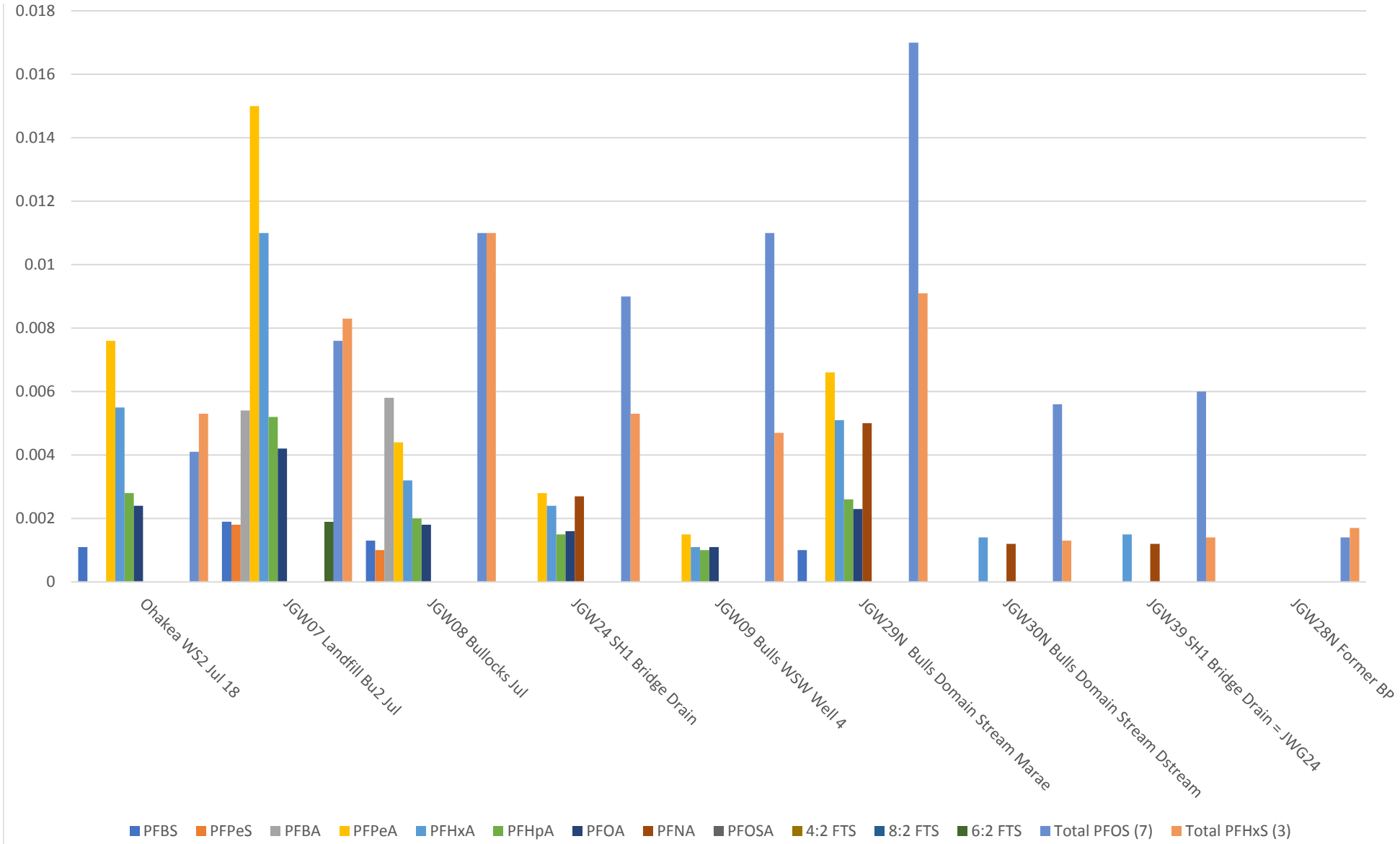

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Figure 7: Groundwater and Surface Water Compositional Analysis

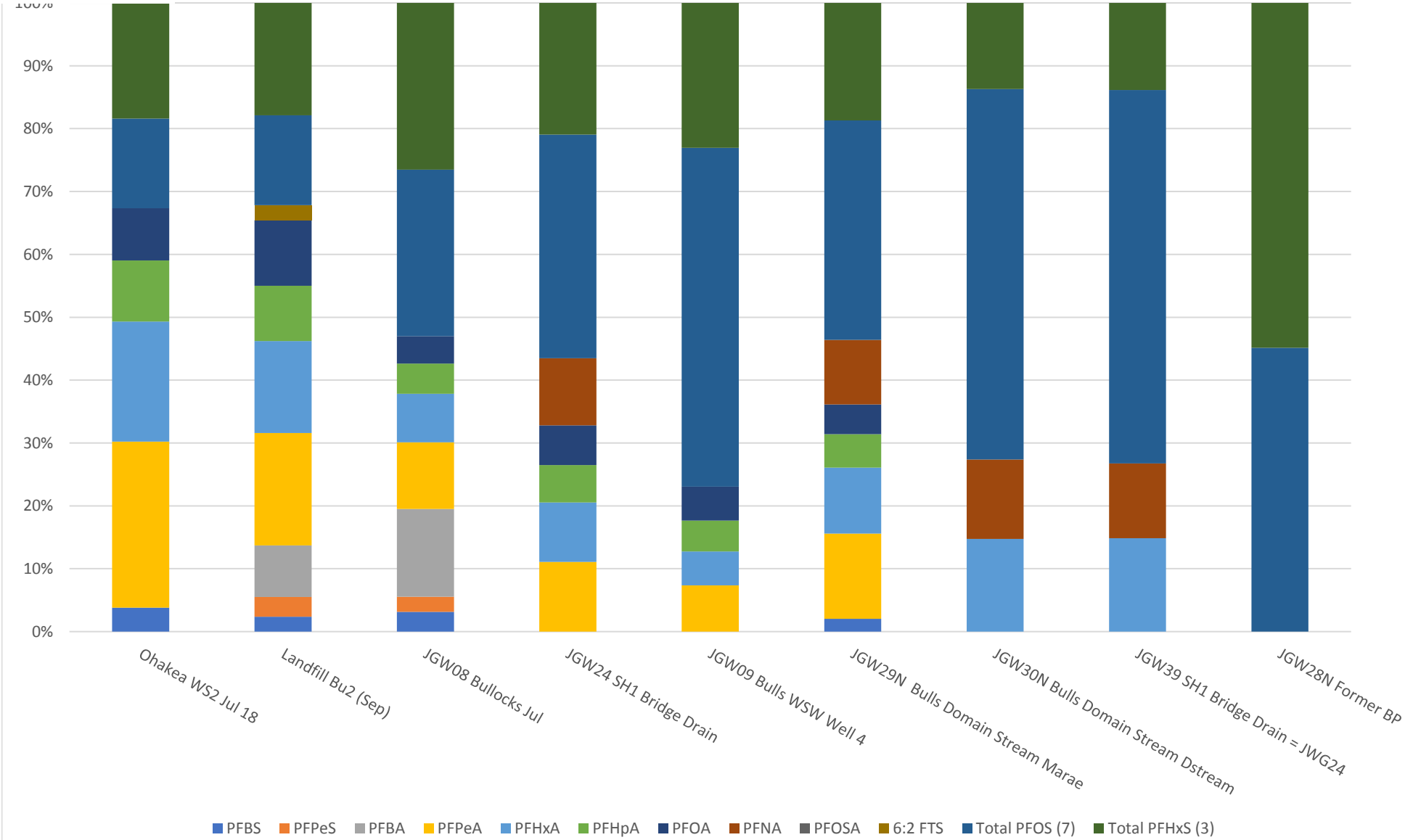

Figure 8: Waste Water Treatment Plant Influent and Effluent Concentrations (groundwater results from Bullock bore shown for comparison) Units ug/L

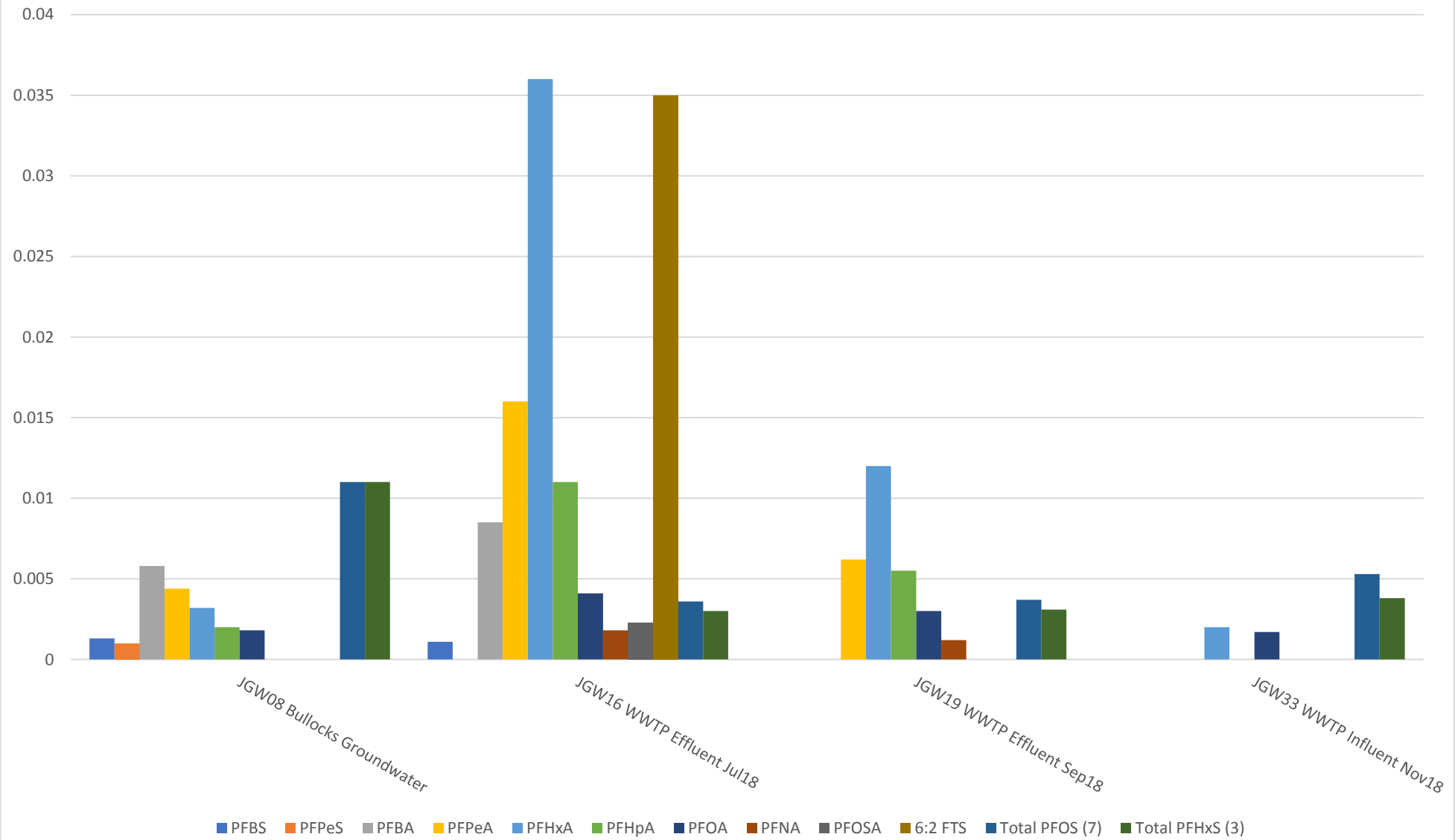

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Figure 9: Waste Water Treatment Plant Influent and Effluent Compositional Analysis (groundwater composition from Bullock bore shown for comparison)

