

Date : 10/07/2019 7:22:21 AM
From : [sch4n4\(6\)P](#)
To : "HAWAS Olga"
Cc : "BLANCHARD Scott", "GREENWOOD Angela", "Luis Rodriguez"
Subject : RE: Additional information requests
Attachment : image003.png;image005.png;image006.png;image007.png;image008.png;image004.png;
Thanks Olga,

Just wanted to confirm we have received the correspondence, and myself and the engineering team will facilitate the provision of the below reports. We also sent a copy of this email to SARA for completeness.

Anything else, please don't hesitate to contact me
Warm Regards

[sch4n4\(6\)](#)
Senior Environmental Business Partner

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From: HAWAS Olga <Olga.Hawas@des.qld.gov.au>
Sent: Tuesday, 9 July 2019 2:01 PM
To: [sch4n4\(6\) Personal](#)@cleanaway.com.au
Cc: BLANCHARD Scott <Scott.Blanchard@des.qld.gov.au>; GREENWOOD Angela <Angela.Greenwood@des.qld.gov.au>
Subject: FW: Additional information requests

Dear [sch4\(6\)](#)

As you know the department has commenced third party geotechnical review of the Cleanaway proposal to increase the height of the New Chum landfill. As part of this review could you please provide the following documents referenced in reports submitted as part of the recent changed application. Please provide these documents by COB tomorrow, 10 July 2019. Please let me know if you need more time, but it is expected that these reports should be readily available as they were recently quoted in the application documents.

Cleanaway application documentation

a. From Golder report (2019) included as **Cleanaway Solid Waste Pty Ltd Appendix E Geotechnical and Hydrogeological Review**

i. From page 1:

The stability of the landfill has been assessed in Technical memorandum 1893805-015-TM.

2.0 AVAILABLE INFORMATION

The following documents provided have been reviewed and considered in the preparation of this technical memorandum:

- 1) GHD 'New Chum Waste Disposal Facility Environmental Monitoring September 2017 Monitoring Event', Report 41/ 29798/8008 January 2018.

1. Requesting a copy of referenced **Golder Technical memorandum 1893805-015-TM**
2. Requesting a copy of available information (2) GHD report 41/29798/8008 January 2018.

ii. From page 2

- 3) New Chum March 2018 Aerial Survey "New_Chum_2018_03_08_Elevations.dwg" provided by Cleanaway.
- 4) Taylor Mining Services Pty Ltd report dated 17 September 2013, 'Overview Report – Past Coal Mining Digital Information for Transpacific New Chum Site'
- 5) Moreton Geotechnical Services Pty Ltd (MGS) letter dated 4 September 1998 (ref 98/36/04), 'Broad Scale Mining Study at Lot 268 New Chum for National Landfill Technologies'.
- 6) MGS letter dated 27 October 2010 (ref. 2010/63), 'Desktop Mining Study Covering Proposed Cells 3 & 4 at New Chum Street, New Chum'.
- 7) MGS letter dated 22 March 2012 (ref. 2010/63A-02), 'Desktop Mining Studies at New Chum – Review Commentary'.

1. Requesting a copy of available information **5) MGS (1998)** and **6) MGS (2010)** and **7) MGS (2012)** as listed above

b. From **Cleanaway Solid Waste Pty Ltd Appendix C Concept Design Report**

Golder Associates Pty Ltd (2015), New Chum Landfill – Summary of Hydrogeological Risks

Golder Associates Pty Ltd (2015a), Impact of Underground Workings on Proposed Sediment Basin at New Chum Landfill

Golder Associates Pty Ltd (2017b), Cleanaway: Clay Pave Hill – Site Visit and Stabilisation Review

1. Requesting copies of 3 reports listed above as referenced on page 44.

Thank you very much in advance and best regards

Olga Hawas
Principal Environmental Officer
Waste and Contaminated Land Assessment
Waste Operations | Waste and Recovery
Department of Environment and Science

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Redesign and Rehabilitation of the New Chum Waste Management Facility

Addendum Report to Address Further Comments on water impact assessment

1. Introduction

Cleanaway Solid Waste Pty Ltd (Cleanaway) has submitted a development application to the Ipswich City Council for a Material Change of Use (MCU) for the redesign and rehabilitation of the landform of the existing New Chum Waste Management Facility located at 100 Chum Street, New Chum.

As part of the assessment process the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) has sought advice from the Department of Environment and Science (DES) to assess the management of environmental risk associated with the application. One aspect of this assessment is the environmental management of groundwater, receiving surface water and leachate. To address this aspect, Cleanaway previously submitted the following report to DSDMIP:

- GHD (April 2019) Redesign & Rehabilitation of the New Chum Waste Management Facility Leachate, Surface water and Hydrogeological Assessment prepared for Cleanaway Solid Waste Pty Ltd (GHD Ref: 4131525) (the 2019 Hydrogeological Report).

Following the DES consideration of the 2019 Hydrogeological Report:

- DES provided further comments to Cleanaway on water impact assessment, via an email dated 24 May 2019;
- DES provided clarification to Cleanaway about the further comments (following a request from Cleanaway for clarification) via an email dated 28 May 2019; and
- DSDMIP provided correspondence to Cleanaway compiling all outstanding matters dated 17 June 2019 (Reference No. 1807-6501 SRA), with section 3 of the letter addressing groundwater and surface water impacts.

The above correspondence is referred to collectively as the "RFI" in this addendum report. The RFI items to be addressed included¹:

- *Water Quality – Revise the water quality reporting to confirm whether or not per and polyfluoroalkyl substances (PFAS) is within the groundwater;*
- *Monitoring System – Provide further information on the proposed groundwater and surface water monitoring system to demonstrate that the proposed surface water monitoring program is robust; and*
- *Conceptual Site Model – the conceptual site model (CSM) should be reviewed and updated and include groundwater to better describe this model to allow interpretation of uncertainties and assumptions so that leachate is managed appropriately.*

1.1 Purpose and Scope

The purpose of this addendum report is to address the matters raised in the RFI, and supplements information previously provided in the 2019 Hydrogeological Report.

The scope of works for the addendum report included the following activities:

- A supplementary PFAS assessment to ultra-trace detection limits in groundwater and surface water monitoring locations;
- A review of the CSM and development of a qualitative risk assessment relating to PFAS in groundwater to assess any environmental impacts associated with the MCU application;

¹ Further issues compiled letter, email from DSDMIP to Wolters dated 17 June 2019

- A review of current site environmental monitoring requirements (relating to water quality), and development of a proposed monitoring program to be conditioned with the MCU application; and
- Additional clarification and refinement of the previously documented CSM, and provision of leachate management information.

2. RFI Responses

The responses to the three RFI items are summarised in the following sections, with detailed information provided in the relevant Attachments.

2.1 PFAS

RFI²: There is a need to confirm whether or not PFAS is in the. The report concluded there was no issue but not having a low enough LOR to complete the assessment and there is a need to resample and analyse at a lower LOR for comparison with the 99% protection levels. This trigger is very low, and some laboratories can achieve this level of reporting. It was recognised in the report that preferential pathways for groundwater may exist between the site and Six Mile creek and that the bore network may not necessarily pick this up. It is paramount to understand whether the groundwater is influenced by leachate to demonstrate that there are no impacts on the environmental values of water.

Supplementary Monitoring Program

Cleanaway engaged Epic Environmental Pty Ltd (Epic) to undertake a supplementary assessment of groundwater and surface water to allow comparison against the PFAS National Environment Management Plan (NEMP) 99% Species Protection Freshwater Guideline Values (99% protection values). A report summarising the monitoring event (including quality assessment and quality control (QA/QC), laboratory reports and tabulated results) is provided as Attachment 1, and summarised as follows:

- The first round of supplementary monitoring was completed on 5 and 6 June 2019, and comprised:
 - Groundwater locations BH02, BH03, BH05A, BH07A, BH11, BH14, BH15, BH16 and BH18;
 - Surface water locations Chum Pond, NWH, Sed-1, DIS, SMC, SMC2, SMC3, DWN, DWN3; and
 - An analytical program comprising of field parameters and PFAS compounds.
- The secondary round of supplementary monitoring was completed on 22 July 2019, and comprised:
 - Groundwater locations BH03, BH12 and BH18:
 - BH03 and BH18 were re-sampled to provide a second data point and to verify the initial concentrations; and
 - BH12 was sampled during this round as it was unable to be sampled during the previous June monitoring event.
 - An analytical program comprising field parameters and PFAS compounds.
- The results indicated:
 - Concentrations of PFAS compounds were reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18), with PFOS reported above the PFAS 99% protection value for BH03, BH12 and BH18. While concentrations in BH03, BH12 and BH18 were marginally above the 99% protection value, they were reported below the drinking water and human health criteria. It is noted that BH18 reported detectable concentrations of PFOS during the June sampling, but was reported as below the laboratory limit of report (LOR) during the July sampling event;
 - Concentrations of TOPA were reported below the LOR for BH03 and BH18, indicating there is unlikely to be a significant mass of precursors in groundwater, and all possible oxidation is likely to have already occurred; and

² Further comments on water impact assessment – New Chum extension, email from DES to Cleanaway dated 24 May 2019.

- Concentrations of PFAS compounds were reported above the PFAS 99% protection value for PFOS in all of the onsite, upstream and downstream surface water monitoring locations. Two of the onsite surface water retention ponds reported PFAS compounds with concentrations above the drinking water values, however, all surface water locations reported concentrations below the 95% protection values. This is generally consistent with the 2019 Hydrogeological Report.

Qualitative PFAS Risk Assessment

Based on the CSM in the 2019 Hydrogeological Report, and the results of the supplementary monitoring, Epic was engaged to review the CSM and develop a qualitative risk assessment relating to PFAS. The findings of this assessment are provided in the Qualitative PFAS Risk Assessment report, which is provided in Attachment 2, and summarised as follows:

- Whilst it is acknowledged that current guidelines recommend the adoption of 99% protection values for PFAS, this is based on high conservation value systems. Six Mile Creek is considered to be an urban creek with catchment landuse comprising open cut coal mines, current and historical landfill sites, industrial uses, road corridors and residential uses. It is noted that all surface and groundwater monitoring locations were below the 95% protection values;
- Due to their widespread use and persistence many types of PFAS are present in the environment. Upstream surface water monitoring locations (i.e. locations that could not be impacted by site activities) reported concentrations above the 99% protection values, with upstream concentrations comparable to concentrations reported within onsite groundwater. Based on the detection of PFAS in upstream portions of Six Mile Creek there are likely multiple offsite sources present within the regional area;
- The review of the 2019 Hydrogeological Report conceptualisation is considered to adequately represent conditions at the site. Epic confirmed regional groundwater flow was in a northerly direction towards the Brisbane River, however the local water table appears to be low relative to its surrounds, with a long term trend of slow rising water levels. As such, it is considered that the local area is acting as a groundwater sink, with localised groundwater flowing towards the formerly mined areas;
- Detectable concentrations of PFAS have been reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18), with three locations (BH03, BH12 and BH18) marginally above the 99% protection value in at least one sampling round. These three locations are located on the north-eastern boundary of the site;
- For the purposes of the site based hydrogeological qualitative risk assessment, the absence of more widespread PFAS detection in groundwater suggests the potential for a localised source (i.e. historical inert waste historically disposed of in unlined Cells), or since PFAS is not believed to be attenuated by natural processes, significant dilution by the greater groundwater volume. The local groundwater flow direction from the vicinity of the impacted bores is to the south or west (i.e. towards the landfill and away from Six Mile Creek).

If groundwater flow directions at the site were to shift towards Six Mile Creek, observed PFAS concentrations within the impacted bores discharging to the creek would be further diluted via advection-dispersion processes (not attenuation) before reaching the creek.

The qualitative risk assessment concludes:

- Based on the reported concentration of PFAS in onsite groundwater monitoring wells, and in consideration of the reported regional geology and groundwater, discharge of groundwater to surface water is considered unlikely;
- Based on upstream (background) concentrations of PFAS within Six Mile Creek, concentrations of PFAS in groundwater at the site is unlikely to result in an increased risk to environmental values of surface water (if surface water discharge to groundwater was to occur); and
- The proposed landform redesign is considered to further mitigate the risk to groundwater and surface water through the design and implementation of engineered lining systems and draining layers for each cell and increasing the efficiency and capacity in the retention basins.

As such, it is considered that implementation of the proposed landform redesign and MCU application will not result in an increased risk to identified sensitive receptors including EVs of Six Mile Creek and groundwater beneath the site with regards to PFAS.

PFAS Discussion

Whilst Cleanaway understands that PFAS is an emerging contaminant, it should be noted that when the New Chum waste management facility was developed and when Cleanaway (then Transpacific) purchased the facility, PFAS was an unknown and unrecognised risk. Understandably, the management practices adopted (in accordance with legislative and licencing requirements in place at the time) throughout the life of the facility were not designed with the unknown and unrecognised risk of PFAS in mind.

It should also be noted that due to their widespread use and persistence many types of PFAS are ubiquitous in the environment. Given this, multiple sources of PFAS are likely, with offsite potential sources likely to be present based on detection of PFAS in upstream portions of Six Mile Creek and regional land uses which include current and historical landfill sites and light industrial uses.

During the environmental authority (EA) amendment in 2018, the site declined to have a PFAS acceptance limit added to its site acceptance criteria given Cleanaway's decision not to knowingly accept PFAS impacted materials to site. As such, the EA for the site does not currently include any PFAS monitoring requirements, and therefore, prior to submission of the MCU application there was no obligation, and no prior request to undertake monitoring of PFAS.

The existence of PFAS levels in receiving surface water and groundwater (if it is found to be a result of the site activities) is a legacy issue that was not foreseeable during the initial development, design and management of the facility.

Importantly therefore, pre-existing PFAS levels should not be used as an indicator of potential for PFAS attributed to the future proposed landform redesign project.

Notwithstanding the above, Cleanaway understands that emerging contaminants should be considered as the risk becomes known. As part of the MCU application, several layers of controls have been identified and proposed which will effectively reduce the risk of increased PFAS impact on water management at the site.

Environmental controls to be introduced as part of this MCU are summarised as follows:

- Current Management Practices:
 - The design of the recent inert landfill cells meets and, in some circumstances, (i.e. liner design) exceed minimum requirements for inert cells and are equal to, or greater than, the design requirements for putrescible landfills. This outcome is to meet the minimum internal standard specified by Cleanaway.
- The landform redesign associated with the MCU application includes the following:
 - Controls to minimise environmental risk associated with the operations relating to groundwater, receiving surface water and leachate. These controls will continue to manage water that comes into contact with waste material as leachate, maintain non-impacted stormwater diversion from active landfilling areas, control releases to receiving surface waters and monitor groundwater, leachate and receiving surface waters to assess the effectiveness of proposed controls. These controls are included in the Site Based Management Plan (GHD 2019), and are detailed in Section 2.3;
 - Where historical single lined cells interface with the landform redesign proposal, the design allows for the construction of a piggyback lining system which ensures new waste, and resulting leachate is managed through a composite lined system. This effectively segregates the new waste from the existing older waste, effectively isolating the cell, and creating a barrier that minimises infiltration of water into the legacy waste mass. The current landform redesign has identified the requirement for this piggyback lining system for Cells 1, 5A and 5 of the existing facility;
 - The landform redesign and future site activities include strategic construction, relocation and decommissioning of some of the current water storage ponds on site as follows:

- An existing sedimentation pond is located in the south eastern portion of the site. This sedimentation pond is scheduled to be decommissioned and replaced with a fit for purpose designed water retention basin. The retention basin will include controlled mechanisms for the release of water to other on-site surface water storage ponds minimising uncontrolled releases, except in extreme events;
- Accelerated final capping of the area within the catchment which feeds the current Chum Street High Efficiency Sediment (HES) pond. This catchment includes the haul road, and two cells which do not form part of the landform redesign and therefore the cells are currently being capped. As such, before the landform redesign activities commence, final capping will be completed on these cells – permanently reducing the risk of surface water in this catchment contacting waste material.
- The monitoring program proposed for inclusion in the EA as part of the landform redesign includes a receiving environment management plan (REMP). This REMP will include a concurrent groundwater, leachate and surface water monitoring program, and will include monitoring for PFAS and create a trigger for an annual review to identify other emerging contaminants that need to be assessed and managed in the future. The proposed monitoring program is discussed in section 2.2.

In summary, the landform redesign has prompted assessment of risks, and the embedding of additional layers of control into the current design and management of the waste management facility. By purposeful design, the proposed landform redesign provides a pathway to improved environmental management of PFAS risk which is considered to be an improved environmental outcome for the MCU application. From a precautionary perspective the landform redesign project provides Cleanaway with the opportunity to increase controls at the existing facility for the management of this emerging contaminant and provides DSDMIP and DES with the opportunity to embed these controls into the future EA for the site.

2.2 Monitoring System

RFI³: It is also important to ensure that the surface water monitoring program is robust as this would provide some additional information to identify impacts should they occur. The study picked up two sites upstream on the creek from other studies, but it wasn't clear whether the sites further upstream were proposed to be included in the monitoring program in future. Including a monitoring site, or sites, further upstream from the landfill would be worth including to exclude potential surface/groundwater influence between the void and the monitoring site currently nominated as 'upstream'. Given the recent changes to the bore network there is limited data at the new bores. Accordingly, there is a need to continue collecting groundwater quality and level data and to revisit the data analysis and conceptual understanding of groundwater as more data comes to hand.

Cleanaway has always planned to continue the groundwater and receiving surface water monitoring under the proposed MCU application. Currently, Cleanaway exceeds the requirements of the monitoring program in its EA (monitoring being completed at a greater frequency than required by the EA and includes leachate and surface water locations) and will continue to undertake environmental monitoring as appropriate to assess and manage environmental risks associated with its operations.

As part of this addendum report, the proposed EA conditions as related to water and the water monitoring program have been reviewed and proposed improvements provided as Attachment 3. The proposed monitoring program and EA conditions include a requirement for Cleanaway to develop a REMP prior to the commencement of the landform redesign approved EA. To address the comments in the RFI, Attachment 3 includes details of what will be incorporated into the REMP, including:

- Monitoring locations (groundwater monitoring network requirements, surface water to include upgradient and down gradient locations, etc.);
- Specifications for monitoring (laboratory quantification limits, frequency); and
- Water quality characteristics (for leachate, surface water and groundwater) including both field and analytical parameters.

³ Further comments on water impact assessment – New Chum extension, email from DES to Cleanaway dated 24 May 2019.

Attachment 3 has been developed having regard to the following:

- The current EA (EPPR00445713) dated 1 May 2018;
- The 'Model operating conditions ERA 60 – Waste Disposal', Department of Environment and Science, ESR/2015/1667 (version 5.01), Feb 2019;
- The Receiving Environment Monitoring Program Guideline – for use with environmentally relevant activities under the Environmental Protection Act 1994, Department of Environment and Science, ESR/2016/2399 (version 2.01), Jun 2015; and
- Correspondence with DES relating to preliminary conditions (email dated 6 March 2019).

2.3 Conceptual Site Model

RFI⁴: There was a need to better describe this model to allow interpretation of uncertainties and assumptions so that there is assurance leachate would be managed appropriately. Also, given the study showed PFAS was present in the surface water storages, there is a need to ensure that releases from those are managed in a way that will protect the EVs of Six Mile Ck. Conceptual site model should be reviewed and updated and should include groundwater.

RFI⁵: Groundwater modelling was presented as cross-section and it was difficult to see groundwater contours and movements direction (through it was described in the report). In the future please provide groundwater contours and movement map in addition to cross-section.

Groundwater Contours and Inferred Flow

To address the RFI, Cleanaway engaged GHD Pty Ltd (GHD) to prepare an update to the CSM as contained in the 2019 Hydrogeological Report. The GHD 2019 Technical Memorandum is provided in Attachment 4, and summarised as follows:

- Groundwater elevation contours and inferred groundwater flow were added to figures to supplement the CSM provided in the 2019 Hydrogeological Report. These were based on monitoring locations sampled as part of February and June 2019 monitoring events;
- Groundwater flow is interpreted to be in a general northerly direction, consistent with the interpretation provided in the 2019 Hydrogeological Report; and
- Future monitoring should include groundwater standing water level monitoring (to be included in the REMP).

Leachate Management

With respect to comments in the RFI relating to leachate management, the following reports have been submitted as part of the MCU application which address leachate management at the site:

- Redesign & Rehabilitation of the New Chum Waste Management Facility Site Based Management Plan, GHD Pty Ltd, Revision 3, 25 Jun 2019;
- Golder Associates Comments on Proposed Modification to Final Landform (June 2019 Version) in relation to the Leachate Water Balance Assessment, Golder Associates Pty Ltd, Revision 0, 26 Jun 2019; and
- Redesign and Rehabilitation of the New Chum Waste Management Facility – Geotechnical and Hydrogeological Review, Golder Associates Pty Ltd, Revision 9, 26 Jun 2019.

Of specific note is the following from the SBMP (GHD 2019):

- A leachate management system is in place for the existing cells with the exception of Cell 1, so that leachate is recovered in accordance with the EA. Design and specifications for the leachate systems

⁴ Further comments on water impact assessment – New Chum extension, email from DES to Cleanaway dated 24 May 2019.

⁵ Clarification to Further comments on water impact assessment – New Chum extension, email from DES to Cleanaway dated 28 May 2019.

have been based on regulatory requirements pertaining to the specific waste types that are received in each disposal cell;

- The specific purpose of the landfill liner system, which includes multiple barriers with a leachate drainage system constructed within each of the cells (excluding Cell 1), is to act as a collection and conveyance layer to prevent leachate from coming into contact with underlying soils and groundwater. Materials used in the construction of the composite liner (engineered soils, Geosynthetic Clay Liner and HDPE geomembrane) are in accordance with industry best practice, meet and exceed Queensland landfill guidelines, and therefore ensure the barrier is robust and effective. Leachate is collected into sumps and is extracted from the cell through an active system of pumps with bespoke monitoring systems; and
- A Leachate Management Plan is provided in the SBMP, which details the potential impact, environmental objective, performance criteria, control measures, monitoring, and corrective actions associated with leachate management for activities under the MCU application.

Cleanaway understands that DSDMIP and DES has been provided with complete copies of the MCU application reports, however, for completeness, an extract from the SBMP (GHD 2019) report is provided as Attachment 5. This extract consists of pages 28 to 36 inclusive, and includes the Surface water management plan, the Leachate management plan and the Groundwater management plan sections.

3. Conclusion

This addendum report has addressed the RFI for environmental relevant activities – groundwater and surface water as provided by DSDMIP as follows:

- Water Quality - The supplementary assessments undertaken have identified legacy PFAS present at four groundwater locations, three in concentrations marginally above the PFAS NEMP 99% protection values, but below drinking water, human health and 95% protection levels;

The PFAS qualitative risk assessment identified that:

- Upstream surface water monitoring locations in Six Mile Creek reported concentrations above the 99% protection values, with upstream concentrations comparable to concentrations reported within onsite groundwater. Six Mile Creek is considered to be an urban creek with catchment landuse comprising open cut coal mines, current and historical landfill sites, industrial uses, road corridors and residential uses. Based on the detection of PFAS in upstream portions of Six Mile Creek, and regional land use, there are likely multiple offsite sources present within the regional area;
- Epic confirmed regional groundwater flow was in a northerly direction towards the Brisbane River, however, it is considered that the local area is acting as a groundwater sink, with localised groundwater flowing towards the formerly mined areas (i.e. towards the landfill and away from Six Mile Creek); and
- For the purposes of the site based hydrogeological qualitative risk assessment, the potential onsite sources of PFAS identified were attributed to historical waste disposal within unlined Cells, or since PFAS is not believed to be attenuated by natural processes, significant dilution by the greater groundwater volume.

Based on the reported concentrations of PFAS, the local geological and hydrogeological characteristics and upgradient concentrations within Six Mile Creek it is considered unlikely that groundwater will discharge to surface water, and if it was to occur, it is unlikely to result in an increased risk of PFAS to the environmental values of surface water.

As such, the qualitative risk assessment concludes that implementation of the proposed landform redesign and MCU application will not result in an increased risk to identified sensitive receptors including EVs of Six Mile Creek and groundwater beneath the site with regards to PFAS.

PFAS as an emerging contaminant was not a known environmental risk when the site was developed. Pre-existing PFAS levels in groundwater, if a result of operational activities, are attributable to legacy

activities which were undertaken to the required standards and legislation to manage the known risks at that time.