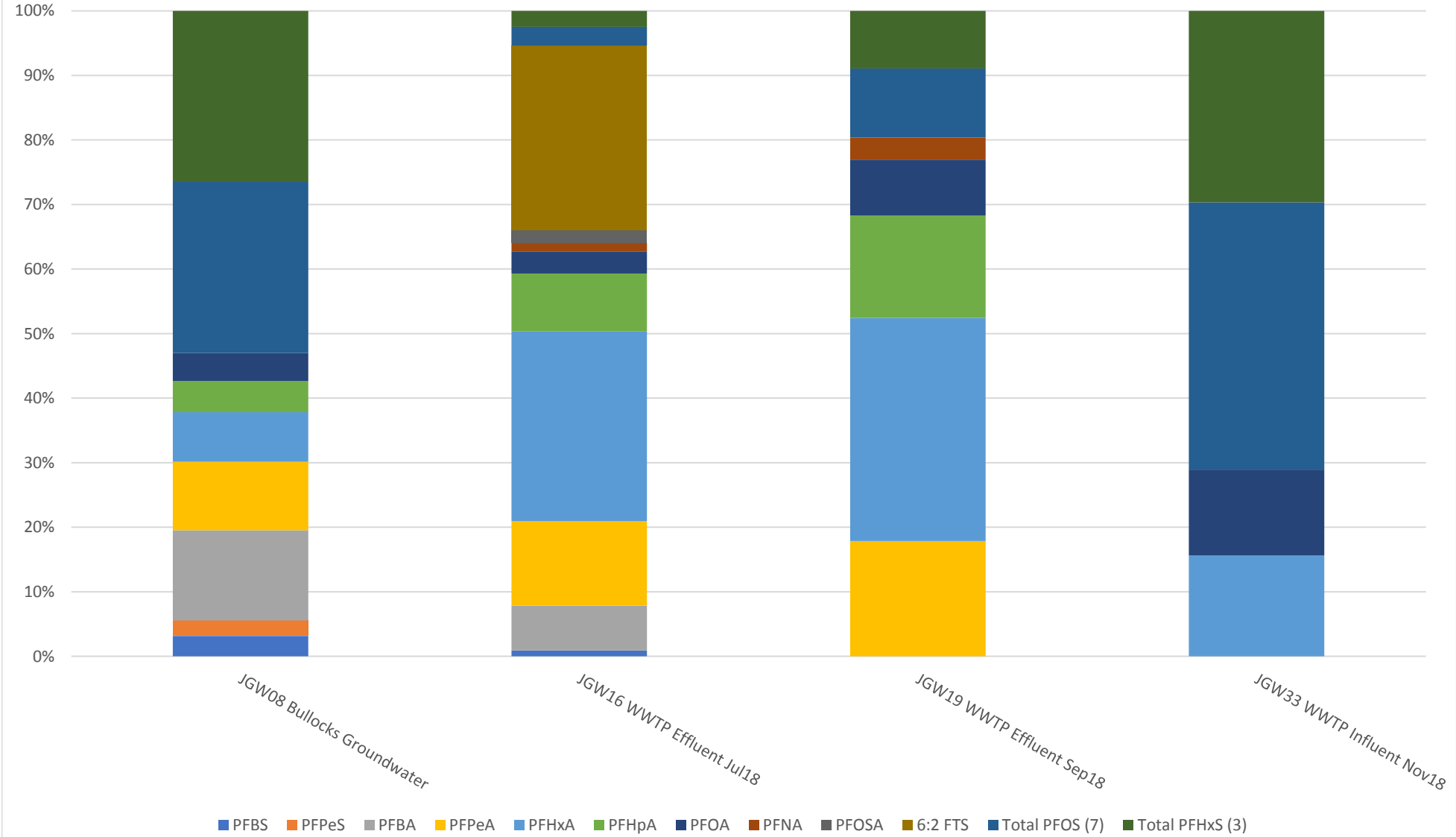

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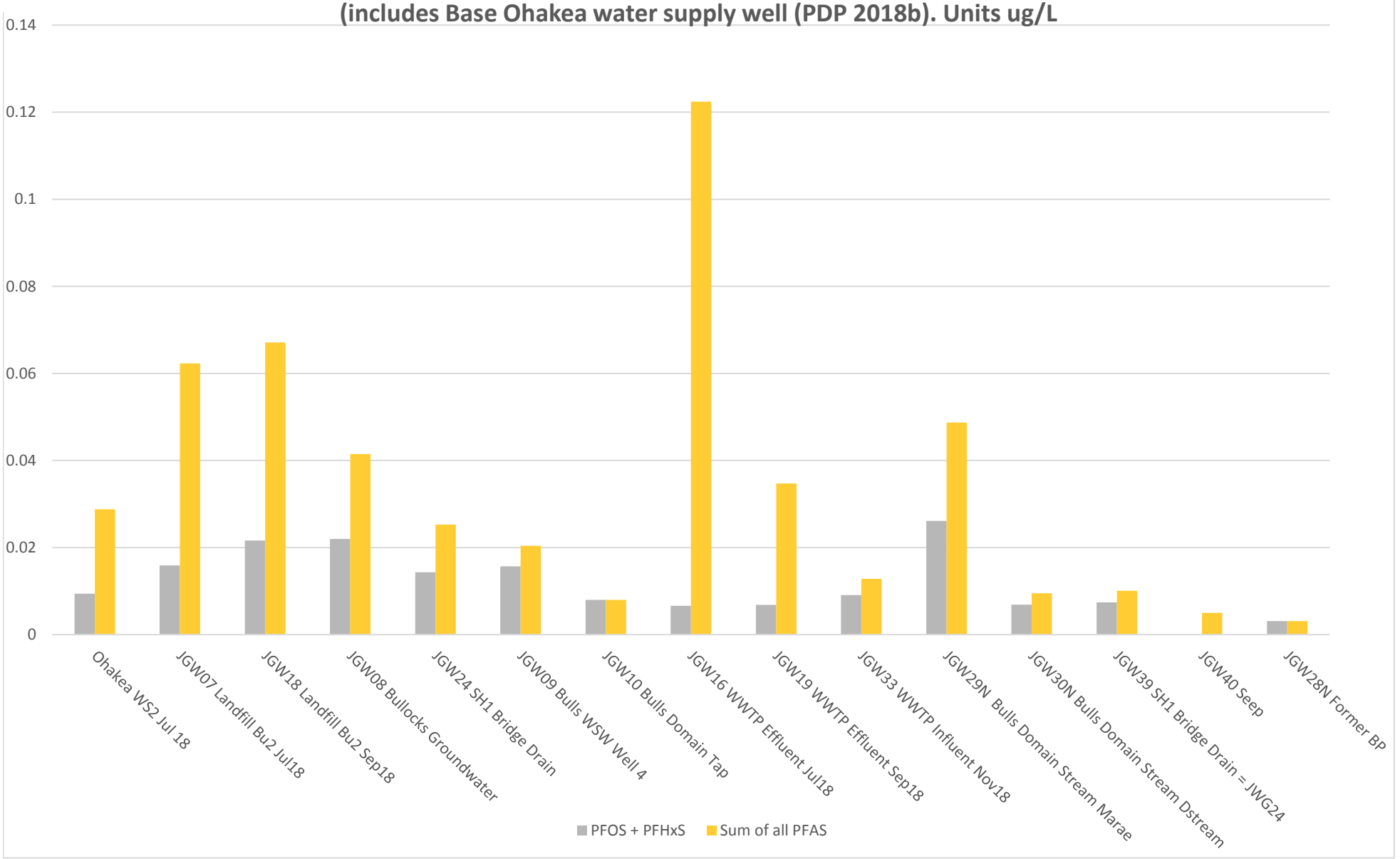
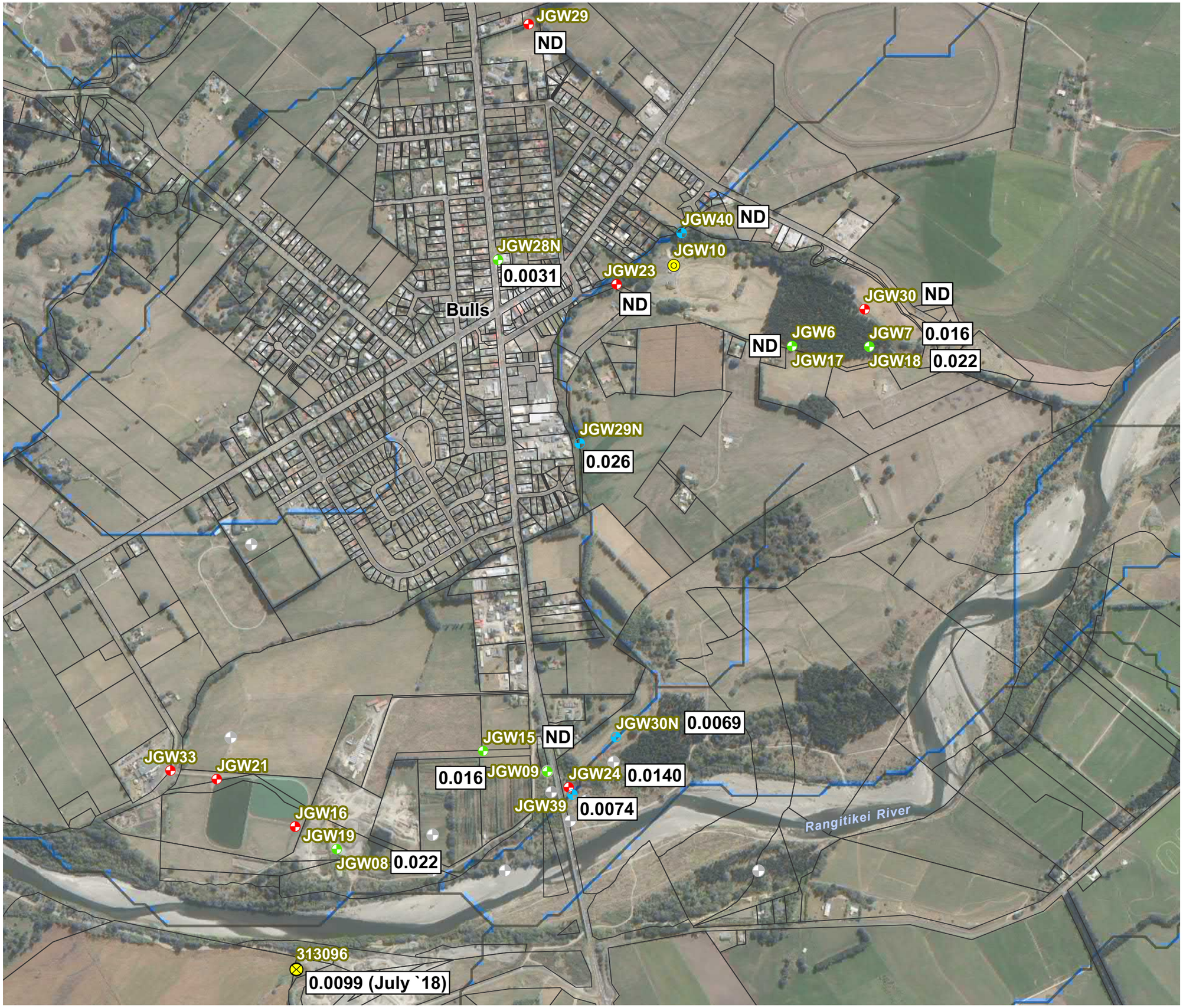
Figure 10: Total PFAS and PFOS + PFHxS Concentrations Primary Samples Where PFAS Detected (includes Base Ohakea water supply well (PDP 2018b). Units ug/L





Legend

- Ohakea Base Water Supply Well
- Potable Network Sample (Tap)
- Surface Water
- SW/WWTP Grab Sample
- Bore Sampled
- Other Bores (not sampled)
- Streams
- Land Parcels
- 0.016 PFOS & PFHxs (µg/L)

N

0 100 200 300 m

Bulls PFAS Study
PFOS & PFHxS Concentrations in Groundwater and Surface Water

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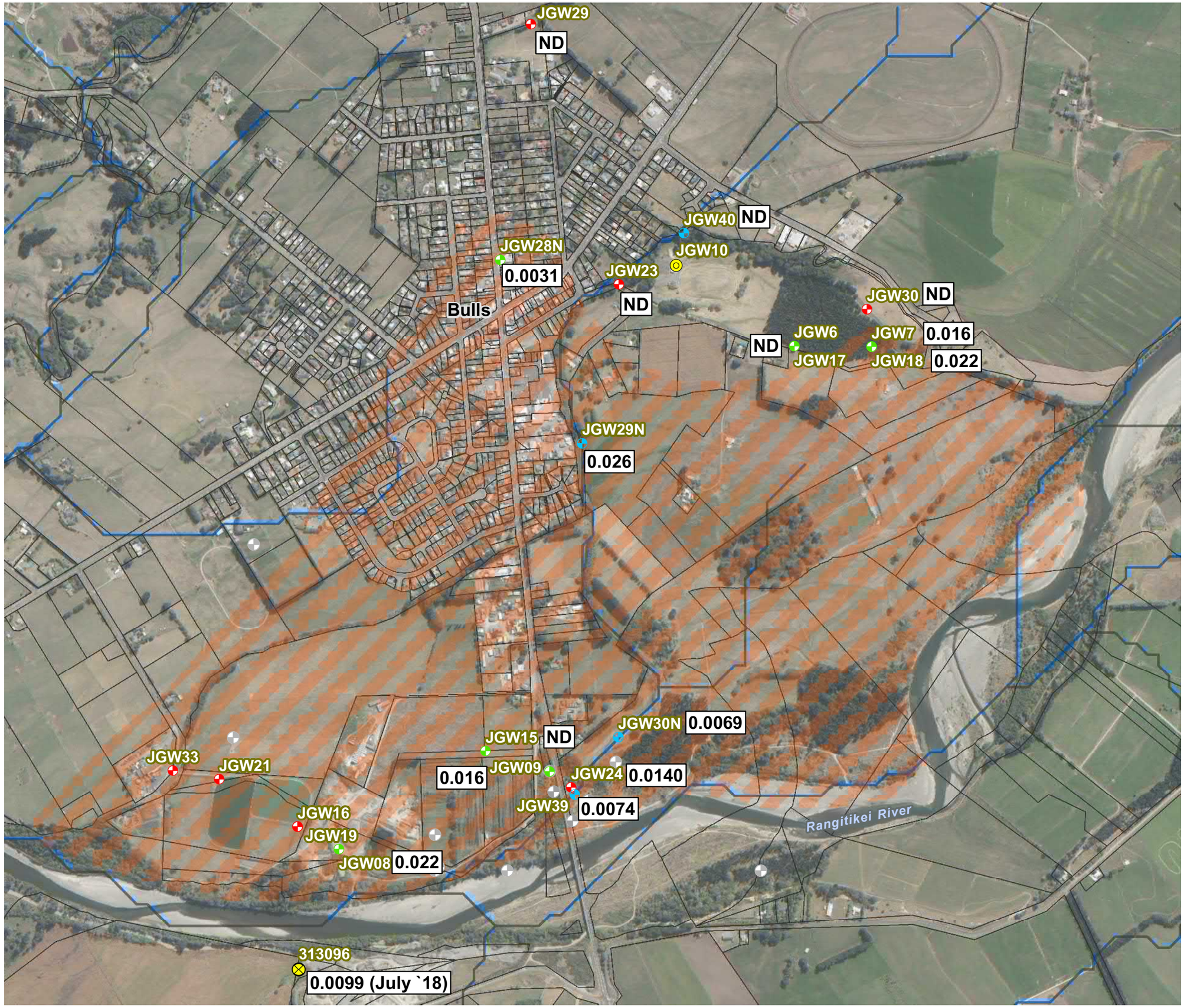

Legend

- Ohakea Base Water Supply Well
- Potable Network Sample (Tap)
- Surface Water
- SW/WWTP Grab Sample
- Bore Sampled
- Other Bores (not sampled)
- inferred PFAS Extent
- Streams
- Land Parcels
- 0.016 PFOS & PFHxs (µg/L)

N

0 100 200 300 m

Bulls PFAS Study
Inferred extent of PFAS in Shallow Ground Water

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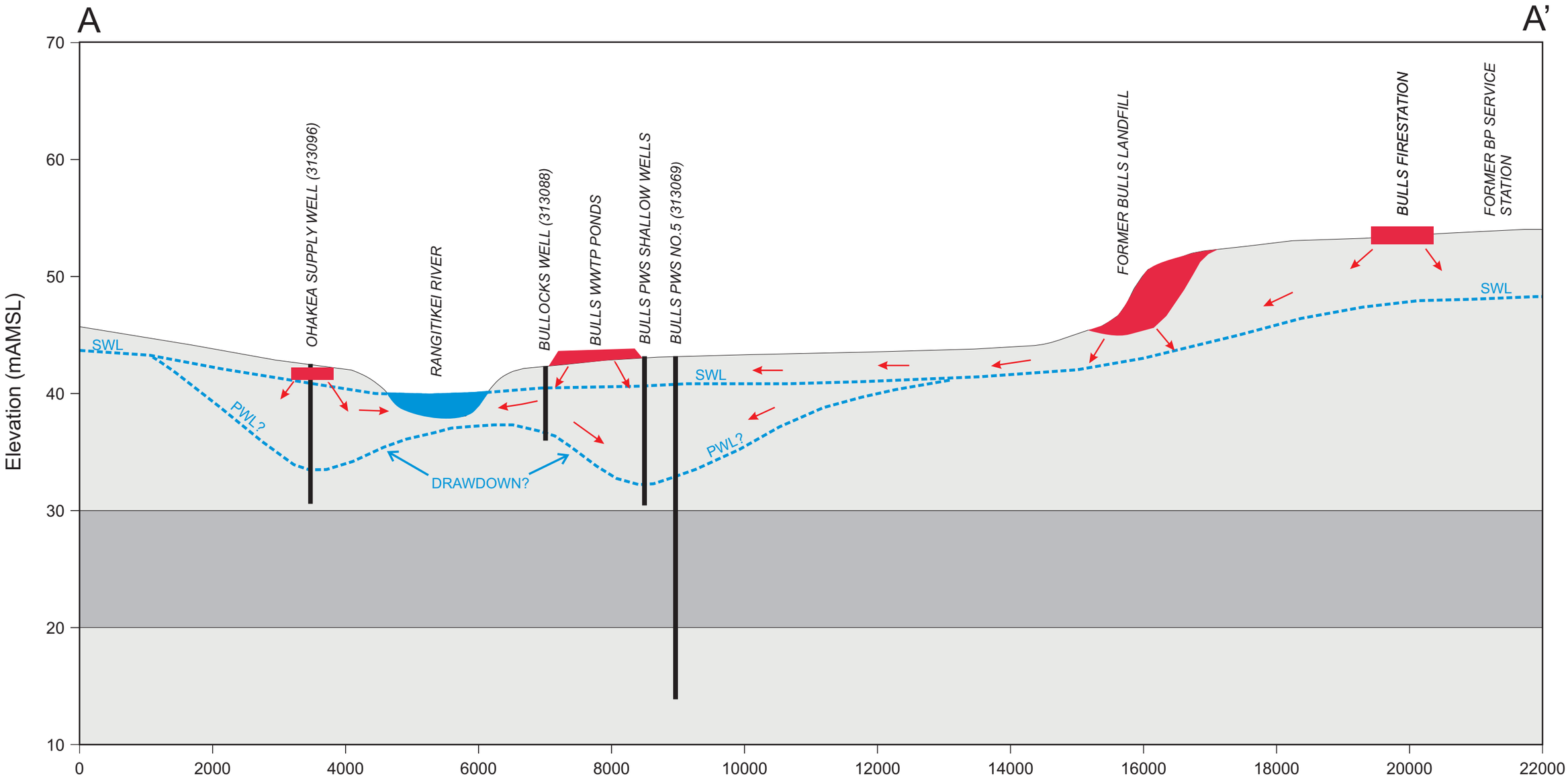


Legend:

- PFAS Source
- Contaminant migration
- SWL = Static water level
  PWL = Pumped water level
- Confining silts / clays / peat
- Gravel

Document Status:

J:\IE\Projects\02_New Zealand\IZ112200\01 Design\Cross-section

Filename	Name	Date
Updated conceptual site model.cdr	CJS	July-19

Data Notes:

Please note that water levels that are marked with question marks denote assumed water levels and have not been groundtruthed.