As part of the MCU application, several layers of controls have been proposed which will effectively reduce the risk of increased PFAS impact on water management at the site. These controls include:

- piggyback lining any historical single or non-lined cells to segregate the new waste from existing older waste, creating a barrier to minimise infiltration of water into the legacy waste mass, therefore reducing the leachate volume within the legacy waste;
- strategic construction, relocation and decommissioning of the current water storage ponds, with improved design and a controlled release management strategy; and
- development of a REMP to include a concurrent groundwater, receiving surface water and leachate monitoring program for an expanded program of representative analytes.

Importantly therefore, pre-existing PFAS levels should not be used as an indicator of potential for PFAS attributed to the future proposed landform redesign project.

By purposeful design, the proposed landform redesign provides a pathway to improved environmental management of PFAS risk which is considered to be an improved environmental outcome for the MCU application.

- Monitoring System - The current monitoring program has been reviewed, and a future monitoring program and associated EA conditions have been proposed to provide clarity to DSDMIP. The EA conditions include the development of a REMP prior to landform redesign commencing under the MCU approval.
- Conceptual Site Model – the CSM has been revised to include groundwater contours and flow direction figures. Information relating to the leachate management of the landform redesign (which is included in other submitted MCU application documents) has been referenced in this report, and extracts included for completeness.

Attachments

- | | |
|--------------|--|
| Attachment 1 | New Chum Landfill – Environmental Monitoring (PFAS), Epic Environmental Pty Ltd, Revision 3, 26 July 2019. |
| Attachment 2 | New Chum Landfill – Qualitative PFAS Risk Assessment, Epic Environmental Pty Ltd, Revision 0, 26 July 2019. |
| Attachment 3 | New Chum Landfill – Groundwater, Surface Water and Leachate Monitoring Program, Epic Environmental Pty Ltd, Revision 2, 26 July 2019. |
| Attachment 4 | Technical Memorandum – Redesign and Rehabilitation of the New Chum Waste Management Facility, Response to the Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, GHD Pty Ltd, 1807-6501 SRA, 26 July 2019. |
| Attachment 5 | Extract from Redesign and Rehabilitation of the New Chum Waste Management Facility, Site Based Management Plan, GHD Pty Ltd, 25 June 2019, pages 28 to 36 inclusive. |

Attachment 1 – New Chum Landfill – Environmental Monitoring (PFAS), Epic Environmental Pty Ltd, Revision 3, 26 July 2019.

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**CLEANAWAY SOLID WASTE PTY
LTD**

**NEW CHUM LANDFILL –
ENVIRONMENTAL MONITORING
(PFAS)**





CLEANAWAY SOLID WASTE PTY LTD

**NEW CHUM LANDFILL –
ENVIRONMENTAL MONITORING
(PFAS)**

26 JULY 2019

NEW CHUM LANDFILL FACILITY

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Document History and Status

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Executive Summary

Cleanaway Solid Waste Pty Ltd (CWS) has submitted a development application to the Ipswich City Council (ICC) for a Material Change of Use (MCU) for the redesign and rehabilitation of the landform of the existing New Chum Waste Management Facility located at 100 Chum Street, New Chum. As part of the MCU application, the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) issued a Request for Information (RFI) relating to environmental relevant activities – groundwater and surface water on 17 June 2019.

Epic Environmental Pty Ltd (Epic) were commissioned by CSW to undertake a supplementary monitoring program for per- and poly-fluoroalkyl substances (PFAS) to support the RFI response.

The site comprises the New Chum Landfill and is legally identified as Lot 268 SP103913 and Lot 227 SP103913 (the site).

The objective of this scope of work was to develop, undertake and document the completion of a PFAS environmental monitoring event to assess PFAS against the PFAS NEMP 99% Species Protection Guideline Values.

To achieve the required objective, an environmental monitoring program was completed which included the completion of a groundwater and surface water monitoring event at existing site monitoring infrastructure.

Based on the data collected, and an assessment of the Quality Assurance/Quality Control (QA/QC) process and Data Quality Indicators (DQIs), Epic concludes that overall, the quality of the analytical data produced is reliable for the purpose of this investigation.

Concentrations of PFAS compounds were reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18). PFOS was detected in BH03, BH12 and BH18, with concentrations above the PFAS NEMP Freshwater 99% Species Protection levels (High conservation value systems), but below the 95% Species Protection Levels (slightly to moderately disturbed systems). PCA compounds were detected in BH11 and 6:2 FTS was detected in BH12, with PFAS concentrations below relevant assessment criteria (where established). It is noted that BH18 reported detectible concentrations of PFAS compounds during sampling completed on 5 June 2019, with subsequent sampling completed on 22 July 2019 reporting concentrations below the laboratory's LOR.

Concentrations of TOPA were reported below the laboratory's LOR, indicating there is unlikely to be a significant mass of precursors in groundwater, and all possible oxidation is likely to have already occurred.

Concentrations of PFAS compounds were reported in all the onsite, upstream and downstream surface water monitoring locations, with the majority of locations reporting detectible concentrations of Perfluoroalkyl Sulfonic Acid (PSA) and PCA compounds, and all locations reported detectible concentrations of PFOS.

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1 Introduction

Cleanaway Solid Waste Pty Ltd (CWS) has submitted a development application to the Ipswich City Council (ICC) for a Material Change of Use (MCU) for the redesign and rehabilitation of the landform of the existing New Chum Waste Management Facility located at 100 Chum Street, New Chum. As part of the MCU application, the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) issued a Request for Information (RFI) relating to environmental relevant activities – groundwater and surface water on 17 June 2019.

Epic Environmental Pty Ltd (Epic) were commissioned by CSW to undertake a supplementary monitoring program for per- and poly-fluoroalkyl substances (PFAS) to support the RFI response.

The site comprises the New Chum Landfill and is legally identified as Lot 268 SP103913 and Lot 227 SP103913 (the site).

1.1 Background and Objectives

It is understood that previous investigation undertaken at the site reported detectable concentrations of PFAS in leachate and onsite surface water bodies. PFAS was not detected in groundwater monitoring wells, however the laboratory reporting limits were above the PFAS National Environmental Management Plan (NEMP) 99% Species Protection Guideline Values.

The objective of this scope of work was to develop, undertake and document the completion of a PFAS environmental monitoring event to assess PFAS against the PFAS NEMP 99% Species Protection Guideline Values.

1.2 Scope of Works

To achieve the objectives of this environmental monitoring program, the following scope of work was undertaken:

- Development of a Sampling, Analysis and Quality Plan (SAQP);
- Preparation of fieldwork documentation, including Health, Safety and Environment Plans (HSEP);
- Sampling and analysis of existing PFAS compatible groundwater monitoring bores;
- Receipt and analysis of samples by a National Association of Testing Authorities (NATA) accredited laboratory; and
- Preparation of a report outlining the findings of the environmental monitoring event.

2 Existing Environmental Monitoring Locations

Several groundwater monitoring wells have been established at upgradient and downgradient locations within the site, with a number of onsite and offsite surface water monitoring locations also established as outlined in **Table 1**.

The location of environmental monitoring locations are presented on **Figure F1**, with available groundwater bore construction details included in GHD 2019¹.

Table 1: Environmental Monitoring Location Summary

Monitoring Location	Location	Comments
Groundwater Monitoring Wells		
BH02	Downgradient Boundary	Northern boundary, adjacent to Cell 1
BH03	Downgradient Boundary	Northern boundary, possible surface connectivity (response to rainfall)
BH05A	Downgradient Boundary	Northern boundary. Adjacent to Cell 5. Replacement for BH05. Possible intersection with historical workings (void)
BH07A	Possibly Upgradient	Western boundary. Adjacent to Cell 5B
BH11	Downgradient	Northern boundary. Adjacent to Cell 1
BH12	Central	Adjacent to Cell 2
BH14	Upgradient Boundary (shallow – nested with BH15)	Possibly perched groundwater along southern boundary. BH14 & BH15 installed as replacement for BH09
BH15	Upgradient Boundary (deep – nested with BH14)	Possibly perched groundwater along southern boundary. BH14 & BH15 installed as replacement for BH09
BH16	Upgradient Boundary	South-east of landfill cells. Installed to replace BH08 which is proposed to be decommissioned as part of proposed landfill expansion
BH17	Downgradient Boundary (shallow – nested with BH18)	Possibly perched groundwater along northern boundary
BH18	Downgradient Boundary (deep – nested with BH17)	Northern boundary, downgradient of Cell 2 and Void 10
Surface Water		
Chum-Pond	Northern Corner	High efficiency sediment pond in the northern portion of the site. Nominated offsite discharge point
NWH	Central	Surface water located within Cell 3. Understood to be decommissioned during proposed construction of Cell 3B
Sed-1	Central-eastern	Downstream of main landfill. Main sedimentation pond. Nominated offsite discharge point (to Void 10)
DIS	Eastern	Eastern side of Void 10 adjacent to Six Mile Creek
SMC	Upstream	Upstream location within Six Mile Creek
SMC2	Upstream	Upstream (~1km) location within Six Mile Creek
SMC3	Upstream	Upstream (~1.5km) location within Six Mile Creek
DWN	Downstream	Downstream location within Six Mile Creek
DWN3	Downstream	Downstream (~2.8km) location within Six Mile Creek

Groundwater sampling for PFAS was not undertaken in monitoring wells with dedicated high-flow groundwater monitoring pumps (BH06, BH08 & BH10) as dedicated monitoring equipment could not be

¹ GHD (2019). Redesign & Rehabilitation of the New Chum Waste Management Facility: Leachate, Surface water and Hydrogeological Assessment, April 2019.

confirmed to be suitable for PFAS analysis. It is reported (GHD 2019) that remaining groundwater monitoring wells (as outlined in **Table 1**) have dedicated low-flow groundwater monitoring pumps fitted with High Density Polyethylene (HDPE) tubing and suitable pump bladders (as recommended in the Western Australian Department of Environment Regulation's Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) 2017).

It is noted that a detailed review of the suitability and integrity of the existing groundwater monitoring well network has not been completed as part of the current scope of work and details of historical use and potential impacts (including cross contamination) have not been determined. In addition, bore construction details are not available for BH02 and BH03.

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3 Methodology

3.1 Groundwater Sampling Methodology

The groundwater sampling methodology adopted for the current monitoring event is presented in **Table 2**. Groundwater monitoring was completed on 5 and 6 June 2019 and included the sampling of groundwater monitoring wells BH02, BH03, BH05A, BH07A, BH11, BH14, BH15, BH16 and BH18. Additional groundwater monitoring was completed on 22 July 2019 and included the sampling of BH12, and re-sampling of BH03 and BH18.

Table 2: Groundwater Sampling Methodology

Action	Description
Sampling Timing	Groundwater samples were collected over a period of two consecutive days in order to minimise the effects of groundwater variation and other environmental conditions on results.
Monitoring Well Gauging	Measurement of the standing water level was undertaken in each groundwater monitoring well using an electronic interface probe. The depth to base of well was not recorded due to the presence of dedicated groundwater pumps installed at each location.
Monitoring Well Sampling	<p>Prior to sampling, monitoring wells were purged using dedicated low flow sampling equipment. Purging continued with frequent measurements of the water quality until parameters stabilised. Water quality parameters recorded in the field included dissolved oxygen, temperature, EC, redox potential, turbidity and pH, using a calibrated water quality meter (SmarTROLL MP). Field parameters were recorded in-field during purging, using a calibrated SmarTROLL MP. All parameters were recorded on Epic's field sheets (Appendix B), and are summarised in Table 12, with equipment calibration certificates included in Appendix C.</p> <p>Sampling of the monitoring wells was completed using the dedicated low flow sampling equipment following stabilisation of water quality parameters. Samples were collected directly from the pumps outlet tube and placed directly into laboratory prepared vials and bottles. All bottles were sealed immediately using a non-Teflon lined cap, labelled and placed on ice (double bagged).</p>
Sample Labelling, Storage and Transport	All samples were clearly labelled with unique identification numbers consisting of the date, sample location and samplers' initials. All samples were bagged and kept in an ice filled Esky prior to dispatch and during transport to the NATA registered laboratory, under chain-of-custody procedures. By prior arrangement with the laboratory, samples were extracted as soon as practicable after receipt.

Of the 11 nominated low flow groundwater monitoring wells, the following were unable to be sampled as outlined below:

- BH12 – The pre-installed groundwater pump in this well was unable to be utilised during the 5-6 June 2019 monitoring event, however sampling of this well was completed on 22 July 2019.
- BH17 – A dedicated groundwater pump had not been installed within the monitoring well and as such groundwater sampling was unable to be completed during the 5-6 June 2019 monitoring event. Sampling of BH17 was unable to be completed during the 22 July 2019 monitoring event due to insufficient groundwater present within the well (<0.7m).

3.2 Surface water Sampling Methodology

The surface water sampling methodology adopted for the current monitoring event is presented in **Table 3**. Surface water monitoring was completed on 6 and 7 June 2019 and included sampling at the following surface water locations: Chum Pond, NWH, Sed-1, DIS, SMC, SMC2, SMC3, DWN and DWN3.

Table 3: Surface Water Investigation Methodology

Action	Description
Surface water Sampling	<p>Surface water sampling was conducted using a decontaminated telescopic sampling pole. Sampling was completed directly into a laboratory prepared sample bottle attached to the pole with the lid open and lowered with the opening facing downwards into the water. Where possible the bottle was lowered to at least 30cm beneath the water surface and at least 30cm from the base of the water body. Care was taken not to disturb any sediments during this process. The sample bottle was then rotated so as to sample water from the centre of the water column. Once full, the bottle was carefully removed.</p> <p>Water quality parameters recorded in the field included dissolved oxygen, temperature, EC, redox potential, turbidity and pH, using a calibrated water quality meter (SmarTROLL MP). Field parameters were recorded in-field using a calibrated SmarTROLL MP. All parameters were recorded on Epic's field sheets (Appendix B), and are summarised in Table 12, with equipment calibration certificates included in Appendix C.</p>
Sample Labelling, Storage and Transport	All samples were clearly labelled with unique sample identification numbers consisting of the date, sample location and sampler's initials. All samples were kept chilled in an ice-filled Eskey prior to dispatch and during transport to the NATA registered laboratory under chain-of-custody procedures. By prior arrangement with the laboratories, samples were extracted as soon as practicable after receipt.
Decontamination	Reusable equipment was decontaminated by hand between each surface water sampling location and event by scrubbing with a solution of Decon 90 (a phosphate-free detergent) followed by a rinse in potable water.

3.3 Analytical Program

All groundwater and surface water samples were submitted to a NATA registered laboratory for analytical testing in accordance with **Table 4**. Groundwater samples reported to exceed the laboratory's limit of reporting (standard suite) as part of initial sampling were submitted for Total Oxidisable Precursor Assay (TOPA) to assess the presence of potential precursor compounds. TOPA provides a conservative and qualitative understanding of the potential for precursor compounds to degrade through natural organic processes to form PFAS.

Table 4: Analytical Program

Analytes		Limit of Reporting (µg/L)	
		Standard Suite	TOP Assay
Perfluoroalkyl Sulfonic Acids (PSAs)	Perfluorobutane sulfonic acid (PFBS)	0.0005	0.002
	Perfluorodecane sulfonic acid (PFDS)	0.0005	0.002
	Perfluoroheptane sulfonic acid (PFHpS)	0.0005	0.002
	Perfluorohexane sulfonic acid (PFHxS)	0.0005	0.002
	Perfluorooctane sulfonic acid (PFOS)	0.0002	0.002

Analytes		Limit of Reporting (µg/L)	
		Standard Suite	TOP Assay
Perfluoroalkyl Carboxylic Acids (PCAs)	Perfluoropentane sulfonic acid (PFPeS)	0.0005	0.002
	Perfluorobutanoic acid (PFBA)	0.002	0.01
	Perfluorodecanoic acid (PFDA)	0.0005	0.002
	Perfluorododecanoic acid (PFDoDA)	0.0005	0.002
	Perfluoroheptanoic acid (PFHpA)	0.0005	0.002
	Perfluorohexanoic acid (PFHxA)	0.0005	0.002
	Perfluorononanoic acid (PFNA)	0.0005	0.002
	Perfluorooctanoic acid (PFOA)	0.0005	0.002
	Perfluoropentanoic acid (PFPeA)	0.0005	0.002
	Perfluorotetradecanoic acid (PFTeDA)	0.0005	0.005
	Perfluorotridecanoic acid (PFTrDA)	0.0005	0.002
	Perfluoroundecanoic acid (PFUnDA)	0.0005	0.002
Perfluoroalkyl Sulfonamides	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	0.001	0.005
	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	0.0005	0.002
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	0.001	0.005
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	0.001	0.005
	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	0.0005	0.002
	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	0.001	0.005
	Perfluorooctane sulfonamide (FOSA)	0.0005	0.002
Fluorotelomer Sulfonic Acids (FSAs)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	0.001	0.005
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	0.001	0.005
	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	0.001	0.005
	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	0.001	0.005

3.4 Groundwater and Surface Water Assessment Criteria

Project analytical data was compared against relevant investigation and screening levels with regards to human health and the environment. The adopted assessment criteria, along with guidance documents used to establish the screening/ investigation levels are summarised in **Table 5**.

Table 5: Adopted Assessment Criteria

Media	Potential Contaminant of Concern	Criteria	Potential Receptor	Guideline Source
Groundwater & Surface Water	PFOS/PFHxS	0.7 µg/L	Human Health	PFAS National Environmental Management Plan (Recreational Water); Australian Government Department of Health, 2017
	PFOA	5.6 µg/L		
	PFOS	0.00023 µg/L	Ecological	PFAS National Environmental Management Plan (Freshwater & Interim Marine) – 99% species protection.
	PFOA	19 µg/L		PFAS National Environmental Management Plan (Freshwater & Interim Marine) – 95% species protection.
	PFOS	0.13 µg/L		
	PFOA	220 µg/L		

Concentrations were compared to 99% Species Protection Guideline Values due to the proximity of the site to sensitive environmental receptors including Six Mile Creek and the potential bioaccumulative

nature of PFAS², with results also compared to 95% Species Protection Levels to indicate likely impacts to environmental values, noting that 99% Species Protection Levels may be below ambient background concentrations.

3.5 Decontamination

Due to the very low screening values and the wide application of uses, prevention of cross contamination of samples from PFAS containing products is important. In order to prevent false positives from cross contamination, specific PFAS sampling procedures were implemented at the site, in addition to the Epic Standard Sampling Procedures discussed below.

3.5.1 Personnel

All personnel involved in handling equipment or samples were required to wash their hands using soapy water, rinse with tap water prior to donning a new, clean pair of nitrile gloves, which are to be changed at each sampling location. Personnel were not to come into contact with any items that may represent potential PFAS contamination (refer **Table 6**); hands were thoroughly washed if this occurred.

All personnel removed and discarded any disposable gloves and PPE prior to departing the immediate work area, for lunch and at the end of each day.

Table 6: Items prohibited from fieldworks

Item	Alternative product or practice
New clothing	All field clothing to be washed a minimum of six times after purchase before using at the site.
Clothing with stain-resistant, rain resistant, or waterproof coatings/treated fabric (e.g. GORE-TEX®)	polyethylene rain gear (e.g. disposable LDPE), vinyl, or polyvinyl chloride (PVC) clothing are acceptable.
Pre-wrapped foods and snacks (e.g. chocolate bars, potato chips etc.)	Use rigid plastic containers or bags or stainless steel containers for all food brought to site.
Teflon®-containing or -coated field equipment (tubing, bailers, tape, storage/sample containers, sample lids, etc.)	High Density Polyethylene (HDPE) or silicone tubing, and HDPE or polypropylene field equipment recommended. Polypropylene lids for sample containers and polypropylene or HDPE containers.
Aluminium foil	Thin HDPE sheeting (commonly used as drop cloths for painting or home improvement) can be used.
Self-sticking notes and similar office products (e.g. 3M Post-it notes)	Avoid the use of these products at the site.
Waterproof paper, notebooks, and labels	Standard paper and paper labels.
Detergents and decontamination solutions (e.g. Decon 90® Decontamination Solution)	Follow water-only decontamination approach.

² NEMP 2018, Table 5: The WQG advise that the 99% level of protection be used for '...slightly to moderately disturbed systems'. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife.

Item	Alternative product or practice
Reusable chemical or gel ice packs	Ice contained in plastic (polyethylene) bags (double bagged).

3.5.2 Plant and Equipment

In accordance with PFAS National Environmental Management Plan (NEMP), reusable equipment is not to be utilised for collection of groundwater samples. Any reusable equipment used during monitoring or gauging (i.e. oil/water interface probe, water quality meter) was decontaminated by scrubbing thoroughly with a plastic brush and rinsing with clean water. The items were then triple-rinsed in distilled or de-ionised water in accordance with the WA Department of Environment Regulations Guidelines *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)*. Where non-disposable field equipment was used, a rinsate blanks was be collected.

4 Quality Assurance and Quality Control

The data quality objectives of the sampling program are to obtain sufficient data to provide an adequate level of confidence that the assessment objectives are achieved. The evaluation criteria (Decision Rules) adopted to ensure the data quality objectives are achieved is summarized in Table 7

Table 7: Data Quality Objectives (DQO)

DQO	Evaluation Criteria
Document Completeness	Completion of field calibration records, field notes, chain of custody documentation, laboratory test certificates from NATA-certified laboratories.
Data Completeness	Sampling density is completed in accordance with the approved Sampling Plan to address the areas of concern.
Data Comparability	Use of appropriate techniques for the sampling, storage and transportation of samples. Use of NATA certified laboratory using NEPM 2013 procedures.
Data Representativeness	Analysis of validation samples in accordance with contaminants of concern as detailed in the Sampling plan.
Precision and accuracy for sampling and analysis	Use properly trained and qualified field personnel. Blind field duplicates to be collected at a minimum rate of 1 in 10. RPD's (Relative Percent Difference) to be less than 30% for inorganic and 50% for organic analyses. Achieve laboratory QC criteria.

4.1 Field Quality Assurance and Quality Control

The Quality Assurance and Quality Control (QA/QC) protocols used during the fieldwork for the assessment are shown in Table 8 below.

Table 8: Field QA/QC

Protocol	Description
Sampling Team	Fieldwork was completed by suitably qualified Epic Environmental consultants. Site personnel comprised only professionally qualified environmental scientists and engineers experienced in undertaking PFAS water sampling programs.
QA/QC System	All field activities, sampling and analysis were conducted in accordance with the Epic Environmental Sampling Plan.
Chain of Custody Protocols	All samples were logged and transferred under appropriately completed Chain of Custody Forms.
Preservation	All samples were received at the laboratory in appropriately preserved containers, with preservation including packing samples with double bagged ice.
Field Duplicates, Rinsate Blanks and Trip Blanks	Field QC samples were prepared in accordance with procedures given in Section 8 of Australian Standard AS4482.1-2005. The frequency of duplicate testing corresponded to at least 10% for water samples in accordance with the PFAS NEMP requirements. Rinsate blanks were collected at a frequency of 1 per matrix per piece of equipment per day.
Field Instruments and equipment	Field instruments was calibrated in accordance with manufacturer recommendations. All field equipment was decontaminated with potable water between sampling events.

4.1.1 Field Duplicates

The RPD calculations for groundwater duplicate samples have been compared against the relevant primary sample. Where either primary or duplicate results have concentrations below the laboratory level of reporting, the RPD was not calculated.

One intra-laboratory and one inter-laboratory duplicate sample was collected from both the groundwater monitoring network and the surface water monitoring network during this sampling event.

One RPD was found to be above the data quality indicators (DQI) for relative percent differences (50% for organic analyses). This exceedance is summarised in **Table 9**, with RPD calculations included in **Appendix D**.

Table 9: Summary of RPD Exceedances

Primary Sample ID	Duplicate Sample ID	Analyte	Primary Sample Result	Duplicate Sample Result	RPD
DIS	SQA1A	Total PFAS	0.0722	0.1339	60

The primary and duplicate concentrations for all remaining analytes tested were either below the laboratory LOR, or within the acceptable RPD range. On review, the RPD exceedance was reported for a summed total of a number of individual compounds, with RPDs for all individual compounds reported within acceptable limits. On this basis analytical data produced is considered reliable for the purpose of this investigation.

4.1.2 Rinsate Blanks

In general, dedicated and/or disposable sampling equipment was used in the collection of groundwater samples comprising dedicated groundwater pumps and tubing, and nitrile gloves. Where non-disposal equipment was used (i.e. water level meter) a rinsate blank was used to determine the suitability of decontamination procedures utilised.

Concentrations were reported below laboratory limit of reporting for all PFAS compounds analysed. On this basis, decontamination procedures utilised are considered to have been adequate.

4.2 Laboratory Quality Assurance and Quality Control

Australian Laboratory Services (ALS) was the nominated primary laboratory to undertake laboratory analysis of validation samples. Envirolab was the nominated secondary laboratory. Both ALS and Envirolab are NATA accredited laboratories. The following data validation process was used to determine the accuracy and precision of analytical results and to assess the reliability of the analytical data suite. Table 10 outlines the analytical data validation criteria, qualifications to the data and the overall QA/QC procedures used for the laboratory testing program.

Table 10: Laboratory QA/QC

Protocol	Description
Holding Times	Holding times are the maximum permissible elapsed time in days from the collection of the sample to its extraction and/or analysis.
Reagent Blanks	The reagent blank sample is a laboratory prepared sample containing the reagents used to prepare the sample for final analysis. The purpose of this procedure is to identify contamination in the reagent materials and assess potential bias in the sample analysis due to contaminated reagents. The QC criteria are no detectable contamination in the reagents. Each analytical procedure will be subject to a reagent blank analysis.
Laboratory Duplicates	Laboratory duplicates are field samples that are split in the laboratory and subsequently analysed a number of times in the same batch. These sub-samples are selected by the laboratory to assess the accuracy and precision of the analytical method. ALS undertakes QA/QC procedures such as calibration standards, laboratory control samples, surrogates, reference materials, sample duplicates and matrix spikes. The adopted laboratory duplicate acceptance criterion is 50% RPD.
Matrix Spikes / Matrix Spike Duplicates (MS/MSD)	MS/MSDs are field samples to which a predetermined stock solution of known concentration has been added. The samples are then analysed for recovery of the known addition. Adopted acceptance criteria for MS are 70% - 130%, while the laboratory MSD acceptance criterion is 50% RPD.
Blind Field Duplicates	Blind duplicates are split field samples which are both sent to the laboratory for individual analyses. The accepted RPD for non-volatiles is 30% and 50% for volatiles. These samples are analysed to assess the field methods.

The Laboratory QA program indicates that the laboratory data was obtained under appropriated sample analysis QA/QC and that the Certificate of Analysis is reliable for the purposes of this assessment.

4.2.1 Completeness

The following information is required to check for completeness of data sets:

- chain-of-custody forms (signed by the analytical laboratory);
- sample receipt forms;
- all sample results reported;
- all blank data reported;
- all lab duplicates reported and relative percent differences (RPDs) calculated;
- all surrogate spike data reported;
- all matrix spike and matrix spike duplicate (MS/MSD) data reported and RPDs calculated; and
- NATA stamp on reports.

The results of this check indicated that required documentation and data has been reported on NATA approved reports.

4.2.2 Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. The determination of accuracy can be achieved through the analysis of

known reference materials or assessed by the analysis of matrix spikes. Spiking of reference materials into an actual sample matrix is the preferred technique because it provides a measure of the matrix effects on the analytical accuracy. Accuracy is measured in terms of percentage recovery. Laboratory personnel calculate percentage recoveries of spiked compounds, which are evaluated against control or acceptance limits taken from the appropriate NATA approved method. If the spike recovery for a sample does not fall within the prescribed control limits, laboratory based corrective action is taken, although the sample is not necessarily reanalysed.

According to Schedule B(3) of NEPM 2013, sample results are qualified when a matrix spike recovery is below or above the QA acceptance criteria. Typically, results are qualified when percentage recovery is below QA acceptance criteria, indicating that sample results may be biased low. However, results are also qualified when percentage recovery is above QA acceptance criteria, indicating that sample results may be biased high.

Laboratory duplicate samples and matrix spike analysis was not completed by the primary analytical laboratory for groundwater samples analysed under Work Order EB1914694. Discussion with the primary analytical laboratory indicate that results reported are considered to be accurate on the basis that laboratory control samples, method blank and surrogate samples were reported within acceptable limits and in accordance with quality control specifications. All laboratory duplicates and MS/MSD RPDs from the secondary analytical laboratory were reported within prescribed limits. It is noted that field duplicate RPDs were generally reported within acceptable limits as discussed in **Section 4.1.1**.

Matrix spike recoveries were not determined for sample (lab no.) EB1914836-004 (PFBS, PFHxS, PFOS & PFHxA) due to background levels being greater than or equal to four times the spike level.

Matrix spike recovery in sample (lab no.) EB1914836-004 (PFPeS, PFOA & PFTeDA) reported recoveries (144%, 164% & 132% respectively) greater than the upper data quality objective (50 – 130%).

Remaining matrix spikes were reported within prescribed limits.

4.2.3 Sensitivity

Sensitivity criteria are used to monitor achievement of quantification using method detection limits. Method detection limits depend on the method of analysis, the instrument's ability to measure analytes and the sample matrix; in particular, background interferences.

When interferences are present in the sample, a loss of sensitivity can occur resulting in an increase in the method detection limit. In some instances, (e.g. where one or more compounds have particularly high concentrations) the sample must be diluted for analysis. This increases the method detection limit by the dilution factor.

Method detection limits for soil/sediments are based on 'wet weight'. Actual detection limits are calculated on a 'dry weight' basis and are higher. The detection limits achieved by the laboratory were below the site criteria for all analytes.

All laboratory detection limits were below the relevant assessment criteria.

4.2.4 Laboratory Blanks

Laboratory blanks monitor externally introduced contaminants that potentially derive from glassware, cleaning reagents and digestion reagents during the analysis process. The blank consists of water and digestion reagents prepared in the laboratory. The laboratory blank is treated as a sample in the laboratory, going through the same sample preparation and analysis procedures as corresponding samples.

To meet the QC acceptance criteria the laboratory blanks should have no detectable concentrations of the target compounds. The laboratory blank results are presented in the laboratory analytical reports.

All laboratory blank results were reported within prescribed acceptance criteria.

4.2.5 Holding Times

Holding times from field sampling to laboratory analysis must be minimised to ensure the representativeness of the result obtained. Delays between sampling and analysis can lead to analytes changing due to processes such as volatilisation, mineralisation, and biological modification.

Where standard holding times are exceeded, professional judgement as to the integrity of the data will be required, taking into account such factors as field storage, laboratory storage and even sample bottle characteristics.

All analytical testing was completed within prescribed holding times for the specific test.

4.3 Data Quality Objective Completion

The data validation procedure employed in the assessment of the field and laboratory QA/QC data indicated that the reported analytical results are representative of the conditions at the sample locations and that the analytical data can generally be relied upon for the purpose of this environmental investigation.

Based on the data collected, and an assessment of the QA/QC process and DQIs, Epic concludes that overall, the quality of the analytical data produced is reliable for the purpose of this investigation; a summary of objective completion can be found in **Table 11** below.

Table 11: Data Quality Indicators and Criteria

DQI	Evaluation Criteria	Status
Document Completeness	Completion of field calibration records, borehole reports, chain of custody documentation, laboratory test certificates from NATA-certified laboratories.	✓
Data Completeness	Sampling density comparison meets Qld Guidelines for potential contaminants of concern at all areas of greatest environmental concern.	✓
Data Comparability	Use of appropriate techniques for the sampling, storage and transportation of samples. Use of NATA certified laboratory using NEPM procedures. Comparison with previous site information.	✓
Data Representativeness	Good sampling coverage of all areas of environmental concern at the site, and selection of representative samples from each sampling location. Targeting areas of concern for contaminants of concern.	✓
Precision and Accuracy for Sampling and Analysis	Use properly trained and qualified field personnel. Blind field duplicates to be collected at a minimum rate of 1 in 20 RPD's to be less than 30% for inorganic and 50% for organic analyses. Achieve laboratory QC criteria.	✓

5 Groundwater Environmental Assessment

5.1 Groundwater Field Parameters

5.1.1 Water Quality Parameters

Groundwater water quality parameters were recorded following well purging and parameter stabilisation. A summary of observations is provided in **Table 12** below.

Table 12: Groundwater Water Quality (Field Parameters)

Well ID	pH	EC ($\mu\text{S}/\text{cm}$)	DO (ppm)	Redox (mV)	Temp (°)	Salinity (PSU)	TDS (ppm)
BH02	6.19	3,355.1	0.14	-99.9	25.86	1.75	2.15
BH03	5.13	7,992.4	0.14	-3.6	22.7	6.71	5.43
BH5A	5.52	3,507.7	0.11	4.3	25.17	1.86	2.27
BH7A	6.34	6,675.5	0.43	-134.3	34.74	3.08	3.66
BH11	5.60	5,056.3	0.12	11.3	24.04	2.81	3.35
BH12	6.95	5,306.2	0.93	-27.1	24.23	2.94	3.49
BH14	6.42	9,588.9	0.13	-36.6	21.63	5.86	6.67
BH15	7.14	10,531	0.08	-58.5	22.37	6.37	7.2
BH16	7.00	5,882.3	0.12	-39.1	22.66	3.39	4.0
BH17	Unable to sample during this event						
BH18	6.92	1,414.4	0.11	-45.7	24.50	0.73	0.94

5.1.2 Standing Water Level Observations

Standing water levels were obtained prior to purging of the well. Observations are provided in **Table 13** below along with observations from the previous groundwater monitoring rounds undertaken by Epic (May 2019) as well as GHD (Feb 2019). Review of current groundwater standing water levels indicate that groundwater levels observed at the site during the current monitoring event (June 2019) are generally comparable to recent monitoring events (February and May 2019). It is noted that some variation in groundwater levels have been observed at the site, with variances attributed to seasonal variation (refer **Figure 1**).

Table 13: Groundwater SWL Observations

Well Number	SWL (m AHD)			
	Feb 2019	May 2019	June 2019	July 2019
BH02	12.98	14.00	14.05	-
BH03	14.40	15.06	14.82	15.24
BH5A	13.29	14.01	14.04	-
BH7A	12.96	14.05	14.08	-
BH11	13.61	14.47	14.56	-
BH12	12.92	13.98	14.03	14.23
BH14	33.70	33.62	33.77	-
BH15	33.86	33.80	33.67	-
BH16	16.09	15.97	16.08	-
BH17	31.72	31.91	31.88	-
BH18	13.06	14.05	14.11	14.25

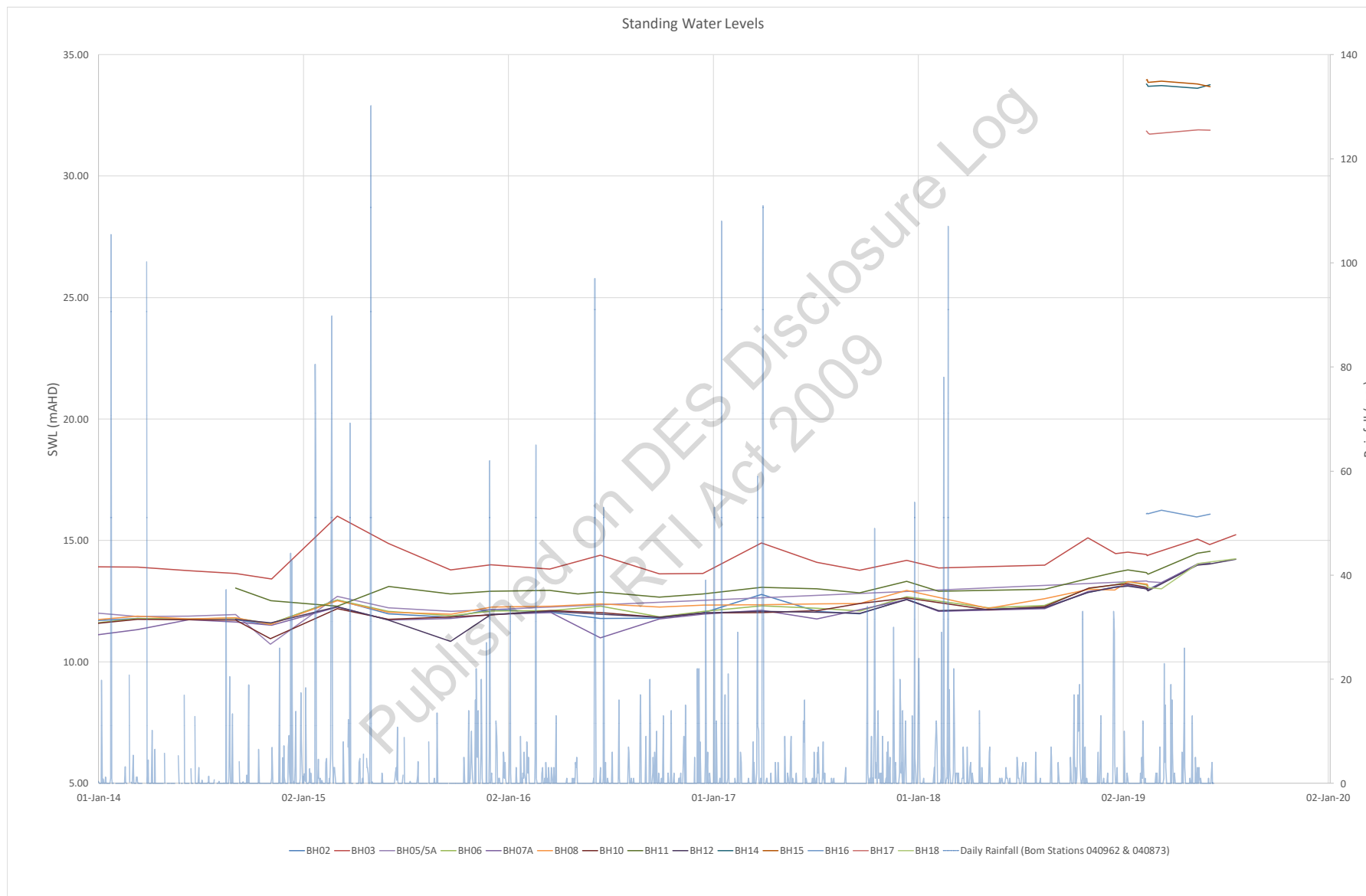


Figure 1: Groundwater Standing Water Levels

5.2 Groundwater Analytical Results

A summary of groundwater analytical results is presented in **Table T1**, with a summary of detections and exceedances outlined below. Laboratory documentation is included in **Appendix D**.

5.2.1 Perfluoroalkyl Sulfonic Acids (PSA)

- PFOS – BH03 (0.0005µg/L [June] & 0.0003µg/L [July]), BH12 (0.0074µg/L [July]) and BH18 (0.0006µg/L [June]) reported detectible concentrations of PFOS above the PFAS NEMP 99% Species Protection Levels, with concentrations below the PFAS NEMP 95% Species Protection, Drinking Water and Recreational Water guideline values. Remaining samples reported concentrations of PFOS below the laboratory's Limit of Reporting (LOR) of 0.0002µg/L;
- Concentrations of PFBS (0.0007µg/L) were reported above the laboratory's LOR in BH18 (June only);
- Concentrations of PFHxS were reported above the laboratory's LOR in BH12 (0.001µg/L) and BH18 (0.0005µg/L [June only]); and
- Concentrations of remaining PSAs were reported below the laboratory's LOR in all samples.

5.2.2 Perfluoroalkyl Carboxylic Acids (PCA)

- PFOA – All samples reported concentrations of PFOA below the laboratory's LOR, with all samples below the adopted assessment criteria;
- Concentrations of PFPeA (0.0011 µg/L) and PFHpA (0.0011 µg/L) were reported above the laboratory's LOR in BH11; and
- Concentrations of remaining PCAs were reported below the laboratory's LOR in all samples.

5.2.3 Fluorotelomer Sulfonic Acids (FSA)

- Concentrations of 6:2 FTS (0.009µg/L) were reported above the laboratory's LOR in BH12; and
- Concentrations of remaining FSAs were reported below the laboratory's LOR in all samples.

5.2.4 Perfluoroalkyl Sulfonamides

- Concentrations of Perfluoroalkyl Sulfonamides were reported below the laboratory's LOR in all samples.

5.2.5 Total PFAS

PFAS was detected in BH03 (total 0.0005µg/L [June] and 0.0003µg/L [July]), BH11 (total 0.0022µg/L), BH12 (total 0.0174µg/L) and BH18 (total 0.0018µg/L [June only]) above the LOR of 0.0002µg/L. PFAS was not detected in remaining groundwater samples (BH02, BH05A, BH07A, BH11, BH14, BH15 and BH16).

5.2.1 TOPA

Both of the two groundwater samples analysed for TOPA (BH03 and BH18) reported concentrations of all PFAS compounds below the laboratory's LOR (0.002µg/L). It is noted that the TOPA LOR was raised above LORs for individual PFAS compounds, however the LOR was comparable to Total PFAS concentrations reported in BH03 (total PFAS 0.005µg/L) and BH18 (total PFAS 0.0018µg/L).

5.3 Groundwater Results Summary

Concentrations of PFAS compounds were reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18). PFOS was detected in BH03, BH12 and BH18, with concentrations above the PFAS NEMP Freshwater 99% Species Protection levels (High conservation value systems), but below the 95% Species Protection Levels (slightly to moderately disturbed systems). PCA compounds were detected in BH11 and 6:2 FTS was detected in BH12, with PFAS concentrations below relevant assessment criteria (where established).

It is noted that BH18 reported detectible concentrations of PFAS compounds during sampling completed on 5 June 2019, with subsequent sampling completed on 22 July 2019 reporting concentrations below the laboratory's LOR.

Concentrations of TOPA were reported below the laboratory's LOR, indicating there is unlikely to be a significant mass of precursors in groundwater, and all possible oxidation is likely to have already occurred.

6 Surface Water Environmental Assessment

6.1 Surface Water Quality Parameters

Surface water quality parameters were recorded at each surface water sampling location following parameter stabilisation. A summary of observations is provided in **Table 12** below.

Table 14: Surface Water Quality (Field Parameters)

Well ID	pH	EC ($\mu\text{S}/\text{cm}$)	DO (ppm)	Redox (mV)	Temp (°)	Salinity (PSU)	TDS (ppm)
Sed-1	7.66	3,321	12.88	30.9	15.47	2.17	2.64
Chum Pond	9.58	1,350	11.9	26.6	17.8	0.80	1.02
DIS	8.3	2,101	8.51	28.7	16.94	1.30	1.62
NWH	9.05	2,503	9.18	43.2	18.28	1.51	1.87
SMC	7.17	2,011	8.75	55.8	15.42	1.27	1.6
SMC2	9.68	3,134	6.98	48.3	17.8	1.96	2.39
SMC3	8.76	3,468	7.85	56.6	22.6	1.94	2.36
DWN	8.2	2,080	7.74	8.4	17.37	1.26	1.58
DWN3	9.53	1,054	6.14	27.1	15.02	1.17	1.47

6.2 Surface Water Analytical Results

A summary of surface water analytical results is presented in **Table T1**, with a summary of detections and exceedances outlined below. Laboratory documentation is included in **Appendix D**.

6.2.1 Perfluoroalkyl Sulfonic Acids (PSA)

- PFOS – All samples reported concentrations of PFOS above the PFAS NEMP 99% Species Protection Levels, with Chum Pond and NWH reported above the PFAS NEMP Drinking Water guideline values. All samples reported concentrations below the PFAS NEMP 95% Species Protection and Recreational Water guideline values. Highest concentrations were reported in Chum Pond (0.124 $\mu\text{g}/\text{L}$) and NWH (0.117 $\mu\text{g}/\text{L}$);
- PFOS + PFHxS – All samples reported concentrations of PFOS + PFHxS above the laboratory's LOR, with Chum Pond and NWH reported above the PFAS NEMP Drinking Water guideline values;
- PFBS, PFHxS, PFHpS & PFDS – Concentrations of PFBS, PFHxS, PFHpS and PFDS were reported above the laboratory's LOR in Chum Pond, NWH, DIS, SMC, DWN and DWN3, with Sed-1, SMC2 and SMC3 reporting concentrations below the laboratory's LOR; and
- PFPeS – All samples reported concentrations of PFPeS below the laboratory's LOR.

6.2.2 Perfluoroalkyl Carboxylic Acids (PCA)

- PFOA – Concentrations of PFOA were reported above the laboratory's LOR in Chum Pond, NWH, DIS, SMC, DWN and DWN3, with Sed-1, SMC2 and SMC3 reporting concentrations below the laboratory's LOR. All samples reported concentrations below the PFAS NEMP 99% Species

Protection Levels, 95% Species Protection, Drinking Water and Recreational Water guideline values;

- PFHpA, PFDA & PFUnDA - Concentrations of PFOA were reported above the laboratory's LOR in Chum Pond, NWH, DIS, SMC, DWN and DWN3, with Sed-1, SMC2 and SMC3 reporting concentrations below the laboratory's LOR;
- PFPeA – Concentrations of PFPeA were reported above the laboratory's LOR in Chum Pond and NWH;
- PFNA – Concentrations of PFNA were reported above the laboratory's LOR in Chum Pond, NWH and DWN; and
- Concentrations of remaining PCAs were reported below the laboratory's LOR in all samples.

6.2.3 Fluorotelomer Sulfonic Acids (FSA)

- 8:2 FTS - Concentrations of 8:2 FTS were reported above the laboratory's LOR in Chum Pond and NWH; and
- Concentrations of remaining FSAs were reported below the laboratory's LOR in all samples.

6.2.4 Perfluoroalkyl Sulfonamides

- Concentrations of Perfluoroalkyl Sulfonamides were reported below the laboratory's LOR in all samples.

6.2.5 Total PFAS

PFAS was detected in all samples with concentrations ranging from 0.0003µg/L in Sed-1 to 0.299µg/L in Chum Pond.

6.3 Surface Water Results Summary

Concentrations of PFAS compounds were reported in all of the onsite, upstream and downstream surface water monitoring locations, with the majority of locations reporting detectible concentrations of PSA and PCA compounds, and all locations reported detectible concentrations of PFOS.

7 Limitations and Disclaimer

Epic Environmental Pty Ltd (Epic) has prepared the following report for the exclusive benefit of Cleanaway Solid Waste Pty Ltd and for the singular purpose of detailing the findings of the PFAS groundwater investigation at the New Chum Landfill Facility. All interpretations, finding or recommendations outlined in this report should be read and relied upon only in the context of the report as a whole.

The following report cannot be relied upon for any other purpose, at any other location or for the benefit of any other person, without the prior written consent of Epic. This report may be relied upon by the Administering Authority and Local Council for the purpose of assessment of Development Applications relating to the site. Except with Epic's prior written consent, this report may not be:

- a. released to any other person, whether in whole or in part;
- b. used or relied upon by any other party; or
- c. filed with any Governmental agency or other person or quoted or referred to in any public document.

This report has been prepared based on information provided by the Client and other parties. In preparing this report Epic:

- a. presumed the accuracy of the information provided by the Client (including its representatives);
- b. has not undertaken any verification to the accuracy or reliability included in this information (with the exception where such verification formed part of the scope of works);
- c. has not undertaken any independent investigations or enquiries outside the scope of works with respect to information provided for this report; and
- d. provides no warranty or guarantee, expressed or implied, as to the accuracy or reliability of the information provided in this report.

In recognition of the limited use of this report, the Client agrees that, to the maximum extent permitted by law, Epic (including its representatives and related entities) is not liable for any losses, claims, costs, expenses, damages (whether pursuant to statute, in contract or tort, for negligence or otherwise) suffered or incurred by the Client or any third party as a result of the information, findings, opinions, estimates, recommendations and conclusions provided in this report.

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- b. for any use or reliance upon this report by any person other than the Client;
- c. where another person has a different interpretation of the same information contained in the report;
- d. for any consequential or indirect losses, or for loss of profit or goodwill or any loss or corruption of any data, database or software.

If a section of this disclaimer is determined by any court or other competent authority to be unlawful and/or unenforceable, the other sections of this disclaimer continue in effect. Where further information becomes available, or additional assumptions need to be made, Epic reserves its right to amend this report, but is not obliged to do so.