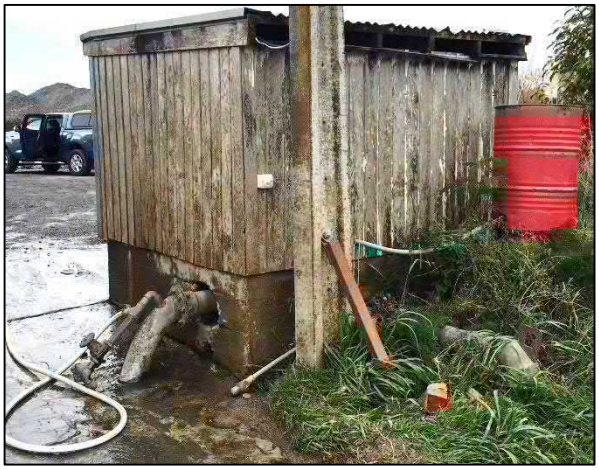
JACOBS
Level 3, 410 Victoria Street
PO Box 54, Waikato Mail Centre
Hamilton 3240
NEW ZEALAND
Tel + 64 7 981 1700
Fax + 64 7 981 1701

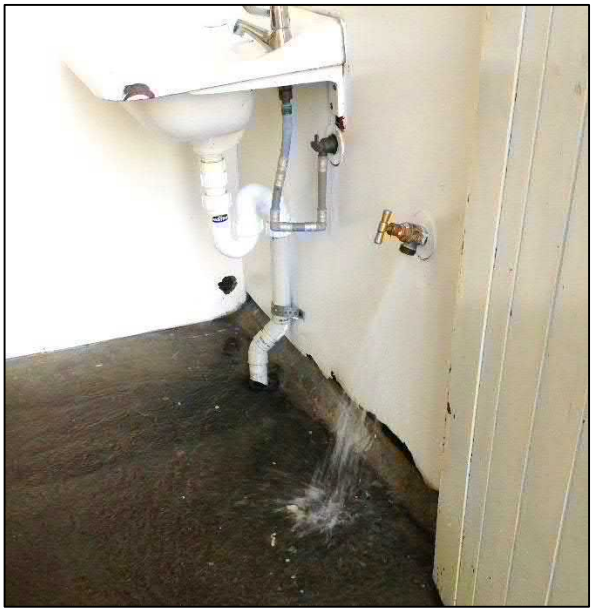
Title:

FIGURE 13:
BULLS WATER SUPPLY INVESTIGATION
UPDATED CONCEPTUAL SITE MODEL

Appendix B. Photographs

Bore ID and description	Photographs representative of conditions during sampling in early July 2018.
313097 Former landfill monitoring well Bu3	**Plate 1: Bore (in red metal casing) is unlocked and fenced on the edge of the forested area. It is adjacent to a maintained and grassed public walkway.** 
313095 Former landfill monitoring well Bu2	**Plate 2: Bore (red metal casing) is unlocked and fenced within the forested area. Forest contains unofficial walking tracks frequented by members of the public as observed during fieldwork.** 

Bore ID and description	Photographs representative of conditions during sampling in early July 2018.
313088 Bullock Co. quarry water supply	**Plate 3: Bore is operated by a pump housed in the small wooden shed. Bore water is piped to the outside tap with hose connection.** 
313093 Public Water Supply Well	**Plate 4: Water supply well fenced and locked. Bore water sampled from the small tap in the foreground of the photo.** 

Bore ID and description	Photographs representative of conditions during sampling in early July 2018.
Domain Tap Public Supply at Bulls Domain	**Plate 5: Public water access point. Sample taken from wall tap inside Domain male toilet block (water running in photo).** 
313069 Public Water Supply Well	**Plate 6: Sample from this bore was taken from the tap in the photo below, located on the southern side of the building within the Water Treatment Plant compound.** 

Bore ID and description	Photographs representative of conditions during sampling in early July 2018.
Bulls WWTP Point of discharge from ponds	**Plate 7: Sample was taken at the piped discharge on the southern side of the culvert/bridge shown with a red arrow in image below.** 

Bulls Supply Well 1 June 2018

Bulls Supply Well 2 June 2018

Bulls Supply Well 3 June 2018

Bulls Supply Well 4 (The original supply well (the Well) is inside the concrete headworks on the left hand side of the photograph) June 2018

Appendix C. Consented Discharges to Land (recent and current)

Discharge Consents - Bulls Area

Rangitikei District Council

Skyhawk crash site

Canterbury Meat Packers Ltd

Kakariki Proteins Ltd

Farmland Foods Ltd

Kakariki Proteins Ltd

Rangitikei District Council

Kakariki Proteins Ltd

Rangitikei District Council

Riverlands Manawatu Ltd

Fulton Hogan Ltd

NZ Defence Force

Manawatu District Council

Site Type

- Biosolids
- Concrete waste
- Landfill
- Meat processing
- Processed wastewater
- Rendering stickwater
- Septic tank
- Treated waste
- WWTP
- Bulls water supply
- Skyhawk crash
- Bores
- All streams order >3
- Defence Force area

horizons regional council

0 1 2 3 4 5 km

N

Appendix D. IOA request Response from FENZ, 17 December 2018

National Headquarters
Level 12
80 The Terrace
PO Box 2133
Wellington
New Zealand

Phone +64 4 496 3600

17 December 2018

Abby Matthews
Science and Innovation Manager
Horizons Regional Council
Palmerston North

By email: abby.matthews@horizons.govt.nz

Dear Abby

Information Request – Bulls fire station

I refer to your official information request dated 20 November 2018 asking for information regarding the storage, use and disposal of AFFF foam at the Bulls Fire Station. On 12 December 2018 you clarified that you were interested in any foams containing PFAS. Fire and Emergency has interpreted this to be all Class B foam, unless it is specifically fluorine free. You also asked for assurance on how Fire and Emergency New Zealand manages foam at the station currently.

Fire and Emergency is taking prudent steps to manage its use of Class B foam. Research by ESR was undertaken through Fire and Emergency's research fund to proactively understand the environmental impacts of the Class B foam used by Fire and Emergency.

The ESR analysis tested the five most commonly used Class B foams within Fire and Emergency and found they did not contain PFOS or PFOA. Fire and Emergency issued a national direction that only these foams could continue to be used in an emergency, with other foams withdrawn from service on a precautionary basis. Fire and Emergency no longer trains with Class B foam.

Class B foam concentrate is usually stored in 20-25 litre containers and most fire appliances will carry 2 foam containers and proportioners (mixing equipment). I can confirm this is the case for Bulls Fire Station.

Fire and Emergency undertook a stocktake of Class B foam in April 2018. It was found that Bulls Fire Station held two 20 – 25 litre containers of Alcoseal dated 1992 and 1998. These were collected and removed from the station.

Anecdotally, Fire and Emergency understands that there may have been a stocktake years earlier which saw the removal of any Class B foams that were known to contain PFOS or PFOA from the Bulls Fire Station, however this is unable to be verified or any associated dates. Bulls Fire Station may also have held some foam from Ohakea but that will not have been on station for a number of years.

Fire and Emergency is not aware of any Class B foam training on the Bulls Fire Station site.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

Yours sincerely

Bella Sutherland
Director, Office of the Chief Executive

Appendix E. Bulls Landfill Information

4 BULLS CLOSED LANDFILL

4.1 Site Description

The closed landfill is located along Watson Street in Bulls. Details of the landfill location are given in Table 4.1.1.

Table 4.1.1: Location Details, Closed Landfill - Bulls

Legal description	Lot 1 D.P.2507 Block XI Rangitoto S.D
Property address	Watson Street, Bulls
Map ref:	S23: 140-119
Current owners	Rangitikei District Council
Area (ha)	0.0238 ha

The Permit 4820 describes the location as *"on an alluvial plain and forms an extension of an upper terrace with the waste extending the terrace over the lower river plain".* The waste was tipped over the edge of the high terrace and compacted onto the lower terrace. Underlying the two terraces is moderately to highly permeable gravels (MWH, Monitoring report, 2011-2012).

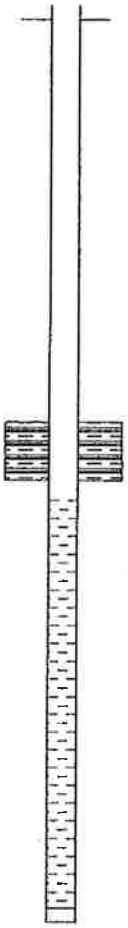
Figure 4.1.1 shows the location of the two bores that are monitored to assess the impact of leachate from the closed Bulls landfill (Bu2 and Bu3).

Figure 4.1.1: Bu2 & Bu3 Monitoring Bore Location for Bulls Landfill


Watson St
Bulls Domain
Watson St

Bul
Destroyed? by capping

PROJECT: Bulls Landfill	DATE: 13/5/94
LOCATION: Rangitikei	GROUND ELEVATION:
METHOD: Cable Tool	LOGGED BY: R.W

Depth (metres)	Graphic Log	Water/ Product	Description/Comment	Sample	Completion
0			TOPSOIL		
1.0			Blue GRAVEL with brown clay		
2.0					
3.0					
4.0			Wet Blue GRAVEL –brown water		
5.0					
6.0			Blue coarse SAND with traces of clay		

Screen Length:	3.0 m	Boring Diameter:	150 mm
Total Depth:	6.3 m	PVC Diameter:	50 mm
Water Level:	4.1 m	Screen Pack:	Pea Gravel
WL Time/Date:	13/5/94	Driller:	Nevill Webb & Sons Ltd

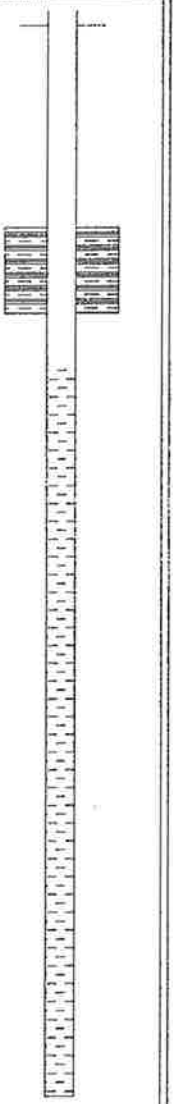
ROYDS CONSULTING LIMITED

Log of Borehole

Bu 2

PROJECT: Bulls Landfill	DATE: 25/3/95
LOCATION: Bulls	GROUND ELEVATION: 85.208 (Top of Piezo.)
METHOD: Odex	LOGGED BY: T.K

Depth (metres)	Graphic Log	Water/ Product	Description/Comment	Sample	Completion
0			Brown/Grey Sandy loose GRAVEL		
1.0					
2.0					
3.0					
4.0			Blue Grey Sandy Tight GRAVEL		
5.0					
6.0					
7.0			Blue SAND with clay		



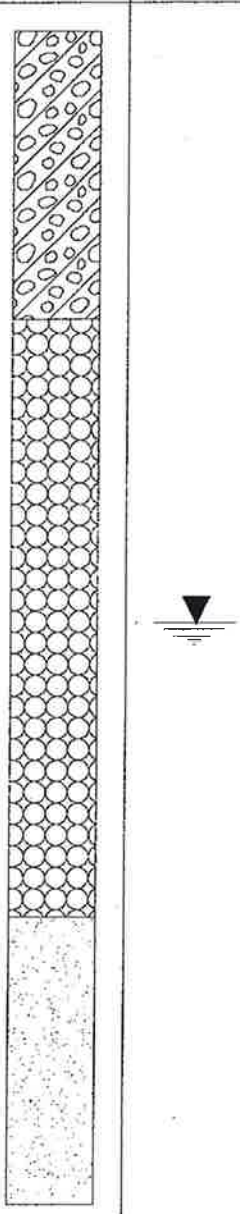
Screen Length:	5.0 m	Boring Diameter:	100 mm
Total Depth:	7.4 m	PVC Diameter:	50 mm
Water Level:	3.96 m	Screen Pack:	Walton Park
WL Time/Date:	27/4/95	Driller:	Webster Drilling & Exploration Ltd

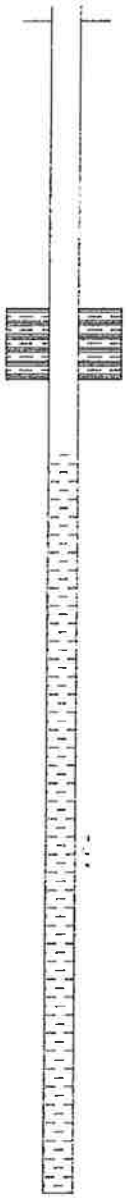
ROYDS CONSULTING LIMITED	Log of Borehole 2

BH3

PROJECT: Bulls Landfill	DATE: 25/3/95
LOCATION: Bulls	GROUND ELEVATION: 84.919 (Top of Piezo.)
METHOD: Odex	LOGGED BY: T.K