8 References

- Australian Standard AS 5667.11-1998 Water quality - Sampling - Guidance on sampling of groundwaters;
- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), October 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 - The Guidelines (Chapters 1-7);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG). Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, 2018;
- Department of Science, Information Technology and Innovation (DSITI, now DES) (2017) Using Monitoring Data to Assess Groundwater Quality and Potential Environmental Impacts;
- Environmental Protection Act, 1994;
- Environmental Protection (Water) Policy, 2009;
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- GHD (2019), Redesign & Rehabilitation of the New Chum Waste Management Facility, Leachate, Surface water and Hydrogeological Assessment, April 2019;
- Guidance on Systematic Planning Using the Data Quality Objectives Process: EPA QA/G-4. United States Environmental Protection Agency, September 1994;
- Heads of EPAs Australia and New Zealand (HEPA), PFAS National Environmental Management Plan (NEMP), January 2018;
- Monitoring and Sampling Manual, Version 2, 2010 (Department of Environment and Heritage Protection);
- National Environmental Protection Council (NEPC), 2013, National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) (No 1);
- Queensland Auditor Handbook for Contaminated Land (Department of Environment and Science, Queensland Government, July 2018);
- USEPA (2006) Guidance on systematic Planning Using the Data Quality Objectives Process; and
- Western Australian Department of Environment Regulation, Interim Guidelines on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Contaminated Sites Guidelines, V 2.1, January 2017.

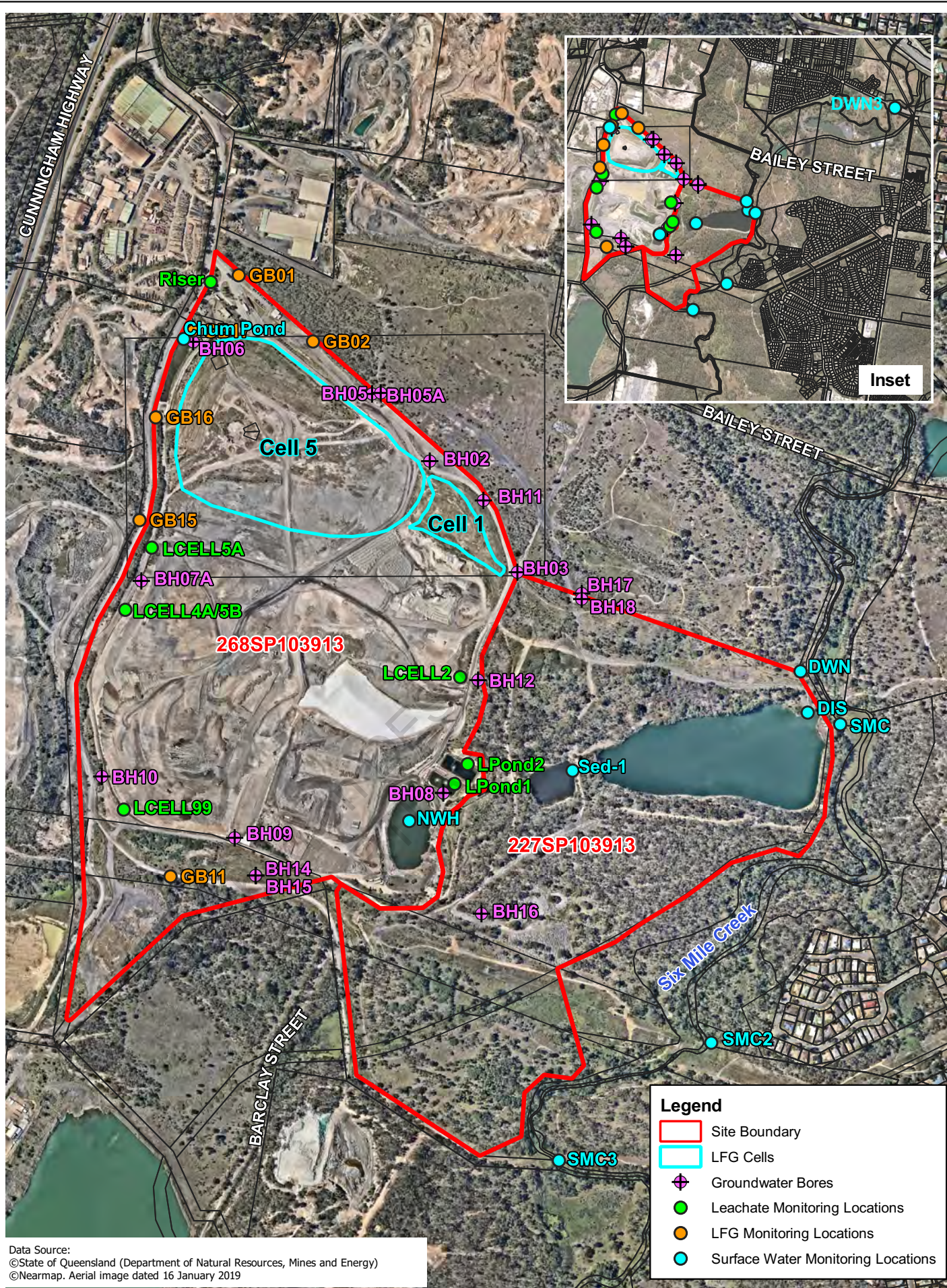
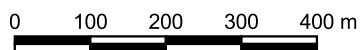
GLOSSARY

▪ AHD	Australian Height Datum
▪ CSM	Conceptual Site Model
▪ DQOs	Data Quality Objectives
▪ DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
▪ EP Act	Environmental Protection Act
▪ ES	Environmentally Sensitive
▪ ESA	Environmental Site Assessment
▪ FSA	Fluorotelomer Sulfonic Acid
▪ GME	Groundwater Monitoring Event
▪ HDPE	High Density Polyethylene
▪ ICC	Ipswich City Council
▪ mAHD	Metres Australian height datum
▪ mBGL	Metres below ground level
▪ MCU	Material Change of Use
▪ NATA	National Association of Testing Authorities
▪ PCA	Per-fluoroalkyl Carboxylic Acid
▪ PFAS	Per- and Poly-fluoroalkyl Substances
▪ PFOA	Per-fluoro Octanoic Acid
▪ PFOS	Per-fluoro Octane Sulfonic acid
▪ PFHxS	Per-fluoro Hexane Sulfonic acid
▪ PPE	Personal Protection Equipment
▪ PPM	Parts Per Million
▪ PSA	Per-fluoro Sulfonic Acid
▪ PSU	Practical Salinity Units
▪ QA/QC	Quality Assurance/Quality Control
▪ RFI	Request for Information
▪ RPD	Relative Percent Difference
▪ SWL	Standing Water Level
▪ TOPA	Total Oxidisable Precursor Assay

FIGURES

Figure F1: Environmental Monitoring Locations

Published on DES Disclosure Log
RTI Act 2009



Scale: 1:11,000 @ A4

Datum: GDA94 Projection: MGA56



Cleanaway Waste Management Limited
 100 Chum Street, New Chum, 4303

Figure F1
 Environmental Monitoring Locations



TABLES

Table T1: PFAS Analytical Results

Published on DES Disclosure Log
RTI Act 2009

Table T1: PFAS Analytical Results

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RTI Act 2009

Appendix A – Groundwater Monitoring Well Construction Details

Published on DES Disclosure Log
RTI Act 2009

HOLE No.: BH6 CO-ORDs / LOCATION:					RL:47.714mAHD	
Drilling method	Water	Scale (m)	Description	Geophysical Log	Borehole construction details	Additional Observations
Tubex Hammer		0	Roadway - Compacted Fill			70.9m TOC
		1m	Coarse, sandy fill material			Concrete Grout 5m
		5m	Sandy/clay fill/darker clay			Bentonite Plug >1m
		8m	Clay - lighter reddish colouration.			
		10		Soft fill bands interspaced with boulders/hard layers		
		11m	Darker clay bands. Courser grained			
		13m	Finer Clay/sand - light colouration.			
		17m	Slight collapse - darker Clay			100mm C12 Standpipe
		18m	Hard Siltstone band			
		20				
		22m	Dark fill material/silty Clay			
		24m	Harder section - Mudstone / Siltstone			
		25m	Thin coal bands interbedded with softer depositional sequences			
		30				5mm Gravel pack
		30m	Silty layer			
		35m	Siltstone - fractured material			
		36m	Siltstone			
		40				
		42m	Siltstone fractured / thin banded			
		43m	Thin Sandstone band - fractured/highly weathered			
		46m	Light grey Siltstone			
		50				46.5 Top of slotted section
		50m	Light grey Siltstone / Thin weathered Sandstone band			
			Seepage 51m			
	54m	Light grey Siltstone			Machine Slotted 2mm	
	60					
	60m	Siltstone (V-notch tested >1L/s)				
	65.5m	End of cased drilling (open hole drill thereafter)				
		Open hole. 1.5-2 L/s				
	70					
	70.5m	E.O.H. Siltstone				

DRILLER ... Hoffman Drilling

DRILLING METHOD Tubex Hammer

DATE Completed 14/02/2008

WATER ENCOUNTERED 51m

STANDING WATER LEVEL SWL = 44.182m 19/2/08 44.33m 03/03/08

LOGGED BY C. Gill

Transpacific Waste Management P/L
T/A Twigg Group

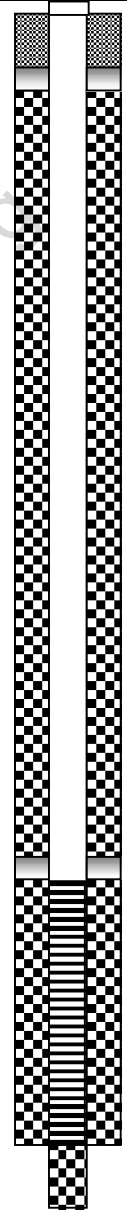
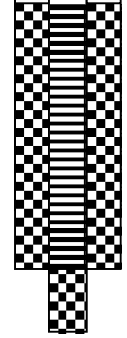
Waste Solutions Australia Pty Ltd

Ph: 07 3366 5778 Fax: 07 3366 7302 wsa@wastesolutions.biz

Groundwater Monitoring Program

DATE: 10/03/2008

JOB W 0489-2

HOLE No.: BH7 CO-ORDs / LOCATION:					RL: 68.31 mAHD	
Drilling method	Water	Scale (m)	Description	Geophysical Log	Borehole construction details	Additional Observations
Tubex Hammer	▽	0	Fill (Sandy medium grained)			85.14 T.O.C. 5m Concrete Grout Bentonite Plug >1m
		4m	Fill harder layer/dark greystone/mud larger chips			
		5m	Some consolidation - harder layer			
		10	Grey coloured fill (some boulders) - Mudstone			
		12m	Fill - Silt / Mudstone/dark grey colour			
		14m	Water seepage noted - Perched			
		18m	Light Grey Siltstone when dry			
		20				
		24m	Softer horizons - Silt some sand			
		30				
		30m	Silty Shaley chips (increased Clay content)			
		36m	Siltstone - section fragmented restricting air flow to surface			
		40				
		40m	Siltstone - harder sequence Clay/Siltstone - lighter colouration			
		47m	Coarser grained fragments/sandy			
		50				
		54m	Siltstone			
		60				
3/3/08 65.13m						
68m	Grey Siltstone / Shaley sequence	67.5 Top of slotted section		Bentonite Plug >1m Tubex Casing broken from 71-83m		
70	Sandstone lense thinly layered					
72m	1.2L/s - lift					
80	Coal seams & airlift 3.82L/s 9.5cm=3062gph					
84m	Hard banded Siltstone Airlift following PVC install 0.27L/s					
90	89m	E.O.H.				
DRILLER ... Hoffman Drilling DRILLING METHOD Tubex Hammer DATE ... Completed 20/02/08 WATER ENCOUNTERED 14m ▽ STANDING WATER LEVEL SWL = 65.074m 28/2/08 65.13m 03/03/08. ▽ LOGGED BY C. Gill			Transpacific Waste Management P/L T/A Twigg Group			
Waste Solutions Australia Pty Ltd 			Groundwater Monitoring Program			
Ph: 07 3366 5778 Fax: 07 3366 7302 wsa@wastesolutions.biz			DATE: 10/03/2008		JOB No.: W 0489-2	

HOLE No.: BH8 CO-ORDs / LOCATION:						RL: 13.128 mAHD	
Drilling method	Water	Scale (m)	Description		Geophysical Log	Borehole construction details	Additional Observations
Tubex Hammer	3/3/08 9.355m ▼ ▷	0					48.6 T.O.C
							5m Concrete Grout
		5m	Fill material Siltstone/Mudstone				Bentonite Plug
		9m	Harder Fill layer banded Siltstone/Mudstone				
		10-11m	Void				100mm C12 Standpipe
		15m	Firm Siltstone sequence - Sandy layer some evidence of seepage - Siltstone				
		18m	Siltstone/even chips/smooth rotation				
		20					5mm Gravel pack
		24m	Siltstone/even chips/smooth rotation				
		30					
		30m	Open hole - Grey mudstone				
		36m	Mudstone/Siltstone/Coal measures				36m Top of slotted section
		40					
		42m	Coal Measures				
		47m	Siltstone				
48m	E.O.H. Airlift approx. 0.1L/s						
DRILLER ... DRILLING METHOD..... DATE ... WATER ENCOUNTERED STANDING WATER LEVEL LOGGED BY		Hoffman Drilling Tubex Hammer Completed 21/02/08 15.5m ▷ SWL = 9.355m 03/03/08 ▼ C. Gill			Transpacific Waste Management P/L T/A Twigg Group		
Waste Solutions Australia Pty Ltd 					Groundwater Monitoring Program		
Ph: 07 3366 5778 Fax: 07 3366 7302 wsa@wastesolutions.biz					DATE: 10/03/2008	JOB No.: W 0489-2	

HOLE No.: BH10 CO-ORDs / LOCATION:						RL: 53.469 mAHD	
Drilling method	Water	Scale (m)	Description		Geophysical Log	Borehole construction details	Additional Observations
Tubex Hammer		0	Fill material/timber				83.65 T.O.C
							5m Concrete Grout
							>1m Bentonite Plug
		20	20m	Fill	Reworked overburden boulders/timber		
							100mm C12 Standpipe
		30m	Fill				5mm Gravel pack
			36m	Fill			
		40					
			48m	Harder Siltstone layer			
				Silt & Mudstone sequence			
				some moisture			
			58m	Coal seam			
		60	60m	Cased to 60 - Open hole thereafter			
				Dark Siltstone - Open hole from 60 - 78m			65.1m Top of slotted section
			71m	Light Siltstone horizon			
		80					
		83m	E.O.H.				
			Minimal H ₂ O encountered during drilling				
			Airlift @ 82m approx. 0.1m/s				
DRILLER ... Hoffman Drilling					Transpacific Waste Management P/L T/A Twigg Group		
DRILLING METHOD Tubex Hammer							
DATE ... Completed 14/02/2008							
WATER DURING DRILLING 56m 							
STANDING WATER LEVEL 49.835m 3/3/2008 					Groundwater Monitoring Program		
LOGGED BY C. Gill							
Waste Solutions Australia Pty Ltd 					DATE: 10/03/2008 JOB No.: W 0489-2		
Ph: 07 3366 5778 Fax: 07 3366 7302 wsa@wastesolutions.biz							



Drillpower QLD
47-57 Elanora Court
Jimboomba QLD 4280
Telephone: 07 5548 6386
Fax: 07 5548 6386

BOREHOLE NUMBER BH1

PAGE 1 OF 2

CLIENT Transpacific Industries Group Pty Ltd

PROJECT NAME Drilling and Monitoring Well Installation

PROJECT NUMBER

PROJECT LOCATION 100 Chum Street

DATE STARTED 10/6/14

COMPLETED 10/6/14

R.L. SURFACE

DATUM

DRILLING CONTRACTOR Drillpower QLD

SLOPE 90°

BEARING ---

EQUIPMENT Comacchio 450P

HOLE LOCATION Between Existing BH2 and BH3

HOLE SIZE 100

LOGGED BY PD

CHECKED BY HD

NOTES 27°61,104S 152°83,894E

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Rotary Air				2			FILL Dark Grey Siltstone backfill		
				4					
				6					
				8					
				10					
				12			Yellow Brown SANDSTONE		
				14					
				16					
				18					
				20					
				22					
				24					
				26					
				28					
				30					
				32					
				34					
				36					
				38			Grey SILTSTONE		
				40					
				42					
				44			Bands of COAL and Carbonaceous Siltstones/shaley coal		
				46					
				48					
				50			Grey Siltstone		

Flow Test carried out - 0.001 Ltre per Second



Drillpower QLD
47-57 Elanora Court
Jimboomba QLD 4280
Telephone: 07 5548 6386
Fax: 07 5548 6386

BOREHOLE NUMBER BH1

PAGE 2 OF 2

CLIENT Transpacific Industries Group Pty Ltd

PROJECT NAME Drilling and Monitoring Well Installation

PROJECT NUMBER _____

PROJECT LOCATION 100 Chum Street

DATE STARTED 10/6/14

COMPLETED 10/6/14

R.L. SURFACE _____

DATUM _____

DRILLING CONTRACTOR Drillpower QLD

SLOPE 90°

BEARING ---

EQUIPMENT Comacchio 450P

HOLE LOCATION Between Existing BH2 and BH3

HOLE SIZE 100

LOGGED BY PD

CHECKED BY HD

NOTES 27°61,104S 152°83,894E

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Rotary Air				52 54 56 58 60 62 64 66 68 70 72 74			Grey Siltstone (continued)		
				76 78 80 82 84 86 88 90 92 94 96 98 100			Borehole BH1 terminated at 74m		

BH12



Drillpower QLD
47-57 Elanora Court
Jimboomba QLD 4280
Telephone: 07 5548 6386
Fax: 07 5548 6386

BOREHOLE NUMBER BH2

PAGE 1 OF 1

CLIENT Transpacific Industries Group Pty Ltd

PROJECT NAME Drilling and Monitoring Well Installation

PROJECT NUMBER

PROJECT LOCATION 100 Chum Street

DATE STARTED 11/6/14

COMPLETED 11/6/14

R.L. SURFACE

DATUM

DRILLING CONTRACTOR Drillpower QLD

SLOPE 90°

BEARING ---

EQUIPMENT Comacchio 450P

HOLE LOCATION Between existing BH2 and BH8

HOLE SIZE 100

LOGGED BY PD

CHECKED BY HD

NOTES 27°61,497S 152°83,877E

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
Air Rotary				2			FILL Sandstone and Clay		5 inch PVC Pre collar installed - removed on completion of hole.
				4			SANDSTONE Yellow		
				6					
				8			SANDSTONE White		
				10					
				12					
				14					
				16			SANDSTONE Grey		
				18					
				20					
				22					
				24					
				26			SILTSTONE Grey		
				28					
				30			COAL bands and carbonaceous rich siltstone / Shaley coal		
				32			SILTSTONE Grey		
				34					
				36					
				38					
				40					
				42					
				44					
				46					
				48			POSSIBLE VOID/COLLAPSED WORKINGS - PARTIAL LOSS OF CIRCULATION, large pieces of coal recovered		
				50			Borehole BH2 terminated at 47.5m		

BOREHOLE / TEST PIT TRANSPACIFIC JUNE 2014.GPJ GINT STD AUSTRALIA GDT 27/6/14



BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH13

Page 1 of 6

Client Cleanaway	Drill Co. Drill Power	Easting, Northing 483894.571, 6946047.753
Project New hum Landfill	Driller P.D	Grid Ref
Project No. 4131525	Rig Type Comacchio	Elevation
Site New Chum Landfill	Drill Method PCD Rotary	Collar RL -
Location New Chum QLD 4303	Total Depth (m) 56	Logged By D.C
Drilled 29/01/2019 - 30/01/2019	Diameter (mm) 99	Checked By

B.C.L No. N/A		Casing uPVC		Screen uPVC Factory Slotted		Surface Completion		Standing monument									
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)						
0.5	PCD Rotary						FILL: SILT, low plasticity, grey/brown, with minor gravels subrounded, trace low plasticity clay.	D	L	No odour, no staining.	55						
1												FILL: SILTSTONE/CLAY, low to moderate plasticity, light brown/grey, with minor Siltstone gravels, subangular to subrounded, weathered.	D	L-MD	No odour, no staining, mine overburden.	54	
1.5																53.5	
2																53	
2.5																52.5	
3													FILL: CLAY, low to moderate plasticity, brown, with Siltstone cobbles and gravels, rounded, trace coal fragments (Overburden).	D	MD-L	No odour, no staining.	52
3.5																	51.5
4													FILL: CLAY, low to moderate plasticity, brown, silt and minor gravels, subrounded to subangular, trace coal fragments (Overburden).	D	MD-L	No odour, no staining.	51
4.5																	50.5
5																	50
5.5											49.5						
6							FILL: SILTY GRAVEL, brown, silstone gravels.	D	L	No odour, no staining.	49						
6.5											48.5						
7											48						
7.5											47.5						
8											47						
8.5											46.5						

Notes

This log is not intended for geotechnical purposes.

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

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BOREHOLE LOG

MONITORING WELL BH13

ENVIRONMENTAL-GROUNDWATER

Page 2 of 6

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
9.5							FILL: SILTSTONE, fine grained, pale brown, with fine grained silt and trace low to moderate plasticity clay, dark grey siltstone gravels at 10 mbgl, becoming pale brown at 11.7 mbgl and dark grey with depth.	D	H	No odour, no staining, driller comments - rods sliding by 300 mm. Casing installed.	46
10											45.5
10.5											45
11											44.5
11.5											44
12							FILL: SILTSTONE, grey, trace coal fragments.	D	H	No odour, no staining.	43.5
12.5											43
13							FILL: MUDSTONE/CLAYSTONE, dark brown, with siltstone fragments.	D	H	No odour, no staining.	42.5
13.5											42
14											41.5
14.5											41
15							FILL: SILTSTONE, grey, with minor sandy clay.	D	H	No odour, no staining.	40.5
15.5											40
16											39.5
16.5											39
17											38.5
17.5											38
18											37.5
18.5											37
19											36.5
19.5											36
											35.5

Notes

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

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BOREHOLE LOG

MONITORING WELL BH13

ENVIRONMENTAL-GROUNDWATER

Page 3 of 6

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
20							FILL: SILTSTONE, fine and coarse grained, grey, interbedded with weathered light grey Siltstone, trace fine grained sands, coarse grained siltstone gravels (20-30 mm) at 22 mbgl.	D	H	No odour, no staining.	35
20.5											34.5
21											34
21.5											33.5
22											33
22.5											32.5
23											32
23.5											31.5
24							FILL: SILTSTONE AND SANDSTONE, fine grained, dark grey, trace clay, with fine grained sands.	D	H	No odour, no staining, driller comments - borehole caved in when new rods were attached between 16-25 mbgl.	31
24.5											30.5
25					Grout		FILL: SAND, grey/brown, trace siltstone fragments.	D	L	No odour, no staining, drilling with injected water at 25 mbgl. installed 115 mm casing to cover up void as no drilling returns to surface.	30
25.5											29.5
26							CORE LOSS.			No odour, no returns at 26 mbgl.	29
26.5											28.5
27							FILL: SILTSTONE, dark grey, with pale grey/brown sand/sandstone, trace clay, siltstone becoming pale grey and soft, with some siltstone subrounded gravels (20 mm) at 28-29 mbgl.	D	H-S	No odour, no staining, commenced drilling with 99 mm pcd rotary. Injected water at 28-31 mbgl.	28
27.5											27.5
28											27
28.5											26.5
29											26
29.5											25.5
30											25
30.5											
Notes											
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Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
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BOREHOLE LOG

MONITORING WELL BH13

ENVIRONMENTAL-GROUNDWATER

Page 4 of 6

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
31							FILL: SILTSTONE, dark grey, with pale grey weathered siltstone of lower strength, trace coal fines.	D	S	No odour, no staining.	24.5
31.5											24
32							FILL: SILTSTONE/SANDSTONE, medium to coarse grained, dark grey/brown.	D	H	No odour, no staining.	23.5
32.5											23
33							FILL: SILTSTONE, dark grey, with bands of lower strength pale grey Siltstone, trace coal fines, very thin bands of Siltstone, dark grey with pale brown layers of Siltstone at 35-36 mbgl.	D	H-VH	No odour, no staining, driller comments - very crumbly bends, not solid rock from 25-36 mbgl. Driller comments at 36 mbgl - getting no resistance to drilling, potentially not competent rock, only competent when drilling through sandstone layers.	22.5
33.5											22
34					Grout						21.5
34.5											21
35											20.5
35.5											20
36											19.5
36.5											19
37											18.5
37.5											18
38					Bentonite		FILL: SANDSTONE/SILTSTONE, medium to coarse grained, brown/grey, slightly weathered.	D	H	No odour, no staining, installed casing to cover up crumbly rock as the borehole kept caving in.	17.5
38.5											17
39											16.5
39.5											16
40					Filter Sand		FILL: SANDSTONE/SILTSTONE, medium to coarse grained, brown/dark grey/pale grey, Sandstone layer of mixed grade, pale brown/red/grey at 41 mbgl, dark grey Siltstone becoming dominant with depth, slightly weathered, trace coal fines.	D	H	No odour, no staining, becoming competent rock, drilling with resistance at 41 mbgl. Installed 115 mm casing to 46 mbgl for drilling purposes, no resistance encountered.	15.5
40.5											15
41											14.5
											14
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations			Consistency Abbreviations		
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated			Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		
									Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard		

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BOREHOLE LOG

MONITORING WELL BH13

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
41.5											13.5
42											13
42.5											12.5
43											12
43.5											11.5
44											11
44.5											10.5
45											10
45.5											9.5
46											9
46.5											8.5
47					Filter Sand						8
47.5											7.5
48											7
48.5											6.5
49											6
49.5											5.5
50							FILL: SILTSTONE, dark grey, trace Sandstone gravels, with pale grey Siltstone.	W	H	No odour, no staining.	5
50.5											4.5
51							FILL: SILTSTONE, medium grained, grey/brown, pale grey bands.	W	H	No odour, no staining.	4
51.5											3.5
52											
Notes											
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Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
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BOREHOLE LOG

MONITORING WELL BH13

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
52.5											3
53											2.5
53.5					Filter Sand						2
54							FILL: SILTSTONE, dark grey, trace coal fines.	W	H	No odour, no staining.	1.5
54.5											1
55											0.5
55.5											0
56							Termination Depth at: 56.00 m				-0.5
56.5											-1
57											-1.5
57.5											-2
58											-2.5
58.5											-3
59											-3.5
59.5											-4
60											-4.5
60.5											-5
61											-5.5
61.5											-6
62											-6.5
62.5											-7
											-7.5
Notes											
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Drilling Abbreviations						Moisture Abbreviations			Consistency Abbreviations		
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									Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard		

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH14

Page 1 of 4

Client Cleanaway	Drill Co. Drill Power	Easting, Northing 483670.576, 6945119.831
Project New hum Landfill	Driller S.M	Grid Ref
Project No. 4131525	Rig Type Comacchio	Elevation 40.17
Site New Chum Landfill	Drill Method Air Hammer	Collar RL -
Location New Chum QLD 4303	Total Depth (m) 42	Logged By S.W
Date Drilled 29/01/2019	Diameter (mm) 125	Checked By

B.C.L No. N/A		Casing uPVC		Screen uPVC Factory Slotted		Surface Completion Standing monument					
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5	AH						FILL: CLAYEY GRAVEL, low plasticity, fine to medium grained, brown, subangular to angular. FILL: SILTY GRAVEL, low plasticity, fine to medium grained, black, angular.	D D	L L	No odour, no staining. No odour, no staining.	40
1											39.5
1.5							39				
2							38.5				
2.5							38				
3							FILL: CLAYEY SAND, low plasticity, fine to medium grained, dark brown/black, angular.	M M	L L	No odour, no staining. No odour, no staining.	37.5
3.5											37
4							FILL: CLAYEY SAND, low plasticity, fine to coarse grained, brown, with fine grained gravel.	M	L	No odour, no staining.	36.5
4.5							FILL: SANDY CLAY, low plasticity, fine to medium grained, brown, with medium grained gravel, round to angular, tree roots and organic matter present.	M M	S S	No odour, no staining. No odour, no staining.	35.5
5											35
5.5							FILL: CLAY, low plasticity, medium grained, dark brown, trace subrounded sand and gravels.	M	S	No odour, no staining.	34.5
6							FILL: SANDY CLAY, low plasticity, fine grained, dark brown/black.	M	S	No odour, no staining.	34
6.5											33.5
7											33
7.5											32.5
8											32
8.5											31.5
9											31
9.5											30.5

Notes

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

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH14

Page 2 of 4

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
10.5											30
11											29.5
11.5											29
12											28.5
12.5							FILL: SILTY SAND, low plasticity, fine to coarse grained, brown, with gravel, fine grained, angular.	W	S	No odour, no staining, wet from injected water to clear borehole.	28
13											27.5
13.5											27
14							FILL: CLAY, low plasticity, orange/brown, with weathered sandstone fragments (Overburden).	W	L	No odour, no staining.	26.5
14.5											26
15											25.5
15.5											25
16											24.5
16.5							SANDSTONE, grey, with sands, weathered.	W	S	No odour, no staining.	24
17											23.5
17.5							SANDY CLAY, low plasticity, fine grained, grey.	W	F	No odour, no staining.	23
18											22.5
18.5							CLAY, low plasticity, grey/brown, with fine grained sands.	W	VST	No odour, no staining.	22
19											21.5
19.5							CLAY, low plasticity, pink.	W	VST	No odour, no staining.	21
20											20.5
20.5							CLAY, low plasticity, grey.	W	VST	No odour, no staining.	20
21											19.5
21.5							CLAY, moderate plasticity, dark grey.	W	ST	No odour, no staining.	19
											18.5
Notes											
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Drilling Abbreviations						Moisture Abbreviations			Consistency Abbreviations		
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									Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard		

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH14

Page 3 of 4

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
22											18
22.5											17.5
23							CLAY, low plasticity, pale grey.	W	ST	No odour, no staining.	17
23.5											16.5
24							CLAY, moderate plasticity, grey, with sand.	W	ST	No odour, no staining.	16
24.5											15.5
25							CLAY, moderate plasticity, grey, trace orange sandstone fragments, becoming abundant with depth.	W	ST	No odour, no staining.	15
25.5											14.5
26											14
26.5											13.5
27					Grout						13
27.5											12.5
28											12
28.5											11.5
29											11
29.5											10.5
30											10
30.5											9.5
31											9
31.5											8.5
32											8
32.5					Bentonite						7.5
33							GRAVELLY CLAY, moderate plasticity, black, siltstone gravels.	W	ST	No odour, no staining.	7
33.5					Filter Sand						6.5
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH14

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
34											6
34.5											5.5
35											5
35.5											4.5
36											4
36.5											3.5
37							GRAVEL, siltstone gravels.	W	ST	No odour, no staining.	3
37.5											2.5
38					Filter Sand						2
38.5											1.5
39							CLAYEY GRAVEL, fine to medium grained, grey, siltstone and sandstone.	W	ST	No odour, no staining.	1
39.5											0.5
40							GRAVEL, orange, siltstone, quartz and weathered sandstone.	W	ST	No odour, no staining.	0
40.5											-0.5
41											-1
41.5											-1.5
42							Termination Depth at: 42.00 m				-2
42.5											-2.5
43											-3
43.5											-3.5
44											-4
44.5											-4.5
45											-5
45.5											-5.5
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH15

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Client Cleanaway	Drill Co. Drill Power	Easting, Northing 483670.162, 6945116.645
Project New hum Landfill	Driller P.D	Grid Ref
Project No. 4131525	Rig Type Comacchio	Elevation 40.24
Site New Chum Landfill	Drill Method PCD Rotary	Collar RL -
Location New Chum QLD 4303	Total Depth (m) 20	Logged By D.C
Date Drilled 01/02/2019	Diameter (mm) 160	Checked By

B.C.L No. N/A Casing uPVC Screen uPVC Factory Slotted Surface Completion Standing monument

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5	PCD Rotary						FILL: CLAYEY GRAVEL, low to moderate plasticity, brown, subangular-angular, mix gravels.		L	No odour, no staining.	40
1							FILL: FRACTURED SILTSTONE/GRAVEL, black, trace coal, angular/ broken rock.	D	L	No odour, no staining, installed casing as no air returned during drilling.	39.5
1.5											39
2											38.5
2.5							FILL: CLAYEY SAND, low plasticity, fine to medium grained, brown, with minor gravels.	M	L	No odour, no staining.	38
3											37.5
3.5											37
4							FILL: GRAVELLY CLAY, moderate plasticity, trace siltstone fragments, angular chips.	M	L	No odour, no staining.	36.5
4.5					Grout						36
5							FILL: SANDY GRAVELLY CLAY, low plasticity, fine to coarse grained, dark brown, broken subrounded-angular gravels (10 mm).	M	L-MD	No odour, no staining, drilling with injected water due to 'sticky' clay.	35.5
5.5											35
6											34.5
6.5											34
7											33.5
7.5											33
8							CLAY, moderate plasticity, mottle brown/orange/grey, trace broken gravels (10 mm), trace fine to medium grained sands, becoming grey/brown mottled pink.	M	MD	No odour, no staining.	32.5
8.5											32
9											31.5
9.5					Bentonite						31
10											30.5

Notes

This log is not intended for geotechnical purposes.

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

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BOREHOLE LOG

MONITORING WELL BH15

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
10.5					Bentonite						30
11							SANDY CLAY, low plasticity, fine to medium grained, mottle yellow/brown, trace subangular gravels.	M	MD	No odour, no staining.	29.5
11.5											29
12							SAND, low plasticity, fine to medium grained, yellow/brown, trace clay, minor gravel/cobble (30 mm).	W	L	No odour, no staining.	28.5
12.5											28
13											27.5
13.5											27
14											26.5
14.5							SANDSTONE, fine to medium grained, pale grey, fragmented, with yellow/brown soft sand, weathered, weathered.	W	L-MD	No odour, no staining.	26
15											25.5
15.5					Filter Sand						25
16											24.5
16.5							SANDSTONE, fine grained, pale grey, with low plasticity silt and clay.	W	L-MD	No odour, no staining.	24
17											23.5
17.5											23
18							SANDSTONE, fine to medium grained, pale grey/yellow/brown banded.	W	L-MD	No odour, no staining.	22.5
18.5											22
19							SILTY SANDY CLAY, low to moderate plasticity, fine grained, grey.	W	MD	No odour, no staining.	21.5
19.5											21
20							Termination Depth at: 20.00 m				20.5
20.5											20
21											19.5
21.5											19
											18.5
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH16

Page 1 of 4

Client Cleanaway	Drill Co. Drill Power	Easting, Northing 484072.872, 6945028.143
Project New hum Landfill Project	Driller P.D	Grid Ref
No. 4131525	Rig Type Comacchio	Elevation 38.12
Site New Chum Landfill	Drill Method PCD Rotary	Collar RL -
Location New Chum QLD 4303	Total Depth (m) 45.1	Logged By D.C
Drilled 04/02/2019 - 05/02/2019	Diameter (mm) 160	Checked By

B.C.L No. N/A Casing uPVC Screen uPVC Factory Slotted Surface Completion Standing monument

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5	PCD Rotary						ROAD BASE.	D	H	No odour, no staining.	38
1							FILL: SANDY GRAVEL, medium to coarse grained, grey/pale grey, sub-angular (broken).	D	L	No odour, no staining.	37.5
1.5											37
2							MUDSTONE, coarse grained, red/brown, with low to moderate plasticity clay, trace coarse grained sand.	D	S-F	No odour, no staining.	36.5
2.5											36
3											35.5
3.5											35
4							CLAYSTONE, medium to coarse grained, pale grey/brown, with gravels, subrounded-subangular and sands.	D	S-F	No odour, no staining.	34.5
4.5											34
5							CLAY, moderate plasticity, brown/grey.	D	S	No odour, no staining.	33.5
5.5											33
6							SANDY SILTSTONE, pale brown/grey.	D	H	No odour, no staining, driller comments - competent rock.	32.5
6.5											32
7							SILTSTONE, fine grained, pale brown/yellow, trace low plasticity clay.	D	MD	No odour, no staining.	31.5
7.5											31
8							SILTSTONE, low to moderate plasticity, pale brown, trace low to moderate plasticity clay.	D	L-MD	No odour, no staining.	30.5
8.5											30
9							SILTSTONE, low to moderate plasticity, grey, trace low to moderate plasticity clay, very fine powdered returns from 10 mbgl.	D	MD	No odour, no staining.	29.5
9.5											29
10											28.5

Notes

This log is not intended for geotechnical purposes.

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

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH16

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
10.5											28
11							SILTSTONE, pale grey, increasing low to moderate plasticity clay content.	D	MD	No odour, no staining.	27.5
11.5											27
12							SILTSTONE, dark grey, decreasing low to moderate plasticity clay content.	D	MD	No odour, no staining.	26.5
12.5											26
13											25.5
13.5					Grout		SANDSTONE/SILTSTONE, fine grained, grey/pale grey, very fine powdered returns from 13 mbgl, becoming Sandstone at 14.5-15 mbgl.	D	MD	No odour, no staining.	25
14											24.5
14.5											24
15											23.5
15.5											23
16							SANDSTONE/SILTSTONE, fine to medium grained, pale grey.	D	MD	No odour, no staining.	22.5
16.5											22
17											21.5
17.5											21
18					Bentonite		SILTSTONE/CLAYSTONE, grey, increasing moderate to high plasticity clay content at 19-20 mbgl, trace fine grained sand at 20-21 mbgl.	D	MD	No odour, no staining.	20.5
18.5											20
19											19.5
19.5											19
20											18.5
20.5					Filter Sand						18
21							SILTSTONE/SANDSTONE, fine to medium grained, grey.	D	MD	No odour, no staining.	17.5
21.5											17
											16.5
Notes											
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Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH16

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
22											16
22.5							SILTSTONE/CLAYSTONE, fine grained, dark grey, Trace fine to medium grained sand at 25-27 mbgl.	D	MD	No odour, no staining.	15.5
23											15
23.5											14.5
24											14
24.5											13.5
25											13
25.5											12.5
26											12
26.5											11.5
27							SANDSTONE, fine to medium grained, grey.	D	MD	No odour, no staining.	11
27.5											10.5
28					Filter Sand		SANDSTONE, fine to medium grained, grey, very slight moisture at 28 mbgl, trace coal fines at 29 mbgl.	M	MD	No odour, no staining.	10
28.5											9.5
29											9
29.5											8.5
30							SANDSTONE, fine to medium grained, grey, trace clay at 30-31 mbgl.	D	MD-D	No odour, no staining.	8
30.5											7.5
31											7
31.5											6.5
32							SANDSTONE, fine to medium grained, pale grey.	D	MD-D	No odour, no staining.	6
32.5											5.5
33											5
33.5											4.5
Notes											
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Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

MONITORING WELL BH16

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
34											4
34.5											3.5
35											3
35.5											2.5
36											2
36.5							SILTSTONE, fine grained, grey/dark grey.	D	MD-D	No odour, no staining.	1.5
37											1
37.5											0.5
38							SILTSTONE, fine to medium grained, Trace sand and coal fines.	M	MD-D	No odour, no staining.	0
38.5											-0.5
39											-1
39.5					Filter Sand						-1.5
40							SANDSTONE, fine to medium grained, grey/pale grey.	D	MD-D	No odour, no staining.	-2
40.5											-2.5
41											-3
41.5											-3.5
42							SILTSTONE, dark grey, trace low plasticity clay/claystone.	D	MD-D	No odour, no staining, borehole left open for 45 minutes to see if groundwater was produced. Borehole was cleared with air and water returned to surface.	-4
42.5											-4.5
43											-5
43.5											-5.5
44							SILTSTONE, fine to medium grained, pale grey banded, trace sand.	D	MD-D	No odour, no staining.	-6
44.5											-6.5
45							Termination Depth at: 45.10 m				-7
45.5											-7.5
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH17

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Client Cleanaway Project New hum Landfill Project No. 4131525 Site New Chum Landfill Location New Chum QLD 4303 Date Drilled 04/02/2019 - 05/02/2019						Drill Co. Drill Power Driller R.D Rig Type Comacchio Drill Method PCD Rotary Total Depth (m) 18 Diameter (mm) 160						Easting, Northing 484280.062, 6945655.534 Grid Ref Elevation 47.41 Collar RL - Logged By D.R Checked By											
B.C.L No. N/A						Casing uPVC						Screen uPVC Factory Slotted						Surface Completion Standing monument					
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.						Elevation (m)							
0.5	PCD Rotary						FILL: Silty SAND, low plasticity, fine grained, dark grey/grey, sub-angular, poorly graded, trace clay.	D	VL	No odour, no staining.						47							
1							FILL: Silty SAND, low plasticity, fine grained, pale grey/grey, subangular, poorly graded.	D	VL	No odour, no staining.						46.5							
1.5																46							
2							FILL: Gravelly Silty SAND, fine to coarse grained, grey, subangular, well graded, fine grained (up to 15 mm), grey/dark grey, siltstone gravel, angular-subangular.	D	VL	No odour, no staining.						45.5							
2.5					Grout											45							
3																44.5							
3.5																44							
4							FILL: Gravelly Silty SAND, fine to coarse grained, grey, subangular, well graded, fine to coarse grained (15-25 mm), grey/dark grey, siltstone gravel, angular-subangular.	D	VL	No odour, no staining.						43.5							
4.5																43							
5							FILL: GRAVEL, fine to coarse grained, black/grey, subrounded-subangular, coal and siltstone (Overburden).	W	VL	No odour, no staining.						42.5							
5.5					Bentonite											42							
6																41.5							
6.5																41							
7							FILL: Sandy Clayey GRAVEL, medium plasticity, fine to coarse grained, black/grey, subangular, well graded, siltstone and coal.	W	L-S	No odour, no staining.						40.5							
7.5																40							
8					Filter Sand											39.5							
8.5																39							
9							FILL: Sandy CLAY, high plasticity, coarse grained, grey, coal and siltstone.	W	S	No odour, no staining.						38.5							
9.5																38							
10																37.5							
Notes This log is not intended for geotechnical purposes.																							
Drilling Abbreviations AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler							Moisture Abbreviations D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated					Consistency Abbreviations Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard											

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BOREHOLE LOG

MONITORING WELL BH17

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
10.5											37
11							FILL: Clayey GRAVEL, medium plasticity, fine to coarse grained, grey/pale grey, well graded, Siltstone and Claystone, trace coal (Overburden).	W	S-L	No odour, no staining.	36.5
11.5											36
12							FILL: SANDSTONE/SILTSTONE, grey/dark grey, lithic, well sorted, medium strength, subangular (up to 40 mm), trace clay, becomes coarse grained Gravel at 14-15 mbgl.	W	L	No odour, no staining.	35.5
12.5					Filter Sand						35
13											34.5
13.5											34
14											33.5
14.5											33
15											32.5
15.5											32
16					Gravel Backfill						31.5
16.5											31
17							FILL: GRAVEL, fine to coarse grained, grey/dark grey/orange, with grey Siltstone and Claystone, and fine Sandstone fragments.	W	L	No odour, no staining.	30.5
17.5											30
18							Termination Depth at: 18.00 m				29.5
18.5											29
19											28.5
19.5											28
20											27.5
20.5											27
21											26.5
21.5											26
											25.5
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations		Consistency Abbreviations			
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated		Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense		Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard	

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BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL BH18

Page 1 of 5

Client Cleanaway Project New hum Landfill Project No. 4131525 Site New Chum Landfill Location New Chum QLD 4303 Date Drilled 06/02/2019 - 07/02/2019	Drill Co. Drill Power Driller S.M/R.D Rig Type Comacchio Drill Method PCD Rotary Total Depth (m) 54 Diameter (mm) 172	Easting, Northing 484292.117, 6945645.918 Grid Ref Elevation 46.78 Collar RL - Logged By D.C Checked By
--	--	--

B.C.L No. N/A		Casing uPVC		Screen uPVC Factory Slotted		Surface Completion Standing monument					
Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
0.5	PCD Rotary						FILL: Sandy SILTSTONE, medium to coarse grained, dark grey/grey, subangular to angular.	D	L	No odour, no staining.	46.5
1							FILL: Sandy GRAVEL, medium to coarse grained, grey/light grey, with sandstone gravels.	D	L	No odour, no staining.	46
1.5										45.5	
2										45	
2.5										44.5	
3										44	
3.5							FILL: Gravelly CLAY, moderate to high plasticity, black/brown, subrounded to subangular gravels, trace cobbles (40-70 mm).	M	S	No odour, no staining.	43.5
4										43	
4.5										42.5	
5										42	
5.5							FILL: Sandy Gravelly CLAY, low to moderate plasticity, fine to medium grained, dark brown, subrounded to subangular (10-20 mm) sands.	D	L-MD	No odour, no staining, installed 125 mm surface casing to 6.5 mbgl.	41.5
6							FILL: Gravelly CLAY, moderate to high plasticity, black/brown, subrounded gravels.	W	D	No odour, no staining, water seepage into the borehole was observed after the casing was installed.	41
6.5				40.5							
7	FILL: Silty Sandy CLAY, moderate plasticity, fine to medium grained, brown, fine silt, trace subrounded gravels at 8-9 mbgl.	D	L-MD	No odour, no staining, drilling method changed to rotary drilling.	40						
7.5				39.5							
8				39							
8.5				38.5							
9				38							
9.5				37.5							
10				37							

Notes

This log is not intended for geotechnical purposes.

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

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BOREHOLE LOG

MONITORING WELL BH18

ENVIRONMENTAL-GROUNDWATER

Page 2 of 5

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
10.5							FILL: GRAVEL, grey/brown, subrounded to subangular gravels (10-30 mm).	D	L-MD	No odour, no staining.	36.5
11											36
11.5											35.5
12											35
12.5							FILL: Sandy GRAVEL, fine to medium grained, grey, with low plasticity clay, subrounded to subangular sand, subrounded gravels.	D	MD	No odour, no staining.	34.5
13											34
13.5							FILL: Clayey SANDSTONE, low plasticity, fine to medium grained, grey, with subrounded gravels.	D	MD	No odour, no staining, installed casing to 15 mbgl.	33.5
14											33
14.5											32.5
15											32
15.5							FILL: SANDSTONE, fine to coarse grained, pale brown/brown, subrounded to subangular gravels, trace clay/claystone.	D	L-MD	No odour, no staining.	31.5
16					Grout						31
16.5											30.5
17											30
17.5											29.5
18											29
18.5											28.5
19											28
19.5											27.5
20											27
20.5											26.5
21											26
21.5							FILL: CLAYSTONE, fine to medium grained, grey, with soft to firm SILSTONE GRAVEL, subangular to subrounded, trace sand.	D	L-MD	No odour, no staining.	25.5
											25
Notes											
This log is not intended for geotechnical purposes.											
Drilling Abbreviations						Moisture Abbreviations			Consistency Abbreviations		
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Push tube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler						D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated			Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard		

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BOREHOLE LOG

MONITORING WELL BH18

ENVIRONMENTAL-GROUNDWATER

Page 3 of 5

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
22											24.5
22.5											24
23											23.5
23.5							FILL: Sandy Siltstone GRAVEL, fine to medium grained, grey, subangular to subrounded sands, well graded, returns broken (10-30 mm), becomes SILTSTONE, less gravels at 26mbgl.	D	MD-D	No odour, no staining.	23
24											22.5
24.5											22
25											21.5
25.5											21
26											20.5
26.5											20
27					Grout						19.5
27.5							FILL: SILTSTONE, grey/dark grey, broken fines, poorly graded, becoming dark grey/black at 29-30 mbgl.	D	L-MD	No odour, no staining.	19
28											18.5
28.5											18
29											17.5
29.5											17
30							SILTSTONE, dark grey, slightly weathered.	D	L-MD	No odour, no staining, installed casing to 30 mbgl. Drilling method changed to 99 mm PCD rotary.	16.5
30.5											16
31											15.5
31.5											15
32											14.5
32.5					Bentonite						14
33							SANDSTONE, fine to medium grained, pale grey, minor siltstone interbedded, becoming powdered at 35-36 mbgl, slightly weathered.	D	L-MD	No odour, no staining.	13.5
33.5											13

Notes

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

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BOREHOLE LOG

MONITORING WELL BH18

ENVIRONMENTAL-GROUNDWATER

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Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
34											12.5
34.5											12
35											11.5
35.5											11
36											10.5
36.5							SHALE, grey/brown, minor Siltstone, trace sand.	D	L-MD	No odour, no staining.	10
37											9.5
37.5											9
38											8.5
38.5											8
39											7.5
39.5											7
40											6.5
40.5											6
41											5.5
41.5											5
42											4.5
42.5							CLAY, medium plasticity, 50% clay content from 5-10% previous.	D	L-MD	No odour, no staining.	4
43											3.5
43.5							SHALE, grey, 10-15% clay, trace coal fines at 45 mbgl.	D	L-MD	No odour, no staining.	3
44											2.5
44.5											2
45											1.5
45.5							SHALE, grey/pale grey, Increasing clay content up to 40-50%.	M	L-MD	No odour, no staining, driller comments - very hard drilling.	1