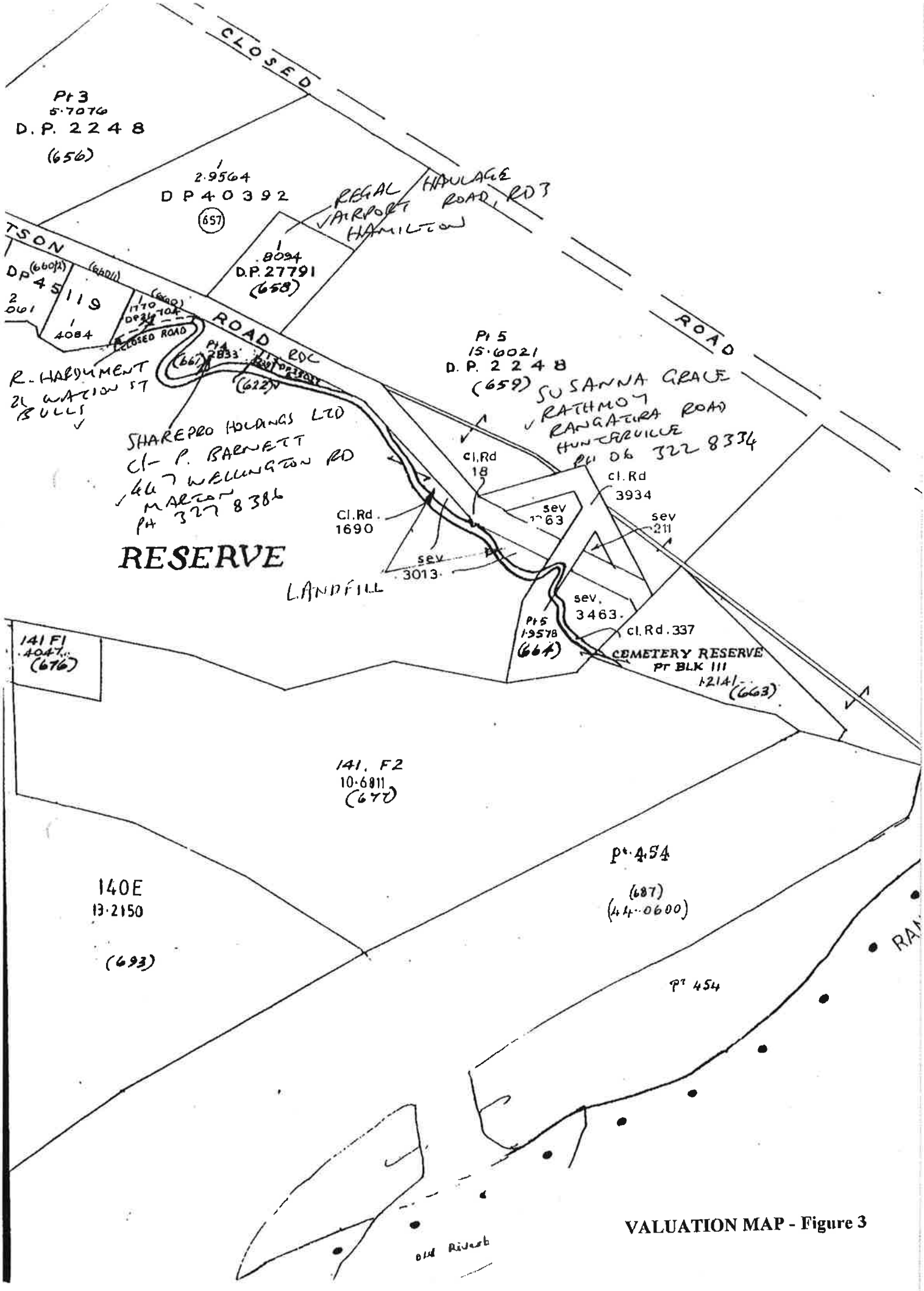
Depth (metres)	Graphic Log	Water/ Product	Description/Comment	Sample	Completion
0			Brown/Grey Sandy Loose GRAVEL		
1.0					
2.0					
3.0					
4.0			Blue Grey Sandy Tight GRAVEL		
5.0					
6.0					
7.0			Blue SAND with clay		
8.0					





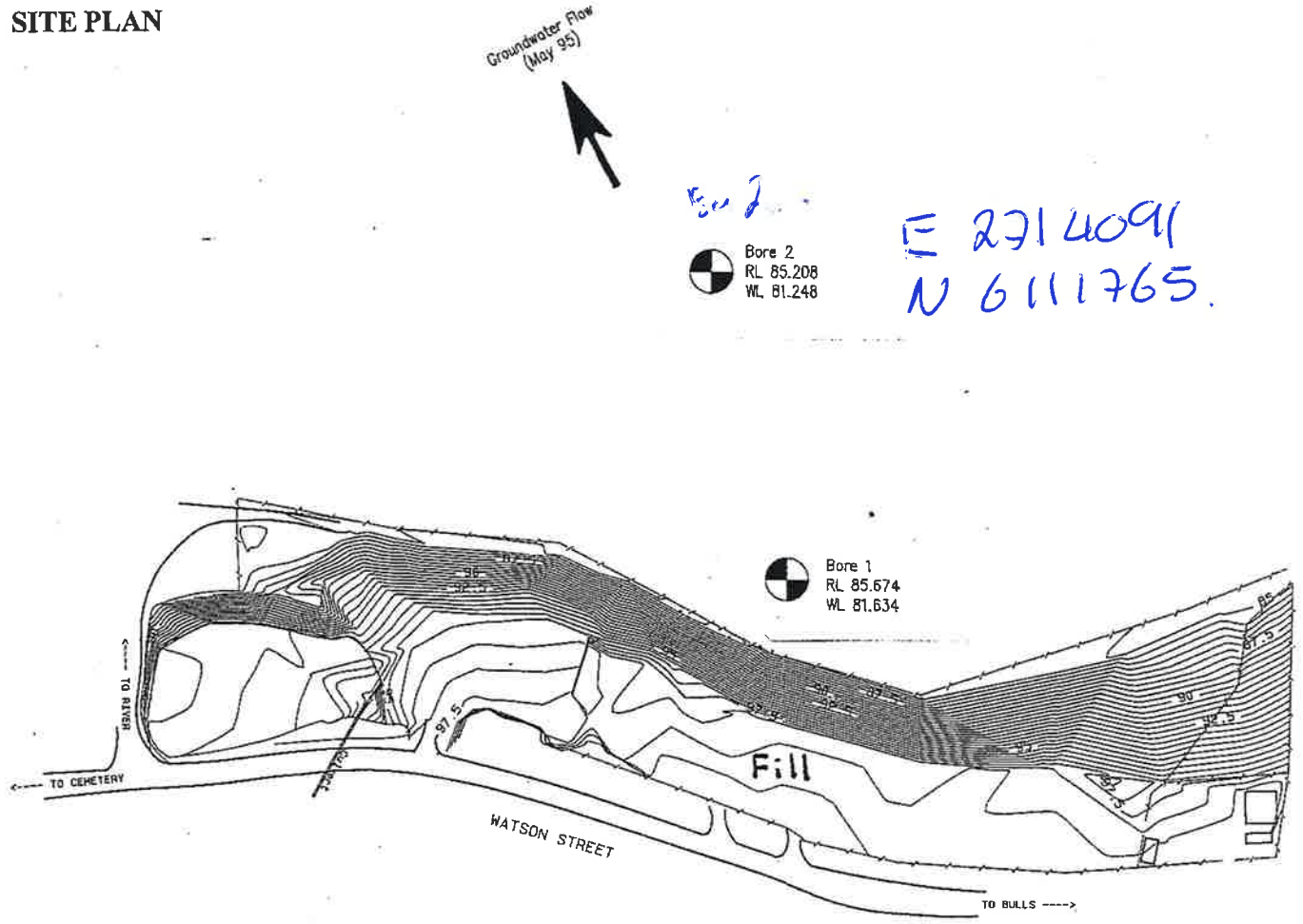
Screen Length:	5.0 m	Boring Diameter:	100 mm
Total Depth:	7.4 m	PVC Diameter:	50 mm
Water Level:	3.82 m	Screen Pack:	Walton Park
WL Time/Date:	27/4/95	Driller:	Webster Drilling & Exploration Ltd

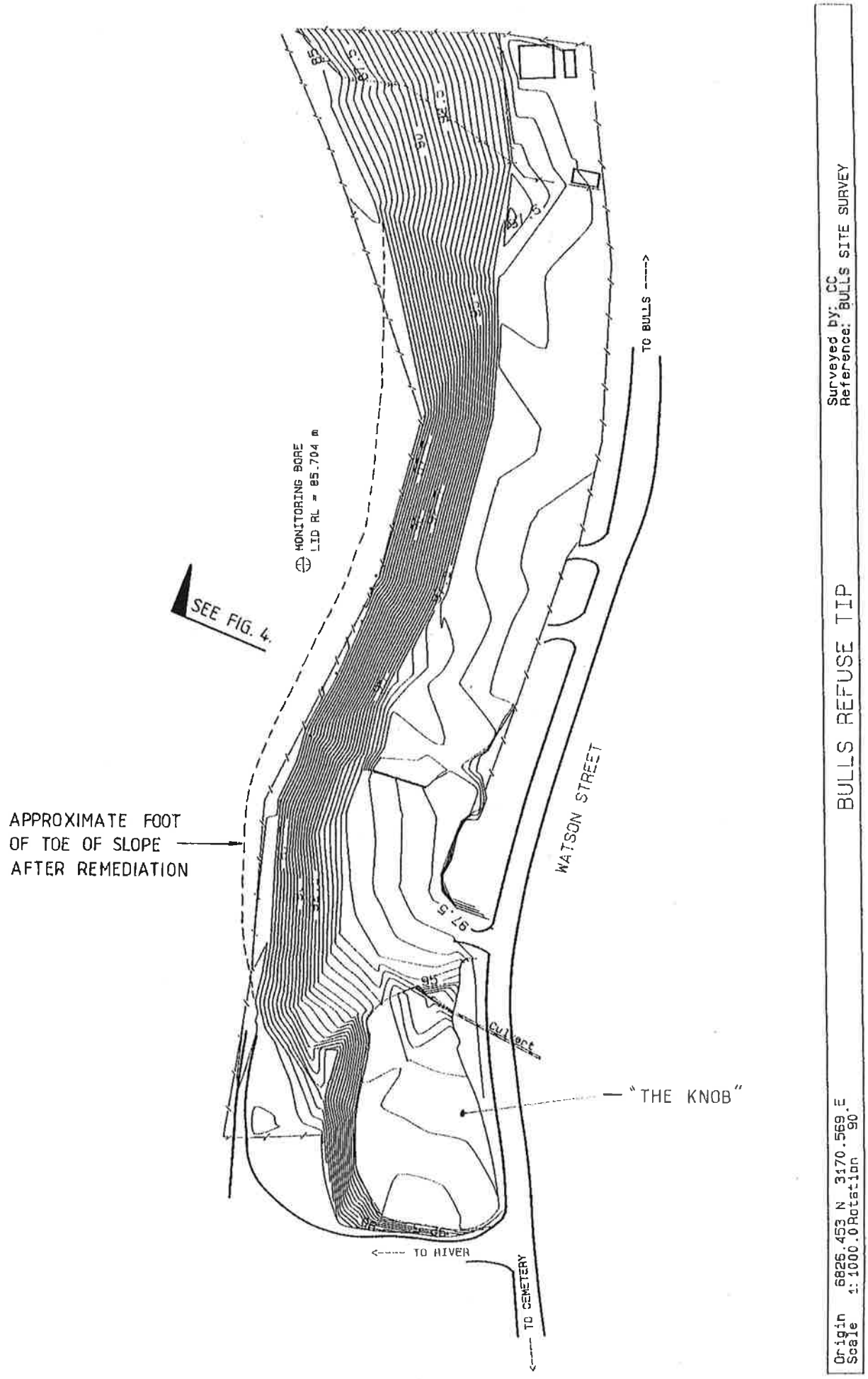
ROYDS CONSULTING LIMITED	Log of Borehole 3



VALUATION MAP - Figure 3

FIGURE 2 SITE PLAN

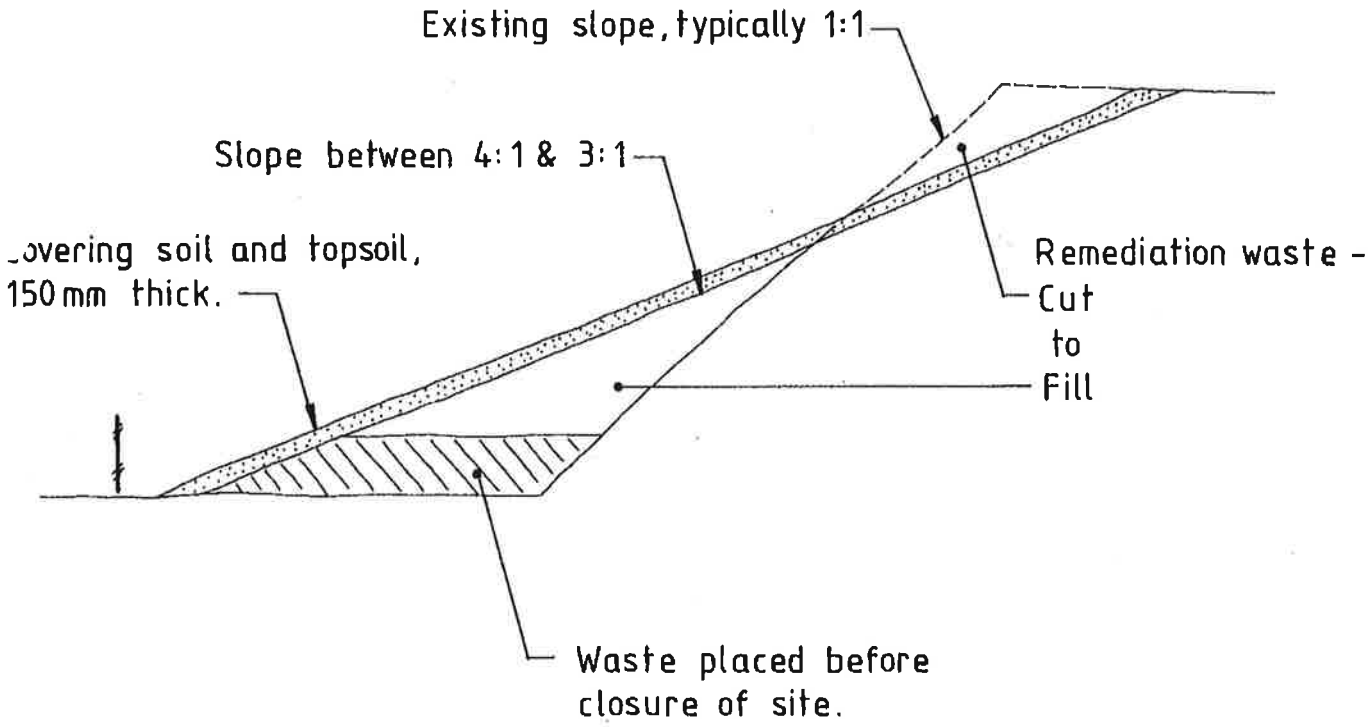




SITE PLAN

FIG. 2

BULLS LANDFILL



NOTE:
Over much of the site there will be only cut to fill.

SITE REMEDIATION FIG.4

Appendix F. Skyhawk Crash Site Report (PDP 2018b)

PATTLE DELAMORE PARTNERS LTD

NZDF PFAS Investigation – Summary Report: 1996 Skyhawk Crash

New Zealand Defence Force

solutions for your environment

NZDF PFAS Investigation – Summary Report: 1996 Skyhawk Crash

Prepared for

New Zealand Defence Force

August 2018

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solutions for your environment

Quality Control Sheet

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CLIENT	New Zealand Defence Force
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ISSUE DATE	14 August 2018
JOB REFERENCE	A02684802
SOURCE FILE(S)	A02684802R006_SummaryReportSHCVersion1 Final.docx

DOCUMENT CONTRIBUTORS

Prepared by

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Reviewed by

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Approved by

Hamish Wilson

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by New Zealand Defence Force and others (not directly contracted by PDP for the work), including Horizons Regional Council, Aecom, and Tonkin and Taylor. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of New Zealand Defence Force for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

The information contained within this report applies to sampling undertaken on the dates stated in this report, or if none is stated, the date of this report. With time, the site conditions and environmental standards could change so that the reported assessment and conclusions are no longer valid. Accordingly, the report should not be used to refer to site conditions and environmental standards applying at a later date without first confirming the validity of the report's information at that time.