Notes

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

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BOREHOLE LOG

MONITORING WELL BH18

ENVIRONMENTAL-GROUNDWATER

Page 5 of 5

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials, separate phase liquids, imported fill, ash.	Elevation (m)
46							SHALE/SILTSTONE, grey, 75:25 Shale:Siltstone, trace coal fines, 15-20% clay content.	D	L-MD	No odour, no staining, moisture observed at 48-49 mbgl during drilling rod change.	0.5
46.5					Filter Sand						0
47											-0.5
47.5											-1
48											-1.5
48.5											-2
49											-2.5
49.5					Bentonite						-3
50							SHALE, grey.	D-M	L-MD	No odour, no staining, drilling rods dropped sharply at 53.5 mbgl. driller comments - heavily fractured rock, could be old workings. drill returns were lost.	-3.5
50.5											-4
51											-4.5
51.5											-5
52											-5.5
52.5											-6
53					Shale Backfill						-6.5
53.5											-7
54							Termination Depth at: 54.00 m				-7.5
54.5											-8
55											-8.5
55.5											-9
56											-9.5
56.5											-10
57											-10.5
57.5											-11

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations

AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler

Moisture Abbreviations

D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated

Consistency Abbreviations

Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense, VD - Very Dense

Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

Appendix B – Groundwater Monitoring Field Sheets

Published on DES Disclosure Log
RTI Act 2009



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New chem firm marking</u>		Well No: <u>BH02</u>								
Job No: <u>BCL0012-01</u>		Well Type: ☒ Monitor ☐ Extraction ☐ Other								
Recorded By: <u>KW</u>		Well Material: ☒ PVC ☐ SS ☐ Other								
Date: <u>6/6/19</u>	Time: <u>0905</u>	Well Head Condition: <u>Boor</u>								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC): <u>—</u> <u>Well</u>		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC): <u>—</u>		☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <u>39.128</u>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC) <u>—</u>		Depth (m BTOC): <u>PS 40</u>								
Height of Standing Water Column (TD-EL, in m): <u>—</u>		Screen Interval (m BTOC) – Top: <u>40</u> Bottom: <u>DS 20</u>								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
0917	0	2.2	24.13	3063.2	5.62	-27.0	19.3	1.82	2.22	
0920	0.25	0.24	3.1	3337.6	6.03	-46.8	24.5	1.78	2.18	
0922	0.5	0.24	2.91	3364.6	6.08	-99.8	25.19	1.78	2.18	
0924	0.75	0.16	1.96	3380.9	6.14	-97.7	25.72	1.77	2.16	
0926	1.0	0.25	3.0	3253.2	6.08	-86.6	24.53	1.74	2.14	
	1.25	0.20	2.45	3334.4	6.07	-88.8	25.21	1.76	2.16	
0931	1.5	0.17	2.07	3343.9	6.15	-95.0	25.54	1.76	2.15	
	1.75	0.13	1.61	3361.7	6.16	-98.6	25.74	1.76	2.15	
	2.0	0.14	1.63	3355.1	6.19	-99.9	25.76	1.75	2.15	
Observations during purging (well condition, turbidity, colour, odour): <u>Sample here.</u>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method										
☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate		Comments				
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Chan</u>				Well No: <u>BH03</u>						
Job No: <u>BC180012.01</u>				Well Type: ☐ Monitor ☐ Extraction ☐ Other						
Recorded By: <u>MW</u>				Well Material: ☒ PVC ☐ SS ☐ Other						
Date: <u>6/6/19</u>		Time: <u>11:39</u>		Well Head Condition: <u>Good</u>						
WELL PURGING										
PURGE VOLUME				PURGE METHOD						
Total Depth of Well (TD in m BTOC):				☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other						
DNAPL Level Depth (DL in m BTOC):				☒ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
Water Level Depth (WL in m BTOC) <u>34.281</u>				PUMP INTAKE SETTING						
LNAPL Level Depth (LL in m BTOC):				Depth (m BTOC): <u>151.80</u> <u>12.25</u> <u>D: 5</u>						
Height of Standing Water Column (TD-EL, in m):				Screen Interval (m BTOC) – Top: Bottom:						
Minimum Purge Volume Required	Well Diameter (D in mm)		Height Water Column (m)		Multiply by (L/m)		=	Multiply by 3		
	50				4					
	100				12					
	Other				$D^2(0.785)=$					
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
<u>11:42</u>	<u>0.25</u>	<u>0.18</u>	<u>2.18</u>	<u>7,958.6</u>	<u>6.95</u>	<u>19.1</u>	<u>23.35</u>	<u>4.62</u>	<u>5.33</u>	
<u>11:44</u>	<u>0.5</u>	<u>0.13</u>	<u>1.60</u>	<u>7,929.5</u>	<u>5.03</u>	<u>-1.2</u>	<u>23.22</u>	<u>4.62</u>	<u>5.34</u>	
<u>11:47</u>	<u>0.75</u>	<u>0.19</u>	<u>2.26</u>	<u>7,855.2</u>	<u>5.24</u>	<u>-21.6</u>	<u>22.82</u>	<u>4.61</u>	<u>5.33</u>	
<u>11:50</u>	<u>1.0</u>	<u>0.20</u>	<u>2.36</u>	<u>7,837.5</u>	<u>5.17</u>	<u>-6.5</u>	<u>22.7</u>	<u>4.61</u>	<u>5.33</u>	
<u>11:56</u>	<u>1.25</u>	<u>0.16</u>	<u>1.91</u>	<u>7,831.5</u>	<u>5.03</u>	<u>12.5</u>	<u>22.67</u>	<u>4.61</u>	<u>5.33</u>	
	<u>1.50</u>	<u>0.14</u>	<u>1.72</u>	<u>7,941.4</u>	<u>5.09</u>	<u>2.5</u>	<u>22.67</u>	<u>4.68</u>	<u>5.40</u>	<u>34.82</u>
	<u>1.75</u>	<u>0.14</u>	<u>1.61</u>	<u>7,992.4</u>	<u>5.13</u>	<u>-3.6</u>	<u>22.7</u>	<u>6.71</u>	<u>5.43</u>	
<u>- 2 up to here -</u>										
Observations during purging (well condition, turbidity, colour, odour):										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other				☐ Same as purge method						
				☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate	Comments					
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Comm enviro.</u>				Well No: <u>BHSA/13</u>						
Job No:				Well Type: ☐ Monitor ☐ Extraction ☐ Other						
Recorded By: <u>AL</u>				Well Material: ☐ PVC ☐ SS ☐ Other						
Date: <u>6/6/19</u>		Time:		Well Head Condition: <u>Good</u>						
WELL PURGING										
PURGE VOLUME				PURGE METHOD						
Total Depth of Well (TD in m BTOC):				☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other						
DNAPL Level Depth (DL in m BTOC):				☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
Water Level Depth (WL in m BTOC) <u>41.091</u>				PUMP INTAKE SETTING						
LNAPL Level Depth (LL in m BTOC)				Depth (m BTOC):						
Height of Standing Water Column (TD-EL, in m):				Screen Interval (m BTOC) – Top:		Bottom:				
Minimum Purge Volume Required	Well Diameter (D in mm)		Height Water Column (m)		Multiply by (L/m)		=	Multiply by 3		
	50				4					
	100				12					
	Other				$D^2(0.785)=$					
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
	0	9.1	88.88	2957.2	6.83	21.1	14.65	1.99	2.41	
	250mL	3.98	42.01	3177.4	5.62	106.9	19.88	1.88	2.29	
	500mL	1.70	15.43	3256.7	5.61	77.2	21.64	1.86	2.28	
	750mL	0.47	5.36	3225.7	6.01	15.0	22.27	1.81	2.21	
	1L	0.40	4.50	3205.1	5.91	3.3	21.43	1.83	2.25	
	1.25L	0.24	2.87	3400.1	5.6	8.2	23.78	1.85	2.26	
	1.5	0.15	1.81	3462.0	5.56	6.2	24.59	1.86	2.27	
	1.75	0.11	1.4	3507.7	5.52	4.3	25.17	1.86	2.27	
Observations during purging (well condition, turbidity, colour, odour): <hr/> <hr/>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD ☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method ☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary		Dupli cate	Triplicate		Comments			
		<u>BHSA - x 4.</u>								
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Chun</u>				Well No: <u>BH 7A</u>						
Job No: <u>Bc190012.01</u>				Well Type: ☐ Monitor ☐ Extraction ☐ Other						
Recorded By: <u>MW</u>				Well Material: ☒ PVC ☐ SS ☐ Other						
Date: <u>01/6/19</u>		Time: <u>1326</u>		Well Head Condition: <u>Per</u>						
WELL PURGING										
PURGE VOLUME				PURGE METHOD						
Total Depth of Well (TD in m BTOC):				☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other						
DNAPL Level Depth (DL in m BTOC):				☐ Pump – Type: ☐ Submersible ☒ Bladder ☐ Other						
Water Level Depth (WL in m BTOC) <u>58.649</u>				PUMP INTAKE SETTING						
LNAPL Level Depth (LL in m BTOC)				Depth (m BTOC): <u>PS: 90 R: 20 D: 10</u>						
Height of Standing Water Column (TD-EL, in m):				Screen Interval (m BTOC) – Top: Bottom:						
Minimum Purge Volume Required	Well Diameter (D in mm)		Height Water Column (m)		Multiply by (L/m)		=	Multiply by 3		
	50				4					
	100				12					
	Other				$D^2(0.785)=$					
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
1338	0	1.22	13.88	5,757.5	5.79	+43.1	23.95	3.31	3.88	
1343	0.25	0.49	6.85	6,611.7	6.46	-219.6	32.51	3.17	3.76	
1347	0.5	0.47	6.42	6,702.6	6.39	-172.1	34.4	3.12	3.70	
1350	0.75	0.44	6.28	6,724.1	6.34	-154.2	34.76	3.11	3.63	
1354	1.0	0.43	6.29	6,675.5	6.34	-134.3	34.74	3.02	3.66	
— Sample here —										
Observations during purging (well condition, turbidity, colour, odour):										
<u>Dark Colour to water, strong Sulphur odor water very warm.</u>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other				☐ Same as purge method						
				☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate	Comments					
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <i>New chm</i>		Well No: <i>3111</i>								
Job No: <i>B180012.01</i>		Well Type: ☒ Monitor ☐ Extraction ☐ Other								
Recorded By: <i>mu</i>		Well Material: ☒ PVC ☐ SS ☐ Other								
Date: <i>6/6/19</i>	Time: <i>1007</i>	Well Head Condition: <i>Poor</i>								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC): <i>—</i>		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC): <i>—</i>		☒ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <i>86.586</i>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC) <i>—</i>		Depth (m BTOC): <i>P51</i> R: <i>D</i>								
Height of Standing Water Column (TD-EL, in m): <i>—</i>		Screen Interval (m BTOC) – Top: <i>—</i> Bottom: <i>—</i>								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)							
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
=										
Multiply by 3										
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
1025	0	8.58	96.41	4,780.9	6.39	25.46	20.93	2.82	3.37	
1031	0.25	2.87	31.03	5,182.6	5.74	48.3	22.35	2.98	3.54	
1035	0.5	1.15	13.64	5,239.1	5.78	56.3	23.38	2.46	3.52	
1038	0.75	0.66	7.90	5,264.6	5.68	47.6	23.71	2.46	3.51	
1041	1.0	0.47	5.74	5,297.6	5.73	18.6	23.69	2.97	3.54	
1045	1.25	0.24	2.88	5,399	5.82	-13.8	23.78	2.99	3.55	
1048	1.5	0.16	1.89	5,131.7	5.79	-12.9	23.9	2.97	3.31	
1052	1.75	0.13	1.59	5,174.6	5.67	4.5	23.7	2.87	3.43	
1055	2.0	0.12	1.49	5,056.3	5.60	11.3	24.04	2.81	3.35	
Observations during purging (well condition, turbidity, colour, odour): <i>Sample here</i>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD ☐ Same as purge method										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate	Comments					
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Chun</u>		Well No: <u>BH14</u>								
Job No: <u>BEL90012-01</u>		Well Type: ☐ Monitor ☐ Extraction ☐ Other								
Recorded By: <u>WW</u>		Well Material: ☒ PVC ☐ SS ☐ Other								
Date: <u>6/6/19</u>	Time: <u>1458</u>	Well Head Condition: <u>Good</u>								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC):		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC):		☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <u>6.352</u>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC)		Depth (m BTOC): <u>PSI: 50 R: 10.60 1.4</u>								
Height of Standing Water Column (TD-EL, in m):		Screen Interval (m BTOC) – Top: Bottom:								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
1502	0.25	1.47	17.51	2086.4	6.66	-21.3	22.49	4.75	5.48	
1504	0.5	1.1	13.1	8,547.3	6.32	3.4	22.65	5.65	7.00	
1506	0.75	0.16	1.97	16,992	6.42	-26.0	22.57	6.64	7.46	
1508	1.0	0.14	1.67	10,601	6.45	-33.7	22.33	6.42	7.24	
1515	1.25	0.09	1.10	9,685.0	6.41	-38.3	22.07	5.87	6.67	
	1.5	0.13	1.55	9,588.9	6.42	-36.6	21.63	5.86	6.67	
Observations during purging (well condition, turbidity, colour, odour):										
<div style="border: 1px solid black; height: 20px; width: 100%;"></div> <div style="border: 1px solid black; height: 20px; width: 100%;"></div>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method										
☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary <u>BH14</u>	Duplicate <u>GQA</u>	Triplicate <u>GQAIA</u>	Comments					
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>Newsum Gnd.</u>		Well No: <u>BH15</u>								
Job No:		Well Type: ☐ Monitor ☐ Extraction ☐ Other								
Recorded By: <u>AL</u>		Well Material: ☐ PVC ☐ SS ☐ Other								
Date: <u>6/06/19</u>	Time: <u>9:57 am</u>	Well Head Condition: <u>Good.</u>								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC):		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC):		☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <u>6.529</u>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC):		Depth (m BTOC):								
Height of Standing Water Column (TD-EL, in m):		Screen Interval (m BTOC) – Top: Bottom:								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
	0	7.49	86.16	9771.1	5.56	-17.5	22.48	5.9	6.7	
	280mL	0.78	8.14	10,024	6.3	-58.5	22.24	6.07	6.88	
	500mL	0.14	1.68	9,576.2	6.61	-63.2	22.3	5.77	6.56	
	750mL	0.11	1.34	9688.0	6.72	-66.9	22.12	5.87	6.67	
	1L	0.09	1.04	10,107.0	6.83	-61.4	22.07	6.15	6.97	
	1.25L	0.08	0.99	10,512	6.96	-59.1	22.25	6.39	7.22	
	1.5L	0.07	0.88	10,530	7.07	-59.1	22.18	6.41	7.24	
	1.75L	0.08	0.93	10,531	7.14	-58.5	22.37	6.37	7.2	
Observations during purging (well condition, turbidity, colour, odour): <u>Slightly murky.</u>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD ☐ Same as purge method										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate	Comments					
		BH15 x 2								
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Ann Gwara</u>		Well No: <u>BH16</u>								
Job No:		Well Type: ☐ Monitor ☐ Extraction ☐ Other								
Recorded By: <u>AZ</u>		Well Material: ☐ PVC ☐ SS ☐ Other								
Date: <u>6/6/19</u>	Time: <u>11:40 am</u>	Well Head Condition:								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC):		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC):		☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <u>21.966</u>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC):		Depth (m BTOC):								
Height of Standing Water Column (TD-EL, in m):		Screen Interval (m BTOC) – Top: Bottom:								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
	0	4.4	51.8	5914.0	7.9	-12.2	23.97	3.4	4.0	
	250mL	0.81	9.4	5937.7	7.66	12.8	23.00	3.4	4.01	
	500mL	0.35	4.05	5732.7	7.25	-33.6	21.99	3.35	3.96	
	750mL	0.4	4.84	5815.9	6.99	-17.6	21.99	3.4	4.02	
	1L	0.36	4.18	5880.8	6.74	-17.9	22.45	3.42	4.02	
	1.25L	0.14	1.65	5891.0	6.79	-33.3	22.65	3.4	4.0	
	1.50L	0.12	1.41	5882.3	7.00	-39.1	22.66	3.39	4.0	
Observations during purging (well condition, turbidity, colour, odour): <u>Slightly brown (light)</u>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method										
☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate		Comments				
Analysis	Bottle	BH16 x2								



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Chun</u>		Well No: <u>BH 17</u>								
Job No:		Well Type: ☐ Monitor ☐ Extraction ☐ Other								
Recorded By:		Well Material: ☒ PVC ☐ SS ☐ Other								
Date:	Time:	Well Head Condition: <u>good</u>								
WELL PURGING										
PURGE VOLUME		PURGE METHOD								
Total Depth of Well (TD in m BTOC):		☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								
DNAPL Level Depth (DL in m BTOC):		☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other								
Water Level Depth (WL in m BTOC) <u>15.496</u>		PUMP INTAKE SETTING								
LNAPL Level Depth (LL in m BTOC)		Depth (m BTOC): <u>Base of well - 30cm.</u>								
Height of Standing Water Column (TD-EL, in m):		Screen Interval (m BTOC) – Top: Bottom:								
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity ($\mu S/cm$)	pH	ORP or RedOx (mV)	Temp. ($^{\circ}C$)	Salinity	TDS	Turbidity (NTU)
Observations during purging (well condition, turbidity, colour, odour):										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD										
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method										
☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other										
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate	Comments					
Analysis	Bottle									



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New cum Guro.</u>				Well No: <u>BH15</u>						
Job No:				Well Type: ☐ Monitor ☐ Extraction ☐ Other						
Recorded By: <u>AL</u>				Well Material: ☐ PVC ☐ SS ☐ Other						
Date: <u>6/6/19</u>		Time: <u>2:40</u>		Well Head Condition:						
WELL PURGING										
PURGE VOLUME				PURGE METHOD						
Total Depth of Well (TD in m BTOC):				☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other						
DNAPL Level Depth (DL in m BTOC):				☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
Water Level Depth (WL in m BTOC) <u>32.636</u>				PUMP INTAKE SETTING						
LNAPL Level Depth (LL in m BTOC):				Depth (m BTOC):						
Height of Standing Water Column (TD-EL, in m):				Screen Interval (m BTOC) – Top:		Bottom:				
Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3					
	50		4							
	100		12							
	Other		$D^2(0.785)=$							
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
12:45	0	2.74	84.32	1438.7	8.03	-9.9	24.59	0.75	0.96	
	250mL	6.25	74.17	1410.1	7.73	4.5	24.18	0.73	0.93	
	500mL	1.77	22.31	1391.4	7.28	21.9	23.94	0.72	0.93	
	750mL	0.54	6.27	1412.2	7.06	-18.4	24.07	0.73	0.93	
	1L	0.41	4.64	1414.5	7.03	-29.8	24.14	0.73	0.94	
	1.25L	0.26	3.06	1415.9	7.00	-39.8	24.15	0.73	0.93	
	1.5L	0.34	3.67	1417.0	6.94	-42.1	24.22	0.73	0.93	
	1.75L	0.12	1.43	1416.2	6.92	-45.0	24.14	0.73	0.93	
1:06	2.0	0.11	1.33	1414.4	6.92	-45.7	24.03	0.73	0.94	
Observations during purging (well condition, turbidity, colour, odour):										
<u>Clear, no odor.</u>										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD								☐ Same as purge method		
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other		
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate		Comments				
Analysis	Bottle									

GROUNDWATER SAMPLING FIELD SHEET



GROUNDWATER SAMPLING FIELD SHEET

Job Name:				Well No: BH18			
Job No:				Well Type: ☐ Monitor ☐ Extraction ☐ Other			
Recorded By:				Well Material: ☐ PVC ☐ SS ☐ Other			
Date: 22/7/19		Time: 12:55		Well Head Condition:			

WELL PURGING					
PURGE VOLUME			PURGE METHOD		
Total Depth of Well (TD in m BTOC):			☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other		
DNAPL Level Depth (DL in m BTOC):			☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other		
Water Level Depth (WL in m BTOC) 32.493			PUMP INTAKE SETTING		
LNAPL Level Depth (LL in m BTOC)			Depth (m BTOC):		
Height of Standing Water Column (TD-EL, in m):			Screen Interval (m BTOC) – Top:		Bottom:

Minimum Purge Volume Required	Well Diameter (D in mm)	Height Water Column (m)	Multiply by (L/m)	=	Multiply by 3
	50		4		
	100		12		
	Other		$D^2(0.785)=$		

FIELD PARAMETER MEASUREMENTS											
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)	
		1.36	14.28	1286.2	6.52	-9.2	26.9	0.63	0.84		
		0.59	7.16	1289.5	6.51	-11.8	26.0	0.64	0.83		
		0.38	4.64	1330.6	6.48	5.2	25.6	0.62	0.86		
		0.32	3.95	1359.2	6.47	23.4	25.2	0.68	0.88		
		0.30	3.64	1361.2	6.47	29.5	25.2	0.69	0.88		
		0.29	3.57	1363.2	6.46	32.1	25.2	0.69	0.88		
		0.29	3.52	1364.6	6.46	33.8	25.2	0.69	0.88		
		0.28	3.48	1365.6	6.46	34.5	25.2	0.69	0.88		
		0.27	3.30	1366.5	6.46	35.0	25.2	0.69	0.88		

Observations during purging (well condition, turbidity, colour, odour):

0.26	3.11	1367.5	6.46	35.3	25.3	0.69	0.88
0.25	3.02	1366.2	6.46	36.1	25.3	0.69	0.88
0.24	2.92	1366.0	6.45	35.7	25.2	0.69	0.88

Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other

WELL SAMPLING	
SAMPLING METHOD ☐ Same as purge method ☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other	
SAMPLE DISTRIBUTION:	

Sample ID	Primary	Duplicate	Triplicate	Comments
Analysis	Bottle			



GROUNDWATER SAMPLING FIELD SHEET

Job Name: <u>New Ash</u>				Well No: <u>BH2</u>						
Job No:				Well Type: ☐ Monitor ☐ Extraction ☐ Other						
Recorded By:				Well Material: ☐ PVC ☐ SS ☐ Other						
Date: <u>22-7-14</u> Time:				Well Head Condition:						
WELL PURGING										
PURGE VOLUME				PURGE METHOD						
Total Depth of Well (TD in m BTOC):				☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other						
DNAPL Level Depth (DL in m BTOC):				☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other						
Water Level Depth (WL in m BTOC) <u>17.045</u>				PUMP INTAKE SETTING						
LNAPL Level Depth (LL in m BTOC)				Depth (m BTOC):						
Height of Standing Water Column (TD-EL, in m):				Screen Interval (m BTOC) – Top:		Bottom:				
Minimum Purge Volume Required	Well Diameter (D in mm)		Height Water Column (m)		Multiply by (L/m)		=	Multiply by 3		
	50				4					
	100				12					
	Other				$D^2(0.785)=$					
FIELD PARAMETER MEASUREMENTS										
Time	Volume Purged (L)	DO (mg/L or ppm)	DO (% Sat)	Electrical Conductivity (µS/cm)	pH	ORP or RedOx (mV)	Temp. (°C)	Salinity	TDS	Turbidity (NTU)
	0.25	4.16	50.73	3,000.6	7.45	27.7	24.11	1.65	2.03	
	0.5	3.77	45.72	2,286.4	7.33	7.1	24.43	1.95	2.26	
	0.75	3.67	43.15	4,320.2	7.11	-25.3	24.32	2.14	3.08	
	1.0	2.02	24.32	5,108.8	7.01	-86.0	24.19	2.85	3.40	
	1.25	1.19	14.30	5,263.1	6.97	-32.6	24.14	2.92	3.48	
	1.50	1.06	17.68	5,243.7	6.76	-29.4	24.19	2.94	3.50	
	1.75	0.93	11.19	5,306.2	6.95	-27.1	24.23	2.74	3.49	
— triple head —										
Observations during purging (well condition, turbidity, colour, odour):										
Discharge water disposal: ☐ Drums ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other										
WELL SAMPLING										
SAMPLING METHOD								☐ Same as purge method		
☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other								☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other		
SAMPLE DISTRIBUTION:										
Sample ID		Primary	Duplicate	Triplicate		Comments				
Analysis	Bottle									

GROUNDWATER SAMPLING FIELD SHEET

Job Name: New Chum Environmental Monitoring						Well No:						
Job No: BC190012.01						Well Type: Monitor (Low Flow)						
Recorded By:						Well Material: PVC						
Date:			Time:			Well Stickup (m):						
WELL PURGING												
WATER LEVEL DATA								PUMP DETAILS				
Total Depth of Well (TD in m BTOC):								Pump – QED T1200M micro purge bladder pump				
LNAPL Level Depth (LL in m BTOC)								Depth (m BTOC):				
Water Level Depth (WL in m BTOC)								Screen Interval (m BTOC) – Top: Bottom:				
DNAPL Level Depth (DL in m BTOC):								PUMP INTAKE SETTING				
Height of Standing Water Column (TD-EL, in m):								Cycles per min:				
PURGE VOLUME (L):								Recharge (sec):			Discharge (sec):	
FIELD PARAMETER MEASUREMENTS												
Time	Volume Purged (L)	SWL / Drawdown (m)	pH	EC ($\mu\text{S/cm}$)	DO (mg/L)	DO (% Sat)	ORP (mV)	Temp. ($^{\circ}\text{C}$)	Salinity	TDS	Turbidity (NTU)	
L Pond 1	-	-	8.79	9944.3	8.22	96.66	174.0	20.82	6.16	6.79		
L Pond 2	-	-	8.42	9836.5	8.58	93.17	192.7	17.42	6.60	7.48		
Observations during purging (well condition, turbidity, colour, odour): 												
Discharge water disposal: ☐ Drums ☐ Leachate System ☐ Other												
WELL SAMPLING												
SAMPLING METHOD ☐ Bailor – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other ☐ Same as purge method ☐ Pump – Type: ☐ Submersible ☐ Bladder ☐ Other												
SAMPLE DETAILS:												
Sample ID		Duplicate		Triplicate		Comments						

Appendix C – Calibration Certificates

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RTI Act 2009

Calibration Report

Instrument SmarTROLL MP
Serial Number 515206
Created 17/05/2019

Sensor	RDO
Serial Number	531217
Last Calibrated	Factory Defaults

Sensor	Conductivity
Serial Number	515206
Last Calibrated	17/05/2019

Calibration Details

Cell Constant	1.098
Reference Temperature	25.00 °C
TDS Conversion Factor (ppm)	0.65

Sensor	Level
Serial Number	514548
Last Calibrated	Factory Defaults

Sensor	pH
Serial Number	18706
Last Calibrated	17/05/2019

Calibration Details

Total Calibration Points	2
--------------------------	---

Calibration Point 1

pH of Buffer	4.00 pH
pH mV	36.4 mV
Temperature	24.23 °C

Calibration Point 2

pH of Buffer	7.00 pH
pH mV	-61.1 mV
Temperature	24.27 °C

Slope and Offset 1

Slope	-32.51 mV/pH
Offset	-61.1 mV

Sensor	ORP
Serial Number	18706
Last Calibrated	29/04/2017
Next Calibration	11/06/2041

Calibration Details

ORP Solution	ZoBell's
Offset	11.6 mV
Temperature	23.76 °C

Published on DES Disclosure Log
RTI Act 2009

Air-Met Scientific Pty Ltd

ABN 73 006 849 949

PO BOX 133, NUNAWADING 3131 VIC

P: 1300 137 067

W: www.airmet.com.au



Picking Slip

CUSTOMER DETAILS

Epic Environmental Pty Ltd
PO Box 5369
West End
QLD
4101

Telephone No: 1800 779 363

CONTRACT NO: B009266

Date of Despatch: 10/05/2019

On Hire Date: 13/05/2019

Our Reference: sch4p4(6) Person

Account No 403949

Customer Order No: BC190012.01

SITE ADDRESS

Epic Environmental Pty Ltd
PO Box 5369
West End
QLD
4101

Site Contact Name: sch4p4(6) Person

Telephone No: 1800 779 363

ITEM NO	DESCRIPTION	BIN LOCATION	QTY	QUANTITY PICKED	SERIAL NUMBER
FHT45	Ground Water Disposable 0.45 Micron Filter, 600 Sq cm		20	20	
QEDKIT	QED Low Flow / Micropurge Sampling Kit including:		1	1	
MP10/TH	- QED MP 10 Controller		1		
CO2DSIZE-C	- CO2 D Size Gas Bottle Complimentary		1		3492
312430	Solinst 122 Interface Meter 60 m (P8/LM3/30M)		1	1	
	Air regulator / Wrench		1		

SPECIAL INSTRUCTIONS:

Signature for and on behalf of Air-Met Scientific (Brisbane)

Name: _____

Date: _____

Signature _____

Time: _____

Contract Number: B009266

Water Level Meter

Instrument Solinist Water /L Meter (100M)
Serial No. 267511


airmet
Air-Met Scientific Pty
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
	above 7.9v	✓	8.6V
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Signed:

sch4p4(6) Pers

Calibration date: 28-May-19

Next calibration due: 24-Nov-19



Calibration Report

Instrument Details:

Instrument Model: Aqua TROLL® 400
Full Scale Pressure Range: 0 - 250 ft (0 - 76 m)
Serial Number: 658215
Manufacture Date: 2019-04-29

Calibration Details:

Calibration Result: PASS
Calibration Date: 2019-04-29
Nominal Range of Applied Temperature: 0 C to +50 C
Temperature Accuracy Specification: +/-0.1 C from 0 C to +50 C
Nominal Range of Applied Pressure: 0 - 250 feet
Pressure Accuracy Specification: +/-0.3% FS
Conductivity Calibration: Pass with a cell constant of 1.00.
Rugged Dissolved Oxygen Calibration: Pass with an optical phase difference of +/- 2 degrees.
pH/ORP Check: Pass with mV readings of +/- 5 mV.

Post-Calibration Check:

Parameter	Applied (PSI)	Reported (PSI)	Deviation (PSI)
Pressure	7	6.982	0.018
Pressure	65	64.992	0.008
Pressure	123	123.004	-0.004
Pressure	84.333	84.352	-0.018
Pressure	45.667	45.68	-0.013
Pressure	7	7.008	-0.008

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Calibrated in 900, 9000, & 90000 μ S/cm conductivity standards.
Manu MENSOR Model 8100 Serial No 570135
Manu HART Model 1504 Serial No B42917
Manu Fluke Model 5665 Serial No B431401

Notes:

1. Standards used in the calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +15C.
5. 1.0 PSI = 6.894757 kPa.

Appendix D – Laboratory Documentation

Published on DES Disclosure Log
RTI Act 2009

CERTIFICATE OF ANALYSIS

Work Order : EB1914694 Amendment : 1 Client : EPIC ENVIRONMENTAL Contact : sch4p4(6) Pers Address : BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000 Telephone : --- Project : New Chum PFAS Order number : - C-O-C number : 1706 Sampler : sch4p4(6) Pers Site : New Chum Quote number : BN/021/19 V3 No. of samples received : 11 No. of samples analysed : 11	Page : 1 of 9 Laboratory : Environmental Division Brisbane Contact : sch4p4(6) Pe Address : 2 Byth Street Stafford QLD Australia 4053 Telephone : sch4p4(6) Person Date Samples Received : 07-Jun-2019 11:00 Date Analysis Commenced : 11-Jun-2019 Issue Date : 19-Jun-2019 12:10
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Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Person	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
sch4p4(6) Pers		Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP231X-SUT: Matrix Spike (MS) recovery for various analytes is bias low due to sample matrix interferences.
- **Analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Amendment (14/06/2019): This report has been amended and re-released to allow the reporting of additional analytical data.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Published on 14/06/2019
RTI Act 2009
Disclosure Log



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH02	BH11	BH03	BH7A	BH5A
Client sampling date / time				05-Jun-2019 09:53	05-Jun-2019 11:11	05-Jun-2019 12:09	05-Jun-2019 14:22	06-Jun-2019 09:11
Compound	CAS Number	LOR	Unit	EB1914694-001	EB1914694-002	EB1914694-003	EB1914694-004	EB1914694-005
				Result	Result	Result	Result	Result
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	74	----	----	----
Magnesium	7439-95-4	1	mg/L	----	138	----	----	----
Sodium	7440-23-5	1	mg/L	----	738	----	----	----
Potassium	7440-09-7	1	mg/L	----	30	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.0005	<0.0002	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0011	<0.0005	<0.0005	<0.0005
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0011	<0.0005	<0.0005	<0.0005
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH02	BH11	BH03	BH7A	BH5A
Client sampling date / time				05-Jun-2019 09:53	05-Jun-2019 11:11	05-Jun-2019 12:09	05-Jun-2019 14:22	06-Jun-2019 09:11
Compound	CAS Number	LOR	Unit	EB1914694-001	EB1914694-002	EB1914694-003	EB1914694-004	EB1914694-005
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.0005	<0.0002	<0.0002
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	0.0022	0.0005	<0.0002	<0.0002
^ Sum of PFAS	----	0.0002	µg/L	<0.0002	0.0022	0.0005	<0.0002	<0.0002
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	80.2	82.7	85.8	83.0	74.7
13C8-PFOA	----	0.0005	%	113	115	119	117	112



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH15	BH16	BH14	GQA1	BH18
Client sampling date / time				06-Jun-2019 10:55	06-Jun-2019 12:14	05-Jun-2019 12:52	05-Jun-2019 12:53	06-Jun-2019 13:09
Compound	CAS Number	LOR	Unit	EB1914694-006	EB1914694-007	EB1914694-008	EB1914694-009	EB1914694-010
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.0007
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.0006
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH15	BH16	BH14	GQA1	BH18
Client sampling date / time				06-Jun-2019 10:55	06-Jun-2019 12:14	05-Jun-2019 12:52	05-Jun-2019 12:53	06-Jun-2019 13:09
Compound	CAS Number	LOR	Unit	EB1914694-006	EB1914694-007	EB1914694-008	EB1914694-009	EB1914694-010
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.0011
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.0018
^ Sum of PFAS	----	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.0018
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	103	72.1	60.8	80.4	70.4
13C8-PFOA	----	0.0005	%	118	116	93.1	119	105



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				RB1	----	----	----	----
Client sampling date / time				06-Jun-2019 14:36	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1914694-011	-----	-----	-----	-----
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB1	----	----	----	----
Client sampling date / time					06-Jun-2019 14:36	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1914694-011	-----	-----	-----	-----
				Result	----	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	----	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	----	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	----	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	----	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	----	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	----	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	----	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	----	----	----	----	----
EP231P: PFAS Sums									
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	<0.0002	----	----	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----	----
^ Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%	83.5	----	----	----	----	----
13C8-PFOA	----	0.0005	%	93.2	----	----	----	----	----



Surrogate Control Limits

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

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

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QUALITY CONTROL REPORT

Work Order	: EB1914694	Page	: 1 of 7
Amendment	: 1		
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Contact	: sch4p4(6) Pe
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: sch4p4(6) Person
Project	: New Chum PFAS	Date Samples Received	: 07-Jun-2019
Order number	: -	Date Analysis Commenced	: 11-Jun-2019
C-O-C number	: 1706	Issue Date	: 19-Jun-2019
Sampler	: sch4p4(6) Pers		
Site	: New Chum		
Quote number	: BN/021/19 V3		
No. of samples received	: 11		
No. of samples analysed	: 11		



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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Pers	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
sch4p4(6) Pe		Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2397748)									
ES1917586-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	4	4	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	2	2	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	6	6	0.00	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.00	No Limit
ES1917640-008	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	56	56	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	39	40	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	74	75	0.00	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2408011)									
EB1914694-008	BH14	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.00	No Limit
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2408011)									
EB1914694-008	BH14	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2408011) - continued									
EB1914694-008	BH14	EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2408011)									
EB1914694-008	BH14	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2408011)									
EB1914694-008	BH14	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2408011)									
EB1914694-008	BH14	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.00	No Limit
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	<0.0002	0.00	No Limit
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	<0.0002	0.00	No Limit

Released



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

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

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
ED093F: Dissolved Major Cations (QCLot: 2397748)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	100	80	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	102	90	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	91.7	82	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	91.4	85	113
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2396665)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	126	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	104	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	91.2	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	125	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	110	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	53.6	50	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2408011)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	125	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	121	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	115	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	128	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	50.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2396665)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	96.3	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	128	50	130
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	129	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	108	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	94.4	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	68.2	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	66.2	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	57.4	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	78.3	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2408011)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	40.3	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	129	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	129	50	130

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound		CAS Number	LOR		Unit	Result	Spike Concentration	Spike Recovery (%) LCS
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2408011) - continued								
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	129	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	129	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	125	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	101	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	87.2	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	45.4	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	117	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2396665)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	82.0	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	56.8	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	56.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	55.6	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	45.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	44.8	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	50.4	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2408011)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	82.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	62.3	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	66.1	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	69.1	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	72.3	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	74.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	80.8	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2396665)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	122	50	130
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	129	50	130

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2396665) - continued								
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	97.2	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	66.6	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2408011)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	123	50	130
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	128	50	130
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	117	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	92.0	50	130
EP231P: PFAS Sums (QCLot: 2396665)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231P: PFAS Sums (QCLot: 2408011)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2408011)							
EB1914694-008	BH14	EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0025 µg/L	129	50	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0025 µg/L	92.8	50	130
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0025 µg/L	107	50	130
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0025 µg/L	122	50	130
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0025 µg/L	105	50	130
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0025 µg/L	60.0	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2408011)							
EB1914694-008	BH14	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.0125 µg/L	35.1	30	130
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0025 µg/L	98.6	50	130
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0025 µg/L	127	50	130
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0025 µg/L	122	50	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0025 µg/L	128	50	130

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Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2408011) - continued							
EB1914694-008	BH14	EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0025 µg/L	106	50	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0025 µg/L	88.2	50	130
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0025 µg/L	62.2	40	130
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0025 µg/L	63.0	40	130
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0025 µg/L	42.0	40	130
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00625 µg/L	44.3	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2408011)							
EB1914694-008	BH14	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0025 µg/L	56.6	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00625 µg/L	40.3	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00625 µg/L	# 33.9	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00625 µg/L	# 29.4	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00625 µg/L	# 32.7	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0025 µg/L	# 35.4	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0025 µg/L	40.6	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2408011)							
EB1914694-008	BH14	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0025 µg/L	104	50	130
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0025 µg/L	117	50	130
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0025 µg/L	110	50	130
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0025 µg/L	51.0	50	130

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QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1914694	Page	: 1 of 6
Amendment	: 1		
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Telephone	: sch4p4(6) Persona
Project	: New Chum PFAS	Date Samples Received	: 07-Jun-2019
Site	: New Chum	Issue Date	: 19-Jun-2019
Sampler	: sch4p4(6) Per	No. of samples received	: 11
Order number	: -	No. of samples analysed	: 11

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231C: Perfluoroalkyl Sulfonamides	EB1914694--008	BH14	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	33.9 %	40-130%	Recovery less than lower data quality objective
EP231C: Perfluoroalkyl Sulfonamides	EB1914694--008	BH14	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	29.4 %	40-130%	Recovery less than lower data quality objective
EP231C: Perfluoroalkyl Sulfonamides	EB1914694--008	BH14	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	32.7 %	40-130%	Recovery less than lower data quality objective
EP231C: Perfluoroalkyl Sulfonamides	EB1914694--008	BH14	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	35.4 %	40-130%	Recovery less than lower data quality objective

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	1	15	6.67	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
HDPE (no PTFE) (ED093F)							
BH11	05-Jun-2019	----	----	----	11-Jun-2019	12-Jun-2019	✓



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) BH02, BH03, GQA1	BH11, BH7A,	05-Jun-2019	11-Jun-2019	02-Dec-2019	✓	11-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH14		05-Jun-2019	18-Jun-2019	02-Dec-2019	✓	18-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH5A, BH16,	BH15, RB1	06-Jun-2019	11-Jun-2019	03-Dec-2019	✓	11-Jun-2019	03-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH18		06-Jun-2019	18-Jun-2019	03-Dec-2019	✓	18-Jun-2019	03-Dec-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT) BH02, BH03, GQA1	BH11, BH7A,	05-Jun-2019	11-Jun-2019	02-Dec-2019	✓	11-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH14		05-Jun-2019	18-Jun-2019	02-Dec-2019	✓	18-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH5A, BH16,	BH15, RB1	06-Jun-2019	11-Jun-2019	03-Dec-2019	✓	11-Jun-2019	03-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH18		06-Jun-2019	18-Jun-2019	03-Dec-2019	✓	18-Jun-2019	03-Dec-2019	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT) BH02, BH03, GQA1	BH11, BH7A,	05-Jun-2019	11-Jun-2019	02-Dec-2019	✓	11-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH14		05-Jun-2019	18-Jun-2019	02-Dec-2019	✓	18-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH5A, BH16,	BH15, RB1	06-Jun-2019	11-Jun-2019	03-Dec-2019	✓	11-Jun-2019	03-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH18		06-Jun-2019	18-Jun-2019	03-Dec-2019	✓	18-Jun-2019	03-Dec-2019	✓

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Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) BH02, BH03, GQA1	BH11, BH7A,	05-Jun-2019	11-Jun-2019	02-Dec-2019	✓	11-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH14		05-Jun-2019	18-Jun-2019	02-Dec-2019	✓	18-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH5A, BH16,	BH15, RB1	06-Jun-2019	11-Jun-2019	03-Dec-2019	✓	11-Jun-2019	03-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH18		06-Jun-2019	18-Jun-2019	03-Dec-2019	✓	18-Jun-2019	03-Dec-2019	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT) BH02, BH03, GQA1	BH11, BH7A,	05-Jun-2019	11-Jun-2019	02-Dec-2019	✓	11-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH14		05-Jun-2019	18-Jun-2019	02-Dec-2019	✓	18-Jun-2019	02-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH5A, BH16,	BH15, RB1	06-Jun-2019	11-Jun-2019	03-Dec-2019	✓	11-Jun-2019	03-Dec-2019	✓
HDPE (no PTFE) (EP231X-SUT) BH18		06-Jun-2019	18-Jun-2019	03-Dec-2019	✓	18-Jun-2019	03-Dec-2019	✓

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Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Major Cations - Dissolved	ED093F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	15	6.67	10.00	✗	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	2	15	13.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	2	15	13.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Major Cations - Dissolved	ED093F	WATER	<p>In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3)</p> <p>Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3)</p> <p>Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)</p>
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	<p>In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1</p>

Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

Published R1914694 Amendment 1



SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1914694**

Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: [sch4p4(6) Pers]	Contact	: [sch4p4(6) Pers]
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: [sch4p4]@epicenvironmental.com.au	E-mail	: [sch4p4(6) Pers]@alsglobal.com
Telephone	: ----	Telephone	: [sch4p4(6) Person]
Facsimile	: ----	Facsimile	: [sch4p4(6) Person]
Project	: New Chum PFAS	Page	: 1 of 2
Order number	: -	Quote number	: EB2019EPIENV0004 (BN/021/19 V3)
C-O-C number	: 1706	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: New Chum		
Sampler	: [sch4p4(6) Pers]		

Dates

Date Samples Received	: 07-Jun-2019 11:00	Issue Date	: 07-Jun-2019
Client Requested Due Date	: 12-Jun-2019	Scheduled Reporting Date	: 12-Jun-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 12.6°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 12 / 10

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **Please be advised, surcharge calculations have been adjusted to account for the NSW public holiday on 10/06/2019.**
- ***Samples were originally received by ALS Brisbane on 06/07/2019 (12.6°C), and forwarded to ALS Sydney for analysis.**
- **A 20% surcharge applies for results returned within 2 days.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Major Cations - Dissolved : ED093F		
BH11	- HDPE (no PTFE)	- Clear Plastic Bottle - Nitric Acid; Filtered

EB1914694-012 : 06-Jun-2019 14:36 :

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28)	WATER - NT-01 Major Cations (Ca, Mg, Na, K)
EB1914694-001	05-Jun-2019 09:53	BH02		✓	
EB1914694-002	05-Jun-2019 11:11	BH11		✓	✓
EB1914694-003	05-Jun-2019 12:09	BH03		✓	
EB1914694-004	05-Jun-2019 14:22	BH7A		✓	
EB1914694-005	06-Jun-2019 09:11	BH5A		✓	
EB1914694-006	06-Jun-2019 10:55	BH15		✓	
EB1914694-007	06-Jun-2019 12:14	BH16		✓	
EB1914694-008	05-Jun-2019 12:52	BH14	✓		
EB1914694-009	05-Jun-2019 12:53	GQA1		✓	
EB1914694-010	06-Jun-2019 13:09	BH18	✓		
EB1914694-011	06-Jun-2019 14:36	RB1		✓	
EB1914694-012	06-Jun-2019 14:36			✓	

Proactive Holding Time Report

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

Requested Deliverables

INVOICES

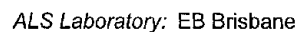
- A4 - AU Tax Invoice (INV)

Email accounts@epicenvironmental.com.au

[sch4p4(6) Per]

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - XTab (XTAB)

Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au
Email [sch4p4(6)@epicenvironmental.com.au



RECEIVED BY:

DATE TIME:

EMAIL INVOICES TO:

Biohazard info:

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

Other comments:

Telephone : + 61-7-3243 7222



CHAIN OF CUSTODY

COC#: 1706 ALS Laboratory: EB Brisbane

RELINQUISHED BY:

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY:

DATE TIME:

DATE TIME:

DATE TIME:

DATE TIME:

CLIENT: EPIENV - EPIC ENVIRONMENTAL

PROJECT: New Chum PFAS

SITE: New chum

ORDER NO:

PROJECT MANAGER: sch4p4(6) P

PRIMARY SAMPLER: sch4p4(6) P

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 2 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

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

Random Sample Temperature on Receipt: 'C

Other comments:

CONTACT PH: sch4p4(6) Per

SAMPLER MOBILE: sch4p4(6)

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

SAMPLE DETAILS

ANALYSIS REQUIRED

SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Analysis NOT REQUIRED	Table 1: Groundwater - Quarterly GROUNDWATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
010	BH18		06/06/2019 01:09 PM	Water	ALS: 2 Non ALS: 0	No				
011	RB1		06/06/2019 02:36 PM	Water	ALS: 1 Non ALS: 0	No		Partial 1/11		

**CHAIN OF CUSTODY**

COC#: 1706

ALS Laboratory: EB Brisbane

RELINQUISHED BY:

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY:

DATE TIME:

DATE TIME:

DATE TIME:

DATE TIME:

CLIENT: EPIENV - EPIC ENVIRONMENTAL

PROJECT: New Chum PFAS

SITE: New chum

ORDER NO:

PROJECT MANAGER: sch4p4(6) P

PRIMARY SAMPLER: sch4p4(6) P

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 2 Days

Biohazard info:

CONTACT PH: sch4p4(6) Per

SAMPLER MOBILE: sch4p4(6) P

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

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

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	PARTIAL ANALYSIS GROUP NAME	MATRIX	SELECTED ANALYSIS NAME
001	BH02	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
002	BH11	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- NT-01 Major Cations (Ca, Mg, Na, K) - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
003	BH03	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
004	BH7A	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
005	BH5A	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
006	BH15	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
007	BH16	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
009	GQA1	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
011	RB1	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)

**CHAIN OF CUSTODY**

COC#: 1706

ALS Laboratory: EB Brisbane

CLIENT: EPIENV - EPIC ENVIRONMENTAL

PROJECT: New Chum PFAS

SITE: New chum

ORDER NO:

PROJECT MANAGER: sch4p4(6) F

PRIMARY SAMPLER: sch4p4(6) F

EMAIL REPORTS TO:

EMAIL INVOICES TO:

RELINQUISHED BY:

DATE TIME:

RECEIVED BY:

DATE TIME:

RELINQUISHED BY:

DATE TIME:

RECEIVED BY:

DATE TIME:

TURNAROUND REQUIREMENTS : 2 Days

Biohazard info:

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

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

Random Sample Temperature on Receipt: °C

Other comments:

CONTACT PH: sch4p4(6) Per

SAMPLER MOBILE: sch4p4(6)

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	BH02	HDPE (no PTFE)	250 mL	00350219038655	Grey	No	
001	BH02	HDPE (no PTFE)	250 mL	00350219038678	Grey	No	
002	BH11	HDPE (no PTFE)	250 mL	00350219038625	Grey	No	
002	BH11	HDPE (no PTFE)	250 mL	00350219038644	Grey	No	
003	BH03	HDPE (no PTFE)	250 mL	00350219038697	Grey	No	
003	BH03	HDPE (no PTFE)	250 mL	00350219038654	Grey	No	
004	BH7A	HDPE (no PTFE)	250 mL	00350219038660	Grey	No	
004	BH7A	HDPE (no PTFE)	250 mL	00350219038662	Grey	No	
005	BH5A	HDPE (no PTFE)	250 mL	00350219038656	Grey	No	
005	BH5A	HDPE (no PTFE)	250 mL	00350219038600	Grey	No	
005	BH5A	HDPE (no PTFE)	250 mL	00350219038669	Grey	No	
005	BH5A	HDPE (no PTFE)	250 mL	00350219038663	Grey	No	
006	BH15	HDPE (no PTFE)	250 mL	00350219038584	Grey	No	
006	BH15	HDPE (no PTFE)	250 mL	00350219038621	Grey	No	
007	BH16	HDPE (no PTFE)	250 mL	00350219038618	Grey	No	
007	BH16	HDPE (no PTFE)	250 mL	00350219038615	Grey	No	
008	BH14	HDPE (no PTFE)	250 mL	00350219038632	Grey	No	
008	BH14	HDPE (no PTFE)	250 mL	00350219038647	Grey	No	
008	BH14	HDPE (no PTFE)	250 mL	00350219038627	Grey	No	
008	BH14	HDPE (no PTFE)	250 mL	00350219038636	Grey	No	
009	GQA1	HDPE (no PTFE)	250 mL	00350219038630	Grey	No	
009	GQA1	HDPE (no PTFE)	250 mL	00350219038605	Grey	No	
010	BH18	HDPE (no PTFE)	250 mL	00350219038567	Grey	No	
010	BH18	HDPE (no PTFE)	250 mL	00350219038672	Grey	No	
011	RB1	HDPE (no PTFE)	250 mL	00350219038668	Grey	No	

CERTIFICATE OF ANALYSIS

Work Order : **EB1914836**
Client : **EPIC ENVIRONMENTAL**
Contact : sch4p4(6) Per
Address : BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY
 BRISBANE QLD, AUSTRALIA 4000
Telephone : ----
Project : New Chum PFAS
Order number : -
C-O-C number : 1776
Sampler : sch4p4(6) Per
Site : New Chum-1
Quote number : BN/021/19 V3
No. of samples received : 8
No. of samples analysed : 8

Page : 1 of 7
Laboratory : Environmental Division Brisbane
Contact : sch4p4(6) Pe
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : sch4p4(6) Perso
Date Samples Received : 10-Jun-2019 15:00
Date Analysis Commenced : 13-Jun-2019
Issue Date : 17-Jun-2019 08:45



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories

Position

Accreditation Category

sch4p4(6) Per

Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

- Analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).