Executive Summary

This report documents a groundwater sampling investigation undertaken on private properties adjacent to the 1996 Skyhawk Crash Site ('the site') for the New Zealand Defence Force (NZDF) to investigate the potential for groundwater contamination relating to the use of per- and poly-fluoroalkyl substances (PFAS) at the site.

Eight groundwater samples were collected from six sample sites, five sites south of the crash site, and one site immediately north. Sampling was undertaken from 24 May to 4 July 2018. Based on bore use information provided by the landowners, two bores are currently used for potable and/or drinking water supply. No PFAS was detected above the limit of reporting in any of the eight groundwater samples.

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Appendices

Appendix A: Quality Assurance / Quality Control Summary

Appendix B: Results Tables

1.0 Introduction

In 1996 a Royal New Zealand Airforce (RNZAF) Skyhawk plane crashed on private farmland north east of Bulls. Fire-fighters from RNZAF attended the crash and applied fire-fighting foam as part of the crash response. The volume of foam used on the crash site was unknown.

Whilst it is not known whether the Aqueous Film Forming Foam (AFFF) used at the crash site contained per- and poly-fluoroalkyl substances (PFAS), NZDF has historically used AFFF containing PFAS.

Pattle Delamore Partners Ltd (PDP), in conjunction with a number of other Environmental Consultancies, have been engaged by the New Zealand Defence Force (NZDF) to undertake an external sampling campaign to investigate the potential for groundwater contamination by the use of AFFF containing PFAS at properties adjacent to and south of the 1996 Sky Hawk Crash Site ('the site'). The investigation area is shown on Figure 1.

The sampling was undertaken from the 24 May to 4 July 2018. A total of seven groundwater bores located in a southerly direction from the site were sampled, as well as one deeper bore north of the site. Note that shallow bores were targeted for sampling and only on properties where access permission was granted.

Based on the bore use information from land owners, a total of two bores are currently used for potable and/or drinking water purposes. Six bores are currently used for stock watering and/or fodder irrigation and two bores are currently used for monitoring purposes only. The sample results for landowners of properties south of and adjacent to the site have been reported in individual landowner reports, with recommendations regarding ongoing use of the water provided in those reports.

This summary report provides a summary of the Skyhawk crash investigation sampling results in the context of the entire investigation area.

1.1 Project Objectives and Scope

The key project objectives for this sampling investigation were:

- To sample and test groundwater from a selection of accessible bore sites as close as possible to the 1996 Skyhawk Crash site and determine if PFAS compounds are present;
- To compare the concentrations of PFAS compounds present against interim drinking water guideline values and applicable screening values.

2.0 Background

PFAS compounds, such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are a group of manufactured chemicals used since the 1950s. PFAS have been and continue to be used in a wide range of industrial and commercial products including aqueous film forming foam (AFFF) used for fighting fuel fires. Recently PFAS have gained increasing scientific and regulatory interest due to their widespread use, their environmental persistence and because some PFAS (primarily PFOS and PFOA) display bioaccumulative and toxic properties to humans and wildlife (CONCAWE, 2016).

PFAS are emerging contaminants. NZDF is investigating the potential for contamination of ground and water associated with the use of AFFF containing PFAS at this RNZAF crash site.

The 1996 Skyhawk Crash site is surrounded by pastoral land predominantly used for grazing cattle and dairy farming.

3.0 Methodology

Groundwater sampling was undertaken in groundwater supply wells at selected locations adjacent to the crash site following the methodology outlined in the *Sampling Protocols for Monitoring Per and Poly-fluorinated Compounds in Groundwater and Surface Water for New Zealand Defence Force* (PDP, February 2018a, and May 2018b) and the guidance documents referenced therein.

Sampling was completed between 24 May and 4 July, 2018. All samples were sent to AsureQuality laboratories, Wellington under standard chain of custody procedures and were analysed for their PFAS suite.

4.0 Guidelines and Screening Values

The interim guidelines for drinking water and non-potable water / recreation currently used in New Zealand to compare with the water sample data collected during this project are presented in Table 1 along with additional screening criteria that have been prepared by NZDF consultants EnRisks. The screening criteria have been developed for water and soil and apply to animals/products grown and consumed at home (home-grown produce).

Guidelines are provided for three PFAS compounds only. These compounds are known to be associated with certain types of AFFF. Henceforth results are discussed for these three compounds only. Results for the full analytical suite of 28 PFAS are available in the laboratory reports. These are provided in a separate electronic file.

Table 1: Environmental and Human Health Guidelines – Water

Media	Sum of Total PFOS + PFHxS	PFOA	Total PFHxS	Total PFOS	Source
Drinking Water	0.07 µg/L	0.56 µg/L	-	-	MoH [1], AGDoH [2]
Non-potable Water / Recreation	0.7 µg/L	5.6 µg/L	-	-	AGDoH [2]
Stock Watering Only (home grown consumption)	-	Beef 150 µg/L	Beef 0.1 µg/L	Beef 0.1 µg/L	EnRisks [3]
	-	Milk 30 µg/L	Milk 0.02 µg/L	Milk 0.02 µg/L	
	-	Eggs 4 µg/L	Eggs 0.2 µg/L	Eggs 0.09 µg/L	
Stock Watering and Fodder Irrigation (home grown consumption)	-	Beef 60 µg/L	Beef 0.06 µg/L	Beef 0.05 µg/L	EnRisks [3]
	-	Milk 14 µg/L	Milk 0.008 µg/L	Milk 0.008 µg/L	

Notes:

1. *Ministry of Health (MoH, 2017) Interim Guidance Level for Drinking Water, PFOA, PFOS and PFHxS.*
2. *Australian Government Department of Health (AGDoH, 2017) Health Based Guidance Values for PFAS for Use in Site Investigations in Australia.*
3. *Site specific screening values from Livestock Uptake Modelling and Screening Criteria Development for PFAS. EnRisks, November 2017. Screening values calculated using a scenario of 10% of the tolerable daily intake. This is the most conservative scenario developed.*

5.0 Quality Assurance/Quality Control

Due to the very low detection limits of PFAS required for this investigation, a robust quality assurance/quality control (QA/QC) programme was required.

5.1 Project Data Quality Objectives

The project data quality objective (DQO) was to determine the presence or absence (less than 0.005 µg/L) of PFASs in groundwater from groundwater bores.

To determine if the DQO was met, the internal QA/QC function ('QAChecker'), in the environmental database software ESdat, was used to calculate relative percent differences between sample duplicates and to check for detections of PFAS in blanks.

The results of the QA/QC check indicate that all samples meet the DQOs. A summary of the QA/QC check is provided in Appendix A. Additional information relating to the QA/QC results can be provided upon request.

6.0 Results Summary and Comparison to Guidelines

A total of eight groundwater samples were taken from 24 May to 4 July 2018. The location of these groundwater samples is shown on Figure 1.

Summary tables for groundwater are provided in Appendix B.

An electronic file containing the laboratory reports for all samples is appended.

6.1 Groundwater

A summary of the groundwater sample results is presented below along with a comparison of the results to the interim drinking water guidelines, the non-potable guidelines, and the screening values for stock watering and fodder irrigation developed by EnRisks (2017). Screening values defined for beef would also be conservative for the consumption of home-grown sheep meat (EnRisks, 2017). Currently there is no information of the applicability of these screening values to the consumption of home-grown goat meat or milk.

6.1.1 Comparison to the Drinking Water Guideline and Screening Values

PFAS compounds were not detected above the limit of reporting (<0.0010 µg/L) in any of the samples collected. Therefore, no samples exceeded any of the guideline or screening values listed in Table 1.

6.1.2 Groundwater Results Summary

No PFAS compounds were detected above the laboratory limit of reporting in any of the groundwater samples collected as part of the investigation into the 1996 Skyhawk Crash Site.

7.0 References

AGDoH, 2017. *Final Health Based Guidance Values for PFAS for use in site investigations in Australia.* The Department of Health, Australian Government, Canberra, Australia. Sourced 15/05/2017 https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE086D480353CA2580C900817CDC/$File/fs-Health-Based-Guidance-Values.pdf

CONCAWE, 2016. *Environmental Fate and Effects of Poly- and Perfluoroalkyl Substances (PFAS).* Report No. 8/16. 23 June 2016.

EnRiskS, 2017. *Livestock Uptake Modelling and Screening Criteria Development for PFAS, draft.* Revision C. Environmental Risk Sciences Pty Ltd. 1 November 2017.

FSANZ, 2017. *Assessment of potential dietary exposure to perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) occurring in foods sampled from contaminated sites* – Table 8, Supporting Document 2. Food Standards Australia New Zealand, April 2017.

HEPA, 2018. *PFAS National Environmental Management Plan.* Heads of EPAs Australia and New Zealand, January 2018.

MoH, 2017. *Poly-fluoroalkyl substances (PFASs), also called perfluoroalkyl substances (PFASs)* draft, Ministry of Health November 2017.

PDP, 2018a. *Sampling Protocols for Monitoring Per and Poly-fluorinated Compounds in Groundwater and Surface Water for New Zealand Defence Force.* Pattle Delamore Partners Ltd. February 2018.

PDP, 2018b. *Sampling and Analysis Plan for Protocols for Polyfluorinated Compounds at RNZAF Ohakea.* Pattle Delamore Partners Ltd. May 2018.

ESDAT QA Checker
Project:A02684802_Combined_Database
Filter: Lab_Report_Number in('1138489','1178487','1178490','1178623','1180677')

Overview Summary
- Count of Samples
- Count of Results

Holding Times

Blanks
- Field Blanks
- Detects in Lab Blanks (0)

Duplicates
- Field and Interlab Duplicates
- Lab Duplicates with high RPDs (0)

Lab Control Samples
- SDG's without a Laboratory Control Sample (0)
- Laboratory Control Samples, Error > 25% (0)

Certified and Standard Reference Materials
- Certified Reference Materials - Error > 25% (0)

Matrix Spikes
- Trip Spikes with invalid Control Sample (0)
- Matrix Spike Recoveries outside lab LCL or UCL (0)

Inorganic

Other
- OriginalChemNames Requiring Validation (0)
- Samples with no Results (0)

Results Tables

Table B-1: Groundwater Sampling Results - Per- and Poly-Fluoroalkyl Substances (PFAS) Detections Only - Drinking Water [1]

			PFOA	Sum PFHxS+PFOS (1) [3]
Interim Guidance Level for Drinking Water, MoH 2017 [2]			0.56	0.07
Sample Name	**Sample Location**	**Date Sampled**		
MAR_SHC_GW89_1_240518	GW89	24/05/2018	<LOR	<LOR
MAR_SHC_GW90_1_240518	GW90	24/05/2018	<LOR	<LOR
MAR_SHC_GW91_1_240518	GW91	24/05/2018	<LOR	<LOR
MAR_SHC_GW92_1_270618	GW92	27/06/2018	<LOR	<LOR
MAR_SHC_GW93_1_270618	GW93	27/06/2018	<LOR	<LOR
MAR_SHC_GW94_1_030718	GW94	3/07/2018	<LOR	<LOR
MAR_SHC_GW95_1_030719	GW95	4/07/2018	<LOR	<LOR
MAR_SHC_GW97_1_030718	GW97	3/07/2018	<LOR	<LOR
Statistical Summary				
Number of Results			8	8
Number of Guideline Exceedances			0	0

Notes:

1. Values in µg/L (parts per billion).
2. Interim Guidance Level for Drinking Water, MoH 2017. Sourced from Australian Government Department of Health - Health Based Guidance Values for PFAS accessed 01/06/2017
3. Summations are made by adding compounds Total PFOS (7), Total PFHxS (3) together. Where one compound is below detection, it is not included in the summation.

<LOR | Less than the laboratory level of reporting

Table B-2: Groundwater Sampling Results - Per- and Poly-Fluoroalkyl Substances (PFAS) Detections Only - Non-potable, Stock Water and Fodder Irrigation [1]

	Sum PFHxS+PFOS (1) [4]	PFOA	Total PFHxS (3) [5]	Total PFOS (7) [5]
Non Potable Water / Contact Recreation Guideline [2]	0.7	5.6	NO GL	NO GL
SSSV - Beef Consumption (home grown) (Stock Watering and Fodder Irrigation) [3]	NO GL	60	0.06	0.05
SSSV - Beef Consumption (home grown) (Stock Watering Only) [3]	NO GL	*150*	*0.1*	*0.1*
SSSV - Egg Consumption (home grown) (Stock Watering Only) [3]	NO GL	4	0.2	0.09
SSSV - Milk Consumption (home grown) (Stock Watering and Fodder Irrigation) [3]	NO GL	14	0.008	0.008
SSSV - Milk Consumption (home grown) (Stock Watering Only) [3]	NO GL	30	0.02	0.02
Sample Name	**Sample Location**	**Date Sampled**		
MAR_SHC_GW89_1_240518	GW89	24/05/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW90_1_240518	GW90	24/05/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW91_1_240518	GW91	24/05/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW92_1_270618	GW92	27/06/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW93_1_270618	GW93	27/06/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW94_1_030718	GW94	3/07/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW95_1_030719	GW95	4/07/2018	<LOR	<LOR	<LOR	<LOR
MAR_SHC_GW97_1_030718	GW97	3/07/2018	<LOR	<LOR	<LOR	<LOR
Statistical Summary						
Number of Results			8	8	8	8
Number of Guideline Exceedances			0	0	0	0

1. Values in µg/L (parts per billion).

2. Australian Government Department of Health - Health Based Guidance Values for PFAS accessed 01/06/2017 (https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE086D480353CA2580C900817CDC/$File/fs-Health-Based-Guidance-Values.pdf).

3. Site specific screening values from *Livestock Uptake Modelling and Screening Criteria Development for PFAS*. EnRisks, November 2017. Screening values calculated using a scenario of 10% of the tolerable daily intake. This is the most conservative scenario developed.

4. Summations are made by adding compounds Total PFOS (7), Total PFHxS (3) together. Where one compound is below detection, it is not included in the summation.

5. Total PFOS, PFHxS are calculated by summing monoethyl, dimethyl and linear isomers. Where an isomer is below the detection limit it is not added to the summation.

No GL	No Guideline or Screening Value
<LOR	Less than the laboratory level of reporting

New Zealand DEFENCE FORCE
Te Ope Kātua O Aotearoa
NAVY NZ ARMY AIR FORCE

FIGURE 1: SKYHAWK INVESTIGATION SAMPLE LOCATIONS

NZDF PFAS INVESTIGATION

pdp solutions for your environment
PATTLE DELAMORE PARTNERS LTD

SOURCE:
Aerial imagery flown 2015/2016 sourced from the LINZ data service lds-manawatu-whanganui-20m-rural-aerial-photos-2015-16 and licenced for re-use under the creative commons attribution 3.0 New Zealand licence.
Topographic information supplied by LINZ.