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Analytical Results

Sub-Matrix: SURFACE WATER
 (Matrix: WATER)

Client sample ID

				SMC	sed-1	DwN	DIS	SQA1
Client sampling date / time				07-Jun-2019 13:42	07-Jun-2019 13:44	07-Jun-2019 13:44	07-Jun-2019 13:45	07-Jun-2019 13:46
Compound	CAS Number	LOR	Unit	EB1914836-001	EB1914836-002	EB1914836-003	EB1914836-004	EB1914836-005
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	0.0135	<0.0005	0.0142	0.0134	0.0133
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	0.0024	<0.0005	0.0025	0.0023	0.0024
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0110	<0.0005	0.0126	0.0119	0.0118
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	0.0010	<0.0005	0.0011	0.0012	0.0010
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0140	0.0003	0.0125	0.0108	0.0108
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0073	<0.0005	0.0092	0.0089	0.0068
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0138	<0.0005	0.0140	0.0137	0.0135
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0042	<0.0005	0.0040	0.0046	0.0038
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0055	<0.0005	0.0056	0.0054	0.0056
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.0006	<0.0005	<0.0005
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: SURFACE WATER
 (Matrix: WATER)

Client sample ID

				SMC	sed-1	DwN	DIS	SQA1
Client sampling date / time				07-Jun-2019 13:42	07-Jun-2019 13:44	07-Jun-2019 13:44	07-Jun-2019 13:45	07-Jun-2019 13:46
Compound	CAS Number	LOR	Unit	EB1914836-001	EB1914836-002	EB1914836-003	EB1914836-004	EB1914836-005
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0250	0.0003	0.0251	0.0227	0.0226
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0693	0.0003	0.0721	0.0687	0.0656
^ Sum of PFAS	----	0.0002	µg/L	0.0727	0.0003	0.0763	0.0722	0.0690
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	61.0	66.6	64.9	64.2	66.8
13C8-PFOA	----	0.0005	%	91.4	97.9	100	98.0	99.7



Analytical Results

Sub-Matrix: SURFACE WATER
 (Matrix: WATER)

Client sample ID

				Chum Pond	NWH	DWN3	----	----
Client sampling date / time				07-Jun-2019 13:47	07-Jun-2019 14:10	07-Jun-2019 15:21	----	----
Compound	CAS Number	LOR	Unit	EB1914836-006	EB1914836-007	EB1914836-008	-----	-----
				Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	0.0215	0.0223	0.0052	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	0.0052	0.0062	0.0010	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0395	0.0370	0.0046	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	0.0149	0.0098	0.0005	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.124	0.117	0.0054	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	<0.0020	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0267	0.0154	0.0025	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0355	0.0302	0.0061	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0109	0.0084	0.0016	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0165	0.0130	0.0022	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	0.0026	0.0024	<0.0005	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	0.0008	0.0012	<0.0005	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	<0.001	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	<0.001	----	----



Analytical Results

Sub-Matrix: SURFACE WATER
 (Matrix: WATER)

Client sample ID

				Chum Pond	NWH	DWN3	----	----
Client sampling date / time				07-Jun-2019 13:47	07-Jun-2019 14:10	07-Jun-2019 15:21	----	----
Compound	CAS Number	LOR	Unit	EB1914836-006	EB1914836-007	EB1914836-008	-----	-----
				Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	<0.001	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	<0.001	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	<0.001	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	0.001	0.001	<0.001	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	<0.001	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	<0.001	----	----
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.164	0.154	0.0100	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.276	0.244	0.0276	----	----
^ Sum of PFAS	----	0.0002	µg/L	0.299	0.264	0.0291	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	84.4	88.6	60.0	----	----
13C8-PFOA	----	0.0005	%	102	120	65.7	----	----



Surrogate Control Limits

Sub-Matrix: **SURFACE WATER**

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

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QUALITY CONTROL REPORT

Work Order	: EB1914836	Page	: 1 of 6
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Contact	: sch4p4(6) Pe
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: sch4p4(6) Person
Project	: New Chum PFAS	Date Samples Received	: 10-Jun-2019
Order number	: -	Date Analysis Commenced	: 13-Jun-2019
C-O-C number	: 1776	Issue Date	: 17-Jun-2019
Sampler	: sch4p4(6) Pers		
Site	: New Chum-1		
Quote number	: BN/021/19 V3		
No. of samples received	: 8		
No. of samples analysed	: 8		



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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Pers		Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2400692)									
EB1914836-001	SMC	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0140	0.0130	7.10	0% - 20%
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	0.0135	0.0136	1.10	0% - 20%
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	0.0024	0.0023	0.00	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0110	0.0123	11.2	0% - 20%
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	0.0010	0.0009	0.00	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2400692)									
EB1914836-001	SMC	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0073	0.0074	1.36	0% - 50%
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0138	0.0138	0.00	0% - 20%
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0042	0.0042	0.00	No Limit
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0055	0.0054	0.00	0% - 50%
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2400692) - continued									
EB1914836-001	SMC	EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2400692)									
EB1914836-001	SMC	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2400692)									
EB1914836-001	SMC	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2400692)									
EB1914836-001	SMC	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0250	0.0253	1.19	0% - 20%
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0693	0.0697	0.576	0% - 20%
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	0.0727	0.0729	0.275	0% - 20%

Published on DES Disclosure Log
 RTI Act 2009



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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2400692)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	110	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	100	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	96.2	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	120	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	107	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	80.8	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2400692)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	35.8	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	113	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	106	50	130
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	117	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	112	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	104	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	116	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	54.8	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	85.1	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2400692)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	98.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	93.3	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	107	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	85.8	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	77.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	79.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	78.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2400692)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	125	50	130

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2400692) - continued								
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	125	50	130
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	123	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	99.4	50	130
EP231P: PFAS Sums (QCLot: 2400692)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2400692)							
EB1914836-004	DIS	EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0025 µg/L	84.8	50	130
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0025 µg/L	125	50	130
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0025 µg/L	69.6	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2400692)							
EB1914836-004	DIS	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.0125 µg/L	34.7	30	130
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0025 µg/L	112	50	130
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0025 µg/L	120	50	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0025 µg/L	59.0	50	130
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0025 µg/L	116	50	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0025 µg/L	84.2	50	130
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0025 µg/L	95.2	40	130
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0025 µg/L	100	40	130
		EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0025 µg/L	48.2	40	130
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00625 µg/L	123	40	130

Released

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLOT: 2400692)							
EB1914836-004	DIS	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0025 µg/L	64.4	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00625 µg/L	68.4	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00625 µg/L	55.8	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00625 µg/L	60.2	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00625 µg/L	55.2	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0025 µg/L	59.8	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0025 µg/L	50.6	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLOT: 2400692)							
EB1914836-004	DIS	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0025 µg/L	120	50	130
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0025 µg/L	124	50	130
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0025 µg/L	121	50	130
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0025 µg/L	72.4	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1914836	Page	: 1 of 5
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Telephone	: sch4p4(6) Persor
Project	: New Chum PFAS	Date Samples Received	: 10-Jun-2019
Site	: New Chum-1	Issue Date	: 17-Jun-2019
Sampler	: sch4p4(6) Pers	No. of samples received	: 8
Order number	: -	No. of samples analysed	: 8

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	DIS	Perfluorobutane sulfonic acid (PFBS)	375-73-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	DIS	Perfluorohexane sulfonic acid (PFHxS)	355-46-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	DIS	Perfluorooctane sulfonic acid (PFOS)	1763-23-1	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EB1914836--004	DIS	Perfluorohexanoic acid (PFHxA)	307-24-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT)		07-Jun-2019	13-Jun-2019	04-Dec-2019	✔	13-Jun-2019	04-Dec-2019	✔
SMC,	sed-1,							
DwN,	DIS,							
SQA1,	Chum Pond,							
NWH,	DWN3							
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT)		07-Jun-2019	13-Jun-2019	04-Dec-2019	✔	13-Jun-2019	04-Dec-2019	✔
SMC,	sed-1,							
DwN,	DIS,							
SQA1,	Chum Pond,							
NWH,	DWN3							



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT)		07-Jun-2019	13-Jun-2019	04-Dec-2019	✔	13-Jun-2019	04-Dec-2019	✔
SMC,	sed-1,							
DwN,	DIS,							
SQA1,	Chum Pond,							
NWH,	DWN3							
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT)		07-Jun-2019	13-Jun-2019	04-Dec-2019	✔	13-Jun-2019	04-Dec-2019	✔
SMC,	sed-1,							
DwN,	DIS,							
SQA1,	Chum Pond,							
NWH,	DWN3							
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT)		07-Jun-2019	13-Jun-2019	04-Dec-2019	✔	13-Jun-2019	04-Dec-2019	✔
SMC,	sed-1,							
DwN,	DIS,							
SQA1,	Chum Pond,							
NWH,	DWN3							

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Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

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 RTI Act 2009

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1914836**

Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Contact	: sch4p4(6) Per
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: sch4p4@epicenvironmental.com.au	E-mail	: sch4p4(6) Pe@alsglobal.com
Telephone	: ----	Telephone	: sch4p4(6) Person
Facsimile	: ----	Facsimile	: sch4p4(6) Person
Project	: New Chum PFAS	Page	: 1 of 2
Order number	: -	Quote number	: EB2019EPIENV0004 (BN/021/19 V3)
C-O-C number	: 1776	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: New Chum-1		
Sampler	: sch4p4(6) Per		

Dates

Date Samples Received	: 10-Jun-2019 15:00	Issue Date	: 10-Jun-2019
Client Requested Due Date	: 17-Jun-2019	Scheduled Reporting Date	: 17-Jun-2019

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 8.7°C
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 8 / 8

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28)
EB1914836-001	07-Jun-2019 13:42	SMC	✓
EB1914836-002	07-Jun-2019 13:44	sed-1	✓
EB1914836-003	07-Jun-2019 13:44	DwN	✓
EB1914836-004	07-Jun-2019 13:45	DIS	✓
EB1914836-005	07-Jun-2019 13:46	SQA1	✓
EB1914836-006	07-Jun-2019 13:47	Chum Pond	✓
EB1914836-007	07-Jun-2019 14:10	NWH	✓
EB1914836-008	07-Jun-2019 15:21	DWN3	✓

Proactive Holding Time Report

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

Requested Deliverables

INVOICES

- A4 - AU Tax Invoice (INV)

Email accounts@epicenvironmental.com.au

sch4p4(6) Per

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - XTab (XTAB)

Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au
Email **sch4p4(** @epicenvironmental.com.au

Samples for ALS Compass

COC No. 1776

Environmental Division
Brisbane
Work Order Reference
EB1914836



Telephone : + 61-7-3243 7222

delivered by

sch4p4(6) Personal information

10/6/19

sch4p4(6) Personal information

1500

10/6/19

sch4p4(6) Personal info

 CHAIN OF CUSTODY COC#: 1776 ALS Laboratory: EB Brisbane		RELINQUISHED BY: DATE TIME:	RECEIVED BY: DATE TIME:	RELINQUISHED BY: DATE TIME:	RECEIVED BY: DATE TIME:
CLIENT: EPIENV - EPIC ENVIRONMENTAL PROJECT: New Chum PFAS SITE: New Chum-1 ORDER NO: PROJECT MANAGER: sch4p4(6) F PRIMARY SAMPLER: sch4p4(6) F EMAIL REPORTS TO: EMAIL INVOICES TO:		TURNAROUND REQUIREMENTS : 3 Days Biohazard info:	LABORATORY USE ONLY (Circle) Custody Seal intact? Yes No N/A Free ice / frozen ice bricks present upon receipt? Yes No N/A Random Sample Temperature on Receipt: °C Other comments:		
		CONTACT PH: sch4p4(6) P QUOTE NO: BN/021/19 V3	SAMPLER MOBILE: sch4p4(6) / EB2019EPIENV0004		

**CHAIN OF CUSTODY**

COC#: 1776

ALS Laboratory: EB Brisbane

RELINQUISHED BY:

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY:

DATE TIME:

DATE TIME:

DATE TIME:

DATE TIME:

CLIENT: EPIENV - EPIC ENVIRONMENTAL

PROJECT: New Chum PFAS

SITE: New Chum-1

ORDER NO:

PROJECT MANAGER: sch4p4(6) P

PRIMARY SAMPLER: sch4p4(6) F

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 3 Days

Biohazard info:

CONTACT PH: sch4p4(6) Pers SAMPLER MOBILE: sch4p4(6)

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

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

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	SMC	HDPE (no PTFE)	250 mL	00350219038653	Grey	No	
001	SMC	HDPE (no PTFE)	250 mL	00350219038687	Grey	No	
001	SMC	HDPE (no PTFE)	250 mL	00350219038589	Grey	No	
001	SMC	HDPE (no PTFE)	250 mL	00350219038648	Grey	No	
002	sed-1	HDPE (no PTFE)	250 mL	00350219038607	Grey	No	
002	sed-1	HDPE (no PTFE)	250 mL	00350219038604	Grey	No	
003	DwN	HDPE (no PTFE)	250 mL	00350219038578	Grey	No	
003	DwN	HDPE (no PTFE)	250 mL	00350219038650	Grey	No	
004	DIS	HDPE (no PTFE)	250 mL	00350219038631	Grey	No	
004	DIS	HDPE (no PTFE)	250 mL	00350219038643	Grey	No	
004	DIS	HDPE (no PTFE)	250 mL	00350219038640	Grey	No	
004	DIS	HDPE (no PTFE)	250 mL	00350219038608	Grey	No	
005	SQA1	HDPE (no PTFE)	250 mL	00350219038558	Grey	No	
005	SQA1	HDPE (no PTFE)	250 mL	00350219038602	Grey	No	
006	Chum Pond	HDPE (no PTFE)	250 mL	00350219038610	Grey	No	
006	Chum Pond	HDPE (no PTFE)	250 mL	00350219038646	Grey	No	
007	NWH	HDPE (no PTFE)	250 mL	00350219038626	Grey	No	
007	NWH	HDPE (no PTFE)	250 mL	00350219038566	Grey	No	
008	DWN3	HDPE (no PTFE)	250 mL	00350219038609	Grey	No	
008	DWN3	HDPE (no PTFE)	250 mL	00350219038598	Grey	No	



SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1914939**

Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: [sch4p4(6) Per]	Contact	: [sch4p4(6) Pe]
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: [sch4p4(6) P]@epicenvironmental.com.au	E-mail	: [sch4p4(6) P]@alsglobal.com
Telephone	: ----	Telephone	: [sch4p4(6) Person]
Facsimile	: ----	Facsimile	: [sch4p4(6) Person]
Project	: New Chum PFAS	Page	: 1 of 2
Order number	: -	Quote number	: EB2019EPIENV0004 (BN/021/19 V3)
C-O-C number	: 1788	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: new chum-2		
Sampler	: [sch4p4(6) Pers]		

Dates

Date Samples Received	: 11-Jun-2019 12:00	Issue Date	: 11-Jun-2019
Client Requested Due Date	: 13-Jun-2019	Scheduled Reporting Date	: 13-Jun-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 10.4°C - Ice present
Receipt Detail	: MEDIUM HARD ESKY	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **A 20% surcharge applies for results returned within 2 days.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	
EB1914939-001	11-Jun-2019 08:28	SMC2	✓
EB1914939-002	11-Jun-2019 08:29	SMC3	✓

WATER - EP231X-SUT
PFAS - Super Ultra Trace Waters Long Suite (28)

Proactive Holding Time Report

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

Requested Deliverables

INVOICES

- A4 - AU Tax Invoice (INV)

Email accounts@epicenvironmental.com.au

sch4p4(6) Pers

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - XTab (XTAB)

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Email sch4p4(epicenvironmental.com.au

CERTIFICATE OF ANALYSIS

Work Order : EB1914939 Amendment : 1 Client : EPIC ENVIRONMENTAL Contact : sch4p4(6) Pers Address : BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000 Telephone : ---- Project : New Chum PFAS Order number : - C-O-C number : 1788 Sampler : sch4p4(6) Pers Site : new chum-2 Quote number : BN/021/19 V3 No. of samples received : 2 No. of samples analysed : 2	Page : 1 of 5 Laboratory : Environmental Division Brisbane Contact : sch4p4(6) Pers Address : 2 Byth Street Stafford QLD Australia 4053 Telephone : sch4p4(6) Perso Date Samples Received : 11-Jun-2019 12:00 Date Analysis Commenced : 13-Jun-2019 Issue Date : 21-Jun-2019 14:29
---	---



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories

Position

Accreditation Category

sch4p4(6) Pers

Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

- PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).
- Amendment (21/06/2019): This report has been amended and re-released to allow repeat anonymous matrix spike QC data to be reported. All regular analysis results are as per the previous report

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Analytical Results

Sub-Matrix: SURFACE WATER
 (Matrix: WATER)

Client sample ID

				SMC2	SMC3	----	----	----
Client sampling date / time				11-Jun-2019 08:28	11-Jun-2019 08:29	----	----	----
Compound	CAS Number	LOR	Unit	EB1914939-001	EB1914939-002	-----	-----	-----
				Result	Result	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0005	0.0004	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	----	----	----



Analytical Results

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

Client sample ID

				SMC2	SMC3	----	----	----
Client sampling date / time				11-Jun-2019 08:28	11-Jun-2019 08:29	----	----	----
Compound	CAS Number	LOR	Unit	EB1914939-001	EB1914939-002	-----	-----	-----
				Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	----	----	----
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0005	0.0004	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0005	0.0004	----	----	----
^ Sum of PFAS	----	0.0002	µg/L	0.0005	0.0004	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	66.3	78.4	----	----	----
13C8-PFOA	----	0.0005	%	90.5	98.2	----	----	----



Surrogate Control Limits

Sub-Matrix: **SURFACE WATER**

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

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QUALITY CONTROL REPORT

Work Order	: EB1914939	Page	: 1 of 6
Amendment	: 1		
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Contact	: sch4p4(6) Pe
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: sch4p4(6) Person
Project	: New Chum PFAS	Date Samples Received	: 11-Jun-2019
Order number	: -	Date Analysis Commenced	: 13-Jun-2019
C-O-C number	: 1788	Issue Date	: 21-Jun-2019
Sampler	: sch4p4(6) Per		
Site	: new chum-2		
Quote number	: BN/021/19 V3		
No. of samples received	: 2		
No. of samples analysed	: 2		



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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Pe		Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2400692)									
EB1914836-001	Anonymous	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0140	0.0130	7.10	0% - 20%
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	0.0135	0.0136	1.10	0% - 20%
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	0.0024	0.0023	0.00	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0110	0.0123	11.2	0% - 20%
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	0.0010	0.0009	0.00	No Limit
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2400692)									
EB1914836-001	Anonymous	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	0.0073	0.0074	1.36	0% - 50%
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	0.0138	0.0138	0.00	0% - 20%
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	0.0042	0.0042	0.00	No Limit
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	0.0055	0.0054	0.00	0% - 50%
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2400692) - continued									
EB1914836-001	Anonymous	EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2400692)									
EB1914836-001	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2400692)									
EB1914836-001	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.00	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2400692)									
EB1914836-001	Anonymous	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0250	0.0253	1.19	0% - 20%
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0693	0.0697	0.576	0% - 20%
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	0.0727	0.0729	0.275	0% - 20%



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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2400692)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	110	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	100	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	96.2	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	120	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	107	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	80.8	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2400692)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	35.8	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	113	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	106	50	130
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	117	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	124	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	112	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	104	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	116	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	54.8	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	85.1	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2400692)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	98.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	93.3	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	107	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	85.8	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	77.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	79.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	78.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2400692)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	125	50	130

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2400692) - continued								
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	125	50	130
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	123	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	99.4	50	130
EP231P: PFAS Sums (QCLot: 2400692)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2400692)							
EB1914836-004	Anonymous	EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0025 µg/L	84.8	50	130
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0025 µg/L	125	50	130
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0025 µg/L	69.6	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2400692)							
EB1914836-004	Anonymous	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.0125 µg/L	34.7	30	130
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0025 µg/L	112	50	130
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0025 µg/L	# Not Determined	50	130
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0025 µg/L	120	50	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0025 µg/L	59.0	50	130
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0025 µg/L	116	50	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0025 µg/L	84.2	50	130
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0025 µg/L	95.2	40	130
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0025 µg/L	100	40	130
		EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0025 µg/L	48.2	40	130
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00625 µg/L	123	40	130

Released

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2400692)							
EB1914836-004	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0025 µg/L	64.4	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00625 µg/L	68.4	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00625 µg/L	55.8	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00625 µg/L	60.2	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00625 µg/L	55.2	40	130
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0025 µg/L	59.8	40	130
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0025 µg/L	50.6	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2400692)							
EB1914836-004	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0025 µg/L	120	50	130
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0025 µg/L	124	50	130
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0025 µg/L	121	50	130
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0025 µg/L	72.4	50	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1914939	Page	: 1 of 4
Amendment	: 1		
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Telephone	: sch4p4(6) Perso
Project	: New Chum PFAS	Date Samples Received	: 11-Jun-2019
Site	: new chum-2	Issue Date	: 21-Jun-2019
Sampler	: sch4p4(6) Pers	No. of samples received	: 2
Order number	: -	No. of samples analysed	: 2

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	Anonymous	Perfluorobutane sulfonic acid (PFBS)	375-73-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	Anonymous	Perfluorohexane sulfonic acid (PFHxS)	355-46-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231A: Perfluoroalkyl Sulfonic Acids	EB1914836--004	Anonymous	Perfluorooctane sulfonic acid (PFOS)	1763-23-1	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP231B: Perfluoroalkyl Carboxylic Acids	EB1914836--004	Anonymous	Perfluorohexanoic acid (PFHxA)	307-24-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) SMC2,	SMC3	11-Jun-2019	13-Jun-2019	08-Dec-2019	✓	13-Jun-2019	08-Dec-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT) SMC2,	SMC3	11-Jun-2019	13-Jun-2019	08-Dec-2019	✓	13-Jun-2019	08-Dec-2019	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT) SMC2,	SMC3	11-Jun-2019	13-Jun-2019	08-Dec-2019	✓	13-Jun-2019	08-Dec-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) SMC2,	SMC3	11-Jun-2019	13-Jun-2019	08-Dec-2019	✓	13-Jun-2019	08-Dec-2019	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT) SMC2,	SMC3	11-Jun