KEY :
Sample Location
Groundwater
1996 Sky Hawk Crash Site

A027448042814_Summary_SkyhawkInvestigation.mxd VERSION DATE: 13 AUG 2018

Appendix G. Laboratory Reports as Received

AsureQuality Limited | 1C Quadrant Drive | Waiwhetu | Lower Hutt 5010 | Wellington | New Zealand
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Global Experts in Food Assurance

Certificate of Analysis

Final Report

Alisa Robertson
Jacobs New Zealand Ltd - Wellington
PO Box 10-283
Wellington 6143
New Zealand

Report Issued: 16-Jul-2018 **AsureQuality Reference: 18-180684** **Sample(s) Received:** 07-Jul-2018 11:00

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW6 - 313097 **AsureQuality ID:** 18-180684-1

Sample Description: Low strength landfill leachate

Sample Condition: Acceptable **Sampled Date**: 06-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	103	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	117	%	AsureQuality Method (LC-MS/MS)
M8PFOS	147	%	AsureQuality Method (LC-MS/MS)
M4PFBA	97	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	103	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	107	%	AsureQuality Method (LC-MS/MS)
MPFHpA	113	%	AsureQuality Method (LC-MS/MS)
M8PFOA	117	%	AsureQuality Method (LC-MS/MS)
M9PFNA	116	%	AsureQuality Method (LC-MS/MS)
M6PFDA	133	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	179 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	173 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	91	%	AsureQuality Method (LC-MS/MS)
MPFOSA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	66	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	71	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	170 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	158 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	85	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	98	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	124	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	107	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	123	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW7 - 313095 **AsureQuality ID:** 18-180684-2

Sample Description: Low strength landfill leachate

Sample Condition: Acceptable **Sampled Date**: 06-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.0018	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.0015	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
L-PFHxS (1)	0.0068	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0083	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0020	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0056	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0076	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.016	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	0.0054	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.015	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.011	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0052	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0042	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	84	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	96	%	AsureQuality Method (LC-MS/MS)
M8PFOS	132	%	AsureQuality Method (LC-MS/MS)
M4PFBA	74	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	84	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	86	%	AsureQuality Method (LC-MS/MS)
MPFHpA	91	%	AsureQuality Method (LC-MS/MS)
M8PFOA	94	%	AsureQuality Method (LC-MS/MS)
M9PFNA	97	%	AsureQuality Method (LC-MS/MS)
M6PFDA	120	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	159 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	163 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	105	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
MPFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	120	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	116	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	155 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	137	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	124	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	114	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	96	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	83	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	106	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW11 - 313095 **AsureQuality ID:** 18-180684-3

Sample Description: Low strength landfill leachate

Sample Condition: Acceptable **Sampled Date**: 06-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.0015	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0068	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0083	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0022	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0054	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0076	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.016	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	0.0055	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.015	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.012	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0054	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0043	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	99	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	111	%	AsureQuality Method (LC-MS/MS)
M8PFOS	131	%	AsureQuality Method (LC-MS/MS)
M4PFBA	90	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	101	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	99	%	AsureQuality Method (LC-MS/MS)
MPFHpA	105	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	106	%	AsureQuality Method (LC-MS/MS)
M6PFDA	116	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	121	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	94	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	94	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	59	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	67	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	124	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	124	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	75	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	86	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	117	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	101	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	108	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW12 **AsureQuality ID:** 18-180684-4

Sample Description: Rinsate

Sample Condition: Acceptable **Sampled Date**: 06-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	90	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	147	%	AsureQuality Method (LC-MS/MS)
M4PFBA	82	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	89	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	86	%	AsureQuality Method (LC-MS/MS)
MPFHpA	93	%	AsureQuality Method (LC-MS/MS)
M8PFOA	98	%	AsureQuality Method (LC-MS/MS)
M9PFNA	108	%	AsureQuality Method (LC-MS/MS)
M6PFDA	141	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	221 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	233 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	174 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	146	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	129	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	184 (R)	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSAA	188 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	137	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	133	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	86	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	82	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	123	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: Trip Blank **AsureQuality ID:** 18-180684-5

Sample Condition: Acceptable

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	105	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	108	%	AsureQuality Method (LC-MS/MS)
M8PFOS	117	%	AsureQuality Method (LC-MS/MS)
M4PFBA	104	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	104	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	104	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	111	%	AsureQuality Method (LC-MS/MS)
M9PFNA	108	%	AsureQuality Method (LC-MS/MS)
M6PFDA	108	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	104	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	98	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	54	%	AsureQuality Method (LC-MS/MS)
MPFOSA	87	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	59	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	61	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	66	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	78	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	91	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	93	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	89	%	AsureQuality Method (LC-MS/MS)

QC Results

Blank

Relates to sample(s) 18-180684-1, 18-180684-2, 18-180684-3, 18-180684-4, 18-180684-5

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	89	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	97	%	AsureQuality Method (LC-MS/MS)
M8PFOS	121	%	AsureQuality Method (LC-MS/MS)
M4PFBA	84	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	88	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	89	%	AsureQuality Method (LC-MS/MS)
MPFHpA	96	%	AsureQuality Method (LC-MS/MS)
M8PFOA	102	%	AsureQuality Method (LC-MS/MS)
M9PFNA	102	%	AsureQuality Method (LC-MS/MS)
M6PFDA	106	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	141	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	194 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	200 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	176 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	141	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	136	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	132	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNEtFOSE	164 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	153 (R)	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	87	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	97	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	103	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

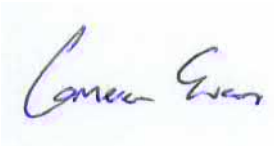
Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable



Cameron □vans

Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	NR
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	0.0010
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid

Analyte	Full Name
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid

Analyte	Full Name
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Global Experts in Food Assurance

Certificate of Analysis

Submission Reference: IZ112200 02

Final Report

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Wellington 6143
New Zealand

Report Issued: 25-Jul-2018 **AsureQuality Reference: 18-184106** **Sample(s) Received:** 12-Jul-2018 16:30

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW09-313093 **AsureQuality ID:** 18-184106-1

Sample Description: Groundwater supply

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0047	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0047	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0037	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0069	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.011	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.016	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0015	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0011	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0011	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	107	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	103	%	AsureQuality Method (LC-MS/MS)
M8PFOS	115	%	AsureQuality Method (LC-MS/MS)
M4PFBA	100	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	100	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	105	%	AsureQuality Method (LC-MS/MS)
MPFHpA	98	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	103	%	AsureQuality Method (LC-MS/MS)
M6PFDA	116	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	118	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	105	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	104	%	AsureQuality Method (LC-MS/MS)
MPFOSA	112	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	93	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	94	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	94	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	96	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	93	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	104	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	81	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	113	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW10 **AsureQuality ID:** 18-184106-2

Sample Description: Potable water supply

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0037	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Total PFHxS (3)	0.0037	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0022	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0021	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0043	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0080	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	109	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	97	%	AsureQuality Method (LC-MS/MS)
M8PFOS	103	%	AsureQuality Method (LC-MS/MS)
M4PFBA	104	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	103	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	107	%	AsureQuality Method (LC-MS/MS)
MPFHpA	97	%	AsureQuality Method (LC-MS/MS)
M8PFOA	98	%	AsureQuality Method (LC-MS/MS)
M9PFNA	99	%	AsureQuality Method (LC-MS/MS)
M6PFDA	104	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	81	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	55	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	54	%	AsureQuality Method (LC-MS/MS)
MPFOSA	90	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNEtFOSA	35	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	58	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	72	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	86	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	51	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	57	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	110	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	81	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	99	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW15-313069 **AsureQuality ID:** 18-184106-3

Sample Description: Groundwater

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	116	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	112	%	AsureQuality Method (LC-MS/MS)
M8PFOS	132	%	AsureQuality Method (LC-MS/MS)
M4PFBA	110	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	110	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	107	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	101	%	AsureQuality Method (LC-MS/MS)
M9PFNA	118	%	AsureQuality Method (LC-MS/MS)
M6PFDA	130	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	113	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	90	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	87	%	AsureQuality Method (LC-MS/MS)
MPFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	67	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	75	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	87	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	111	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	64	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	76	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	116	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	98	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	126	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW16 **AsureQuality ID:** 18-184106-4

Sample Description: Wastewater sample

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0011	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0030	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0030	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0017	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0019	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0036	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Sum PFHxS+PFOS (1)	0.0066	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	0.0085	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.016	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.036	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.011	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0041	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0018	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	0.0023	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	NR	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	NR	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	NR	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.035	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	98	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	126	%	AsureQuality Method (LC-MS/MS)
M4PFBA	71	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	83	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	95	%	AsureQuality Method (LC-MS/MS)
MPFHpA	91	%	AsureQuality Method (LC-MS/MS)
M8PFOA	105	%	AsureQuality Method (LC-MS/MS)
M9PFNA	115	%	AsureQuality Method (LC-MS/MS)
M6PFDA	138	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	137	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	134	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	104	%	AsureQuality Method (LC-MS/MS)
MPFOSA	69	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	75	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	70	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	167 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	167 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	NR	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	NR	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M4:2FTS	NR	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	186 (R)	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	196 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW8-3130088 **AsureQuality ID:** 18-184106-5

Sample Description: Groundwater

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0013	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.0016	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0098	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.011	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0046	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0068	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.011	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.022	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	0.0058	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0044	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0032	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0020	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0018	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	105	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	104	%	AsureQuality Method (LC-MS/MS)
M4PFBA	112	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	108	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	115	%	AsureQuality Method (LC-MS/MS)
MPFHpA	106	%	AsureQuality Method (LC-MS/MS)
M8PFOA	101	%	AsureQuality Method (LC-MS/MS)
M9PFNA	102	%	AsureQuality Method (LC-MS/MS)
M6PFDA	103	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	83	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	60	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	49	%	AsureQuality Method (LC-MS/MS)
MPFOSA	92	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	45	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	62	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	75	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	86	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	49	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	68	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	116	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	81	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	100	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW-TRIP02 **AsureQuality ID:** 18-184106-6

Sample Description: Trip Blank

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	94	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	94	%	AsureQuality Method (LC-MS/MS)
M8PFOS	115	%	AsureQuality Method (LC-MS/MS)
M4PFBA	99	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	96	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	101	%	AsureQuality Method (LC-MS/MS)
MPFHpA	96	%	AsureQuality Method (LC-MS/MS)
M8PFOA	97	%	AsureQuality Method (LC-MS/MS)
M9PFNA	104	%	AsureQuality Method (LC-MS/MS)
M6PFDA	128	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	138	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	122	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	81	%	AsureQuality Method (LC-MS/MS)
MPFOSA	114	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	113	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	123	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	138	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	140	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	121	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	122	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	91	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	75	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	126	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW-TRIP03 **AsureQuality ID:** 18-184106-7

Sample Description: Trip Blank

Sample Condition: Acceptable **Sampled Date**: 12-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	113	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	113	%	AsureQuality Method (LC-MS/MS)
M8PFOS	136	%	AsureQuality Method (LC-MS/MS)
M4PFBA	106	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	105	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	104	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
MPFHpA	98	%	AsureQuality Method (LC-MS/MS)
M8PFOA	107	%	AsureQuality Method (LC-MS/MS)
M9PFNA	113	%	AsureQuality Method (LC-MS/MS)
M6PFDA	139	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	154 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	149	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	125	%	AsureQuality Method (LC-MS/MS)
MPFOSA	118	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	118	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	147	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	156 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	110	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	102	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	94	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	82	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	116	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: Duplicate of 18-184106-2 **AsureQuality ID:** 18-184106-8

Sample Description: JGW10 dup

Sample Condition: Acceptable

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0038	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0038	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0021	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0020	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0041	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0079	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	110	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	110	%	AsureQuality Method (LC-MS/MS)
M8PFOS	126	%	AsureQuality Method (LC-MS/MS)
M4PFBA	106	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	106	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	108	%	AsureQuality Method (LC-MS/MS)
MPFHpA	104	%	AsureQuality Method (LC-MS/MS)
M8PFOA	107	%	AsureQuality Method (LC-MS/MS)
M9PFNA	117	%	AsureQuality Method (LC-MS/MS)
M6PFDA	126	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	100	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	68	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	93	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	43	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	57	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	96	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	119	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	51	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	64	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	111	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	88	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	119	%	AsureQuality Method (LC-MS/MS)

QC Results

Blank

Relates to sample(s) 18-184106-1, 18-184106-2, 18-184106-3, 18-184106-4, 18-184106-5, 18-184106-6, 18-184106-7, 18-184106-8

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.025	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	122	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	119	%	AsureQuality Method (LC-MS/MS)
M8PFOS	101	%	AsureQuality Method (LC-MS/MS)
M4PFBA	129	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	126	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	126	%	AsureQuality Method (LC-MS/MS)
MPFHpA	118	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M8PFOA	118	%	AsureQuality Method (LC-MS/MS)
M9PFNA	107	%	AsureQuality Method (LC-MS/MS)
M6PFDA	96	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	64	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	46	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	110	%	AsureQuality Method (LC-MS/MS)
MPFOSA	52	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	30	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	34	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	45	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	58	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	35	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	37	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	122	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	125	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	92	%	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable

Cameron □vans

Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	NR
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	NR
NMeFOSE-M	NR
Telomere Sulfonic acids	
4:2 FTS	NR
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid

Analyte	Full Name
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid

Analyte	Full Name
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Global Experts in Food Assurance

Certificate of Analysis

Final Report

Alisa Robertson
Jacobs New Zealand Ltd - Wellington
PO Box 10-283
Wellington 6143
New Zealand

Report Issued: 12-Oct-2018 **AsureQuality Reference: 18-241064** **Sample(s) Received:** 25-□ep-2018 08:30

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW19 **AsureQuality ID:** 18-241064-1

Sample Description: 1055

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0031	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0031	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0015	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0022	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0037	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0068	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0062	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.012	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0055	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0030	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0012	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	NR	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	NR	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	72	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	115	%	AsureQuality Method (LC-MS/MS)
M8PFOS	130	%	AsureQuality Method (LC-MS/MS)
M4PFBA	21 (R)	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	35	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	62	%	AsureQuality Method (LC-MS/MS)
MPFHpA	93	%	AsureQuality Method (LC-MS/MS)
M8PFOA	102	%	AsureQuality Method (LC-MS/MS)
M9PFNA	115	%	AsureQuality Method (LC-MS/MS)
M6PFDA	131	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	151 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	231 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	181 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	103	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	150	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	157 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	185 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	195 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	111	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	118	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	NR	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	NR	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	171 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Subcontracted Tests

Gamma Irradiation	Complete		Subcontracted to MSD Animal Health Upper Hutt

Customer Sample Name: JGW21 **AsureQuality ID:** 18-241064-2

Sample Description: 1050

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	107	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	111	%	AsureQuality Method (LC-MS/MS)
M8PFOS	110	%	AsureQuality Method (LC-MS/MS)
M4PFBA	107	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	101	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	112	%	AsureQuality Method (LC-MS/MS)
MPFHpA	121	%	AsureQuality Method (LC-MS/MS)
M8PFOA	121	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M9PFNA	127	%	AsureQuality Method (LC-MS/MS)
M6PFDA	115	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	81	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	142	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	160 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	91	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	120	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	126	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	104	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	113	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	105	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	113	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	134	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	174 (R)	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	147	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Subcontracted Tests

Gamma Irradiation	Complete	Subcontracted to MSD Animal Health Upper Hutt

Customer Sample Name: Duplicate of 18-241064-2A **AsureQuality ID:** 18-241064-3

Sample Description: JGW21 duplicate

Sample Condition: Acceptable

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFDoDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	113	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	110	%	AsureQuality Method (LC-MS/MS)
M8PFOS	107	%	AsureQuality Method (LC-MS/MS)
M4PFBA	105	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	102	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	109	%	AsureQuality Method (LC-MS/MS)
MPFHpA	126	%	AsureQuality Method (LC-MS/MS)
M8PFOA	118	%	AsureQuality Method (LC-MS/MS)
M9PFNA	124	%	AsureQuality Method (LC-MS/MS)
M6PFDA	110	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	84	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	138	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	164 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	96	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	124	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	128	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	104	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	112	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	111	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	112	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	135	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	169 (R)	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	159 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

QC Results

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Relates to sample(s) 18-241064-1

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Internal Standards			
M3PFBS	101	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	105	%	AsureQuality Method (LC-MS/MS)
M8PFOS	119	%	AsureQuality Method (LC-MS/MS)
M4PFBA	101	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	100	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	95	%	AsureQuality Method (LC-MS/MS)
MPFHpA	104	%	AsureQuality Method (LC-MS/MS)
M8PFOA	102	%	AsureQuality Method (LC-MS/MS)
M9PFNA	105	%	AsureQuality Method (LC-MS/MS)
M6PFDA	119	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	143	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	170 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	137	%	AsureQuality Method (LC-MS/MS)
MPFOSA	120	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	99	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	118	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	143	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	128	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	109	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	101	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	110	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	99	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

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Relates to sample(s) 18-241064-2, 18-241064-3

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	103	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	106	%	AsureQuality Method (LC-MS/MS)
M8PFOS	108	%	AsureQuality Method (LC-MS/MS)
M4PFBA	105	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	102	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	102	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	104	%	AsureQuality Method (LC-MS/MS)
M9PFNA	107	%	AsureQuality Method (LC-MS/MS)
M6PFDA	107	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	119	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	118	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	135	%	AsureQuality Method (LC-MS/MS)
MPFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	110	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	108	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	109	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M6:2FTS	96	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	111	%	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Lauren Fleury

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)
mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)
L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)
Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)
di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)
mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)
L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)
Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)
Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)
For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.
Reported results are corrected for internal standard recovery

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
DX-PFCS01, 05-HIGHLE□EL	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans

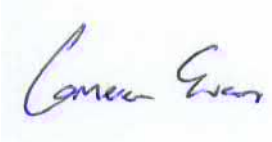
di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)
mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)
L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)
Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)
di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)
mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)
L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)
Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)
Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)
For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.
Reported results are corrected for internal standard recovery

MSD Animal □ealth Upper □utt□Upper □utt (Subcontracted)

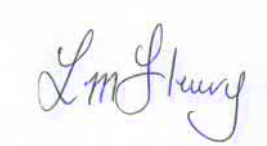
33 Whakatiki □t, Trentham | □pper Hutt 5018 | New Zealand

Analysis	Method	Accreditation
Gamma Irradiation		
SC-GAMA01, 01-DEFAULT	Subcontracted to MSD Animal Health Upper Hutt	NA - Subcontracted

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.
NR = Not Reportable



Cameron □vans
Scientist



Lauren Fleury
Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Listing applies to samples: 18-241064-1	
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	0.0010
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	NR
6:2 FTS	NR
8:2 FTS	0.0010

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Listing applies to samples: 18-241064-2 18-241064-3	
Perfluoroalkylsulfonic acids	
PFPrS	0.10
PFBS	0.10
PFPeS	0.10
di-PFHxS (1)	0.10
mono-PFHxS (1)	0.10
L-PFHxS (1)	0.10
Total PFHxS (3)	0.10
PFHpS	0.10
di-PFOS (5)	0.10
mono-PFOS (5)	0.10
L-PFOS (5)	0.10
Total PFOS (7)	0.10
Sum PFHxS+PFOS (1)	0.10
PFNS	0.10
PFDS	0.10
Perfluoroalkylcarboxylic acids	
PFBA	0.10
PFPeA	0.10
PFHxA	0.10
PFHpA	0.10
PFOA	0.10
PFNA	0.10
PFDA	0.10
PFUnDA	0.10
PFDoDA	0.10
PFTrDA	0.10
PFTeDA	0.10
Perfluorooctanesulfonamides	
PFOSA	0.10
NEtFOSA-M	0.10
NMeFOSA-M	0.10
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.10
NMeFOSAA	0.10
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.10
NMeFOSE-M	0.10
Telomere Sulfonic acids	
4:2 FTS	0.10
6:2 FTS	0.10
8:2 FTS	0.10

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Listing applies to samples: 18-241064-1	
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid

Analyte	Full Name
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide

Analyte	Full Name
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Listing applies to samples: 18-241064-2 18-241064-3	
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid

Analyte	Full Name
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Global Experts in Food Assurance

Certificate of Analysis

Final Report

Alisa Robertson
Jacobs New Zealand Ltd - Wellington
PO Box 10-283
Wellington 6143
New Zealand

Report Issued: 08-Oct-2018 **AsureQuality Reference: 18-241085** **Sample(s) Received:** 25-□ep-2018 08:30

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW17-313097 **AsureQuality ID:** 18-241085-1

Sample Description: Weak strength leachate 1455

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	88	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	79	%	AsureQuality Method (LC-MS/MS)
M8PFOS	69	%	AsureQuality Method (LC-MS/MS)
M4PFBA	92	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	93	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	94	%	AsureQuality Method (LC-MS/MS)
MPFHpA	87	%	AsureQuality Method (LC-MS/MS)
M8PFOA	83	%	AsureQuality Method (LC-MS/MS)
M9PFNA	82	%	AsureQuality Method (LC-MS/MS)
M6PFDA	79	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	90	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	90	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	62	%	AsureQuality Method (LC-MS/MS)
MPFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	61	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	86	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	83	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	96	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	106	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	110	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	97	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	75	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	79	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW18-313095 **AsureQuality ID:** 18-241085-2

Sample Description: Weak strength leachate 1605

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0016	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.0021	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
mono-PFHxS (1)	0.0021	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.012	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0036	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0060	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0096	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.022	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	0.0055	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.012	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0098	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0059	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0070	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.0016	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	103	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	99	%	AsureQuality Method (LC-MS/MS)
M4PFBA	96	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	98	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	102	%	AsureQuality Method (LC-MS/MS)
MPFHpA	100	%	AsureQuality Method (LC-MS/MS)
M8PFOA	96	%	AsureQuality Method (LC-MS/MS)
M9PFNA	103	%	AsureQuality Method (LC-MS/MS)
M6PFDA	115	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	102	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
MPFDoDA	96	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	42	%	AsureQuality Method (LC-MS/MS)
MPFOSA	109	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	75	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	89	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	90	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	111	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	112	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	114	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	113	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	84	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	98	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW23 **AsureQuality ID:** 18-241085-3

Sample Description: 1215

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	96	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	69	%	AsureQuality Method (LC-MS/MS)
M8PFOS	51	%	AsureQuality Method (LC-MS/MS)
M4PFBA	106	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	101	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	104	%	AsureQuality Method (LC-MS/MS)
MPFHpA	89	%	AsureQuality Method (LC-MS/MS)
M8PFOA	73	%	AsureQuality Method (LC-MS/MS)
M9PFNA	64	%	AsureQuality Method (LC-MS/MS)
M6PFDA	58	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	52	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	66	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	56	%	AsureQuality Method (LC-MS/MS)
MPFOSA	96	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	47	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	70	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	62	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	67	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	96	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	106	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	77	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	53	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW24 **AsureQuality ID:** 18-241085-4

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0053	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0053	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0038	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0052	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0090	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.014	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0028	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0024	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0015	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0016	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0027	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	115	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	121	%	AsureQuality Method (LC-MS/MS)
M8PFOS	157 (R)	%	AsureQuality Method (LC-MS/MS)
M4PFBA	105	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	105	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	111	%	AsureQuality Method (LC-MS/MS)
MPFHpA	121	%	AsureQuality Method (LC-MS/MS)
M8PFOA	121	%	AsureQuality Method (LC-MS/MS)
M9PFNA	146	%	AsureQuality Method (LC-MS/MS)
M6PFDA	158 (R)	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	210 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	219 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	124	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	143	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSA	135	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	163 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	155 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	126	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	112	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	142	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	122	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	148	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW28 **AsureQuality ID:** 18-241085-5

Sample Description: 1415

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	99	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	103	%	AsureQuality Method (LC-MS/MS)
M8PFOS	124	%	AsureQuality Method (LC-MS/MS)
M4PFBA	102	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	98	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	98	%	AsureQuality Method (LC-MS/MS)
MPFHpA	100	%	AsureQuality Method (LC-MS/MS)
M8PFOA	96	%	AsureQuality Method (LC-MS/MS)
M9PFNA	113	%	AsureQuality Method (LC-MS/MS)
M6PFDA	139	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	149	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	131	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	79	%	AsureQuality Method (LC-MS/MS)
MPFOSA	116	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	96	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	127	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	143	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	81	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	86	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	97	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	97	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	129	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW29 **AsureQuality ID:** 18-241085-6

Sample Description: 1200

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	109	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	113	%	AsureQuality Method (LC-MS/MS)
M8PFOS	134	%	AsureQuality Method (LC-MS/MS)
M4PFBA	92	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	93	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	105	%	AsureQuality Method (LC-MS/MS)
MPFHpA	105	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	119	%	AsureQuality Method (LC-MS/MS)
M6PFDA	128	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	136	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	187 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	229 (R)	%	AsureQuality Method (LC-MS/MS)
MPFOSA	107	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	114	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	117	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	136	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSAA	139	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	90	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	164 (R)	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	106	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	121	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW30 **AsureQuality ID:** 18-241085-7

Sample Description: 1400

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	NR	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	114	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	127	%	AsureQuality Method (LC-MS/MS)
M8PFOS	138	%	AsureQuality Method (LC-MS/MS)
M4PFBA	95	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	103	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	113	%	AsureQuality Method (LC-MS/MS)
MPFHpA	118	%	AsureQuality Method (LC-MS/MS)
M8PFOA	114	%	AsureQuality Method (LC-MS/MS)
M9PFNA	123	%	AsureQuality Method (LC-MS/MS)
M6PFDA	132	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	161 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	190 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	95	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	56	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	59	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	158 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	148	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	76	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	70	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	NR	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	124	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	128	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW31 **AsureQuality ID:** 18-241085-8

Sample Description: Weak strength leachate 1455

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	100	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	102	%	AsureQuality Method (LC-MS/MS)
M8PFOS	121	%	AsureQuality Method (LC-MS/MS)
M4PFBA	98	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	91	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	98	%	AsureQuality Method (LC-MS/MS)
MPFHpA	100	%	AsureQuality Method (LC-MS/MS)
M8PFOA	96	%	AsureQuality Method (LC-MS/MS)
M9PFNA	103	%	AsureQuality Method (LC-MS/MS)
M6PFDA	123	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	139	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	145	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	123	%	AsureQuality Method (LC-MS/MS)
MPFOSA	103	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	73	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	90	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	123	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	138	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	74	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSE	75	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	97	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	86	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	115	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW-TRIP04 **AsureQuality ID:** 18-241085-9

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	103	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	93	%	AsureQuality Method (LC-MS/MS)
M8PFOS	96	%	AsureQuality Method (LC-MS/MS)
M4PFBA	101	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	99	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	100	%	AsureQuality Method (LC-MS/MS)
MPFHpA	96	%	AsureQuality Method (LC-MS/MS)
M8PFOA	98	%	AsureQuality Method (LC-MS/MS)
M9PFNA	100	%	AsureQuality Method (LC-MS/MS)
M6PFDA	103	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	92	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	92	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	75	%	AsureQuality Method (LC-MS/MS)
MPFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	91	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	96	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	93	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	101	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	94	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	90	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW-TRIP05 **AsureQuality ID:** 18-241085-10

Sample Description: ND

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	94	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	93	%	AsureQuality Method (LC-MS/MS)
M8PFOS	92	%	AsureQuality Method (LC-MS/MS)
M4PFBA	95	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	97	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	99	%	AsureQuality Method (LC-MS/MS)
MPFHpA	93	%	AsureQuality Method (LC-MS/MS)
M8PFOA	92	%	AsureQuality Method (LC-MS/MS)
M9PFNA	93	%	AsureQuality Method (LC-MS/MS)
M6PFDA	99	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	89	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	93	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	59	%	AsureQuality Method (LC-MS/MS)
MPFOSA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	83	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	95	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	92	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	123	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	113	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	95	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	66	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	76	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: 18-241085-1A Duplicate **AsureQuality ID:** 18-241085-11

Sample Description: Duplicate of JGW17-313097

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	NR	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	98	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M8PFOS	107	%	AsureQuality Method (LC-MS/MS)
M4PFBA	92	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	90	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	95	%	AsureQuality Method (LC-MS/MS)
MPFHpA	91	%	AsureQuality Method (LC-MS/MS)
M8PFOA	92	%	AsureQuality Method (LC-MS/MS)
M9PFNA	97	%	AsureQuality Method (LC-MS/MS)
M6PFDA	111	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	122	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	131	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	66	%	AsureQuality Method (LC-MS/MS)
MPFOSA	92	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	NR	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	NR	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	107	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	94	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	77	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	102	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	74	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	82	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: 18-241085-4A duplicate **AsureQuality ID:** 18-241085-12

Sample Description: Duplicate of JGW24

Sample Condition: Acceptable **Sampled Date**: 24-Sep-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0051	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0051	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0040	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0090	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.014	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0030	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0024	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0016	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0015	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFNA	0.0028	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	110	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	112	%	AsureQuality Method (LC-MS/MS)
M8PFOS	137	%	AsureQuality Method (LC-MS/MS)
M4PFBA	96	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	97	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	98	%	AsureQuality Method (LC-MS/MS)
MPFHpA	110	%	AsureQuality Method (LC-MS/MS)
M8PFOA	106	%	AsureQuality Method (LC-MS/MS)
M9PFNA	126	%	AsureQuality Method (LC-MS/MS)
M6PFDA	135	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	169 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	209 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	111	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	116	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	152 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	150	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	107	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	137	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	102	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	109	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

QC Results

Blank

Relates to sample(s) 18-241085-1, 18-241085-2, 18-241085-3, 18-241085-10, 18-241085-11

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Internal Standards			
M3PFBS	108	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	104	%	AsureQuality Method (LC-MS/MS)
M8PFOS	90	%	AsureQuality Method (LC-MS/MS)
M4PFBA	117	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	115	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	121	%	AsureQuality Method (LC-MS/MS)
MPFHpA	110	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	102	%	AsureQuality Method (LC-MS/MS)
M6PFDA	93	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	83	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	100	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	147	%	AsureQuality Method (LC-MS/MS)
MPFOSA	76	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	42	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	59	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	72	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	76	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	78	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	86	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	115	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	102	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	78	%	AsureQuality Method (LC-MS/MS)

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Relates to sample(s) 18-241085-4, 18-241085-12

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	100	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	100	%	AsureQuality Method (LC-MS/MS)
M4PFBA	100	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	100	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	100	%	AsureQuality Method (LC-MS/MS)
MPFHpA	100	%	AsureQuality Method (LC-MS/MS)
M8PFOA	100	%	AsureQuality Method (LC-MS/MS)
M9PFNA	100	%	AsureQuality Method (LC-MS/MS)
M6PFDA	100	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	100	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	100	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	100	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	100	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	100	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	100	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	100	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M8:2FTS	100	%	AsureQuality Method (LC-MS/MS)

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Relates to sample(s) 18-241085-5, 18-241085-6, 18-241085-7, 18-241085-8, 18-241085-□

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	101	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	105	%	AsureQuality Method (LC-MS/MS)
M8PFOS	106	%	AsureQuality Method (LC-MS/MS)
M4PFBA	103	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	97	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	92	%	AsureQuality Method (LC-MS/MS)
MPFHpA	96	%	AsureQuality Method (LC-MS/MS)
M8PFOA	99	%	AsureQuality Method (LC-MS/MS)
M9PFNA	105	%	AsureQuality Method (LC-MS/MS)
M6PFDA	108	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	102	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	106	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	124	%	AsureQuality Method (LC-MS/MS)
MPFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	90	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	93	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	98	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	94	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	92	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	91	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	105	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	112	%	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans, Lauren Fleury

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable

Cameron □vans
Scientist

Lauren Fleury
Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	NR
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	NR
NMeFOSA-M	NR
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	NR
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

Analyte	Full Name
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Certificate of Analysis

Submission Reference: IZ112200
Final Report

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Report Issued: 07-Dec-2018 **AsureQuality Reference: 18-300506** **Sample(s) Received:** 30-Nov-2018 11:20

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW28 **AsureQuality ID:** 18-300506-1

Sample Description: Former petrol station monitoring bore

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0017	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0017	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0031	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	129	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	126	%	AsureQuality Method (LC-MS/MS)
M8PFOS	121	%	AsureQuality Method (LC-MS/MS)
M4PFBA	121	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	110	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	111	%	AsureQuality Method (LC-MS/MS)
MPFHpA	114	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	123	%	AsureQuality Method (LC-MS/MS)
M6PFDA	115	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	148	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	181 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	73	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	91	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	75	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	109	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	79	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	68	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	127	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	120	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	113	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW29 **AsureQuality ID:** 18-300506-2

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
mono-PFHxS (1)	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0077	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0091	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0070	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0096	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.017	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.026	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.0066	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0051	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.0026	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.0023	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	120	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	128	%	AsureQuality Method (LC-MS/MS)
M8PFOS	114	%	AsureQuality Method (LC-MS/MS)
M4PFBA	121	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	108	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	105	%	AsureQuality Method (LC-MS/MS)
MPFHpA	119	%	AsureQuality Method (LC-MS/MS)
M8PFOA	115	%	AsureQuality Method (LC-MS/MS)
M9PFNA	123	%	AsureQuality Method (LC-MS/MS)
M6PFDA	102	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	120	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
MPFDoDA	146	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	82	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	72	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	66	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	115	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	86	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	74	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	117	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	117	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	100	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW30 **AsureQuality ID:** 18-300506-3

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0013	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0013	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0012	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0044	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0056	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0069	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0012	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	134	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	146	%	AsureQuality Method (LC-MS/MS)
M8PFOS	167 (R)	%	AsureQuality Method (LC-MS/MS)
M4PFBA	128	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	113	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	117	%	AsureQuality Method (LC-MS/MS)
MPFHpA	135	%	AsureQuality Method (LC-MS/MS)
M8PFOA	127	%	AsureQuality Method (LC-MS/MS)
M9PFNA	160 (R)	%	AsureQuality Method (LC-MS/MS)
M6PFDA	168 (R)	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	246 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	348 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	88	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	107	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	94	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	232 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	207 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	98	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	80	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	215 (R)	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	168 (R)	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	195 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW35 **AsureQuality ID:** 18-300506-4

Sample Description: Rinsate (Dip meter). Rinsate on field e□uipment

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	110	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	109	%	AsureQuality Method (LC-MS/MS)
M8PFOS	132	%	AsureQuality Method (LC-MS/MS)
M4PFBA	104	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	98	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	101	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	127	%	AsureQuality Method (LC-MS/MS)
M6PFDA	125	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	174 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	170 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	85	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	82	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSA	88	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	128	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	119	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	99	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	90	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	100	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	106	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	132	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW36 **AsureQuality ID:** 18-300506-5

Sample Description: Rinsate (Basler). Rinsate on field e□uipment

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	123	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	124	%	AsureQuality Method (LC-MS/MS)
M8PFOS	142	%	AsureQuality Method (LC-MS/MS)
M4PFBA	124	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	109	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	110	%	AsureQuality Method (LC-MS/MS)
MPFHpA	117	%	AsureQuality Method (LC-MS/MS)
M8PFOA	120	%	AsureQuality Method (LC-MS/MS)
M9PFNA	133	%	AsureQuality Method (LC-MS/MS)
M6PFDA	141	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	198 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	202 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	92	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	68	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	72	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	155 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	143	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	94	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	85	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	107	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	114	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	136	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW37 **AsureQuality ID:** 18-300506-6

Sample Description: Trip blank

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	107	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	116	%	AsureQuality Method (LC-MS/MS)
M8PFOS	124	%	AsureQuality Method (LC-MS/MS)
M4PFBA	109	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	101	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	104	%	AsureQuality Method (LC-MS/MS)
MPFHpA	108	%	AsureQuality Method (LC-MS/MS)
M8PFOA	104	%	AsureQuality Method (LC-MS/MS)
M9PFNA	123	%	AsureQuality Method (LC-MS/MS)
M6PFDA	120	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	137	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	136	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	111	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	110	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNEtFOSAA	144	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	121	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	119	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	107	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	112	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	106	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	112	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: JGW39 **AsureQuality ID:** 18-300506-7

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.0014	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.0013	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.0047	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.0060	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.0074	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.0015	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	0.0012	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	126	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	136	%	AsureQuality Method (LC-MS/MS)
M8PFOS	159 (R)	%	AsureQuality Method (LC-MS/MS)
M4PFBA	121	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	113	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	120	%	AsureQuality Method (LC-MS/MS)
MPFHpA	133	%	AsureQuality Method (LC-MS/MS)
M8PFOA	125	%	AsureQuality Method (LC-MS/MS)
M9PFNA	145	%	AsureQuality Method (LC-MS/MS)
M6PFDA	161 (R)	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	195 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	234 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	87	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	68	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	76	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	173 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	168 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	85	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	90	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	195 (R)	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	171 (R)	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	173 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW40 **AsureQuality ID:** 18-300506-8

Sample Description: Natural source (seep)

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.0025	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	0.0024	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	118	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	121	%	AsureQuality Method (LC-MS/MS)
M8PFOS	87	%	AsureQuality Method (LC-MS/MS)
M4PFBA	119	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	105	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	109	%	AsureQuality Method (LC-MS/MS)
MPFHpA	116	%	AsureQuality Method (LC-MS/MS)
M8PFOA	105	%	AsureQuality Method (LC-MS/MS)
M9PFNA	110	%	AsureQuality Method (LC-MS/MS)
M6PFDA	81	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	72	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	76	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	86	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	50	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	53	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	74	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	75	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	68	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
DNMeFOSE	65	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	112	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	108	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	85	%	AsureQuality Method (LC-MS/MS)

QC Results

Blank

Relates to sample(s) 18-300506-1, 18-300506-2, 18-300506-3, 18-300506-4, 18-300506-5, 18-300506-6, 18-300506-7, 18-300506-8

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	112	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	116	%	AsureQuality Method (LC-MS/MS)
M8PFOS	134	%	AsureQuality Method (LC-MS/MS)
M4PFBA	102	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	103	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	100	%	AsureQuality Method (LC-MS/MS)
MPFHpA	109	%	AsureQuality Method (LC-MS/MS)
M8PFOA	112	%	AsureQuality Method (LC-MS/MS)
M9PFNA	133	%	AsureQuality Method (LC-MS/MS)
M6PFDA	135	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	177 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	184 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	148	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	120	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	146	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	153 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	143	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	115	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	95	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	101	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	120	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

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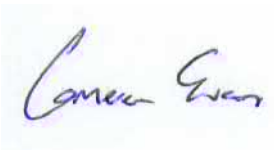
Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable



Cameron □vans

Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	NR
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	0.0010
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

Analyte	Full Name
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Global Experts in Food Assurance

Certificate of Analysis

Submission Reference: IZ112200
Final Report

Alisa Robertson
Jacobs New Zealand Ltd - Wellington
PO Box 10-283
Wellington 6143
New Zealand

PO Number: IZ112200

Report Issued: 13-Dec-2018 **AsureQuality Reference: 18-304819** **Sample(s) Received:** 30-Nov-2018 11:20

Results

The tests were performed on the samples as received.

Customer Sample Name: JGW33 **AsureQuality ID:** 18-304819-1

Sample Description: WWTP influent

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1) ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1) ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1) ☐	0.0038	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3) ☐	0.0038	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5) ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5) ☐	0.0027	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5) ☐	0.0026	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7) ☐	0.0053	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1) ☐	0.0091	µg/L	AsureQuality Method (LC-MS/MS)
PFNS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA ☐	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA ☐	0.0020	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA ☐	0.0017	µg/L	AsureQuality Method (LC-MS/MS)
PFNA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTeDA ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M ☐	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS ☐	NR	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS ☐	129	%	AsureQuality Method (LC-MS/MS)
M3PFHxS ☐	144	%	AsureQuality Method (LC-MS/MS)
M8PFOS ☐	127	%	AsureQuality Method (LC-MS/MS)
M4PFBA ☐	103	%	AsureQuality Method (LC-MS/MS)
M5PFPeA ☐	122	%	AsureQuality Method (LC-MS/MS)
M5PFHxA ☐	115	%	AsureQuality Method (LC-MS/MS)
MPFHpA ☐	149	%	AsureQuality Method (LC-MS/MS)
M8PFOA ☐	116	%	AsureQuality Method (LC-MS/MS)
M9PFNA ☐	129	%	AsureQuality Method (LC-MS/MS)
M6PFDA ☐	150	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA ☐	174 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA ☐	NR	%	AsureQuality Method (LC-MS/MS)
MPFTeDA ☐	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA ☐	80	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA ☐	NR	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA ☐	138	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA ☐	NR	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA ☐	111	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE ☐	128	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE ☐	76	%	AsureQuality Method (LC-MS/MS)
M4:2FTS ☐	NR	%	AsureQuality Method (LC-MS/MS)
M6:2FTS ☐	NR	%	AsureQuality Method (LC-MS/MS)
M8:2FTS ☐	NR	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Customer Sample Name: JGW38 **AsureQuality ID:** 18-304819-2

Sample Description: Trip Blank

Sample Condition: Acceptable **Sampled Date**: 29-Nov-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	99	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	100	%	AsureQuality Method (LC-MS/MS)
M8PFOS	88	%	AsureQuality Method (LC-MS/MS)
M4PFBA	103	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	95	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	98	%	AsureQuality Method (LC-MS/MS)
MPFHpA	96	%	AsureQuality Method (LC-MS/MS)
M8PFOA	95	%	AsureQuality Method (LC-MS/MS)
M9PFNA	84	%	AsureQuality Method (LC-MS/MS)
M6PFDA	79	%	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
M7PFUnDA	72	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	59	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	53	%	AsureQuality Method (LC-MS/MS)
MPFOSA	94	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	48	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	67	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	76	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	86	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	66	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	77	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	86	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	103	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	76	%	AsureQuality Method (LC-MS/MS)

QC Results

Blank

Relates to sample(s) 18-30481□-1, 18-30481□-2

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.0050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)

Test	Result	Unit	Method Reference
PFTeDA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	95	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	117	%	AsureQuality Method (LC-MS/MS)
M8PFOS	205 (R)	%	AsureQuality Method (LC-MS/MS)
M4PFBA	91	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	89	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	93	%	AsureQuality Method (LC-MS/MS)
MPFHpA	98	%	AsureQuality Method (LC-MS/MS)
M8PFOA	116	%	AsureQuality Method (LC-MS/MS)
M9PFNA	158 (R)	%	AsureQuality Method (LC-MS/MS)
M6PFDA	237 (R)	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	298 (R)	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	316 (R)	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	140	%	AsureQuality Method (LC-MS/MS)
MPFOSA	162 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	300 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	270 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	288 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	236 (R)	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	218 (R)	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	174 (R)	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	107	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	103	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	175 (R)	%	AsureQuality Method (LC-MS/MS)

R = Recovery outside method limits

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	IANZ	Lisa Graham

Analysis	Method	Accreditation	Authorised by

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

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Any tests marked with ☐are not accredited for specific matrices or analytes.

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable

Lisa Graham

Scientist / Team Leader

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Listing applies to samples: 18-304819-1	
Perfluoroalkylsulfonic acids	
PFPrS☐	0.0010
PFBS☐	0.0010
PFPeS☐	0.0010
di-PFHxS (1)☐	0.0010
mono-PFHxS (1)☐	0.0010
L-PFHxS (1)☐	0.0010
Total PFHxS (3)☐	0.0010
PFHpS☐	0.0010
di-PFOS (5)☐	0.0010
mono-PFOS (5)☐	0.0010
L-PFOS (5)☐	0.0010
Total PFOS (7)☐	0.0010
Sum PFHxS+PFOS (1)☐	0.0010
PFNS☐	0.0010
PFDS☐	0.0010
Perfluoroalkylcarboxylic acids	
PFBA☐	0.0010
PFPeA☐	0.0010
PFHxA☐	0.0010
PFHpA☐	0.0010
PFOA☐	0.0010
PFNA☐	0.0010
PFDA☐	0.0010
PFUnDA☐	0.0010
PFDoDA☐	NR
PFTrDA☐	NR
PFTeDA☐	NR
Perfluorooctanesulfonamides	
PFOSA☐	0.0010
NEtFOSA-M☐	NR
NMeFOSA-M☐	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA☐	NR
NMeFOSAA☐	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M☐	0.0010
NMeFOSE-M☐	0.0010
Telomere Sulfonic acids	
4:2 FTS☐	NR
6:2 FTS☐	NR
8:2 FTS☐	NR
Listing applies to samples: 18-304819-2	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010

di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	0.0010
PFTrDA	0.0010
PFTeDA	0.0010
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	0.0010
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	**Full Name**
Listing applies to samples: 18-304819-1	
Perfluoroalkylsulfonic acids	
PFPrS☐	Perfluoro-1-propanesulfonic acid
PFBS☐	Perfluoro-1-butanesulfonic acid
PFPeS☐	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)☐	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)☐	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)☐	Linear Perfluorohexanesulfonic acid
PFHpS☐	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)☐	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)☐	Total Perfluoromethylheptane sulfonic acids

Analyte	Full Name
L-PFOS (5)☐	Linear Perfluorooctanesulfonic acid
PFNS☐	Perfluoro-1-nonanesulfonic acid
PFDS☐	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA☐	Perfluoro-n-butanoic acid
PFPeA☐	Perfluoro-n-pentanoic acid
PFHxA☐	Perfluoro-n-hexanoic acid
PFHpA☐	Perfluoro-n-heptanoic acid
PFOA☐	Perfluoro-n-octanoic acid
PFNA☐	Perfluoro-n-nonanoic acid
PFDA☐	Perfluoro-n-decanoic acid
PFUnDA☐	Perfluoro-n-undecanoic acid
PFDoDA☐	Perfluoro-n-dodecanoic acid
PFTrDA☐	Perfluoro-n-tridecanoic acid
PFTeDA☐	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA☐	Perfluoro-1-octanesulfonamide
NEtFOSA-M☐	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M☐	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA☐	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA☐	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M☐	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M☐	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS☐	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS☐	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS☐	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS☐	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS☐	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS☐	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA☐	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA☐	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA☐	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA☐	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA☐	Perfluoro-n-[13C8]octanoic acid
M9PFNA☐	Perfluoro-n-[13C9]nonanoic acid
M6PFDA☐	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA☐	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA☐	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA☐	Perfluoro-n-[1,2-13C2]tetradecanoic acid
MPFOSA☐	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA☐	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA☐	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA☐	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA☐	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE☐	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE☐	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS☐	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS☐	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS☐	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

Analyte	Full Name
Listing applies to samples: 18-304819-2	
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

Analyte	Full Name
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

Any tests marked with ☐are not accredited for specific matrices or analytes.

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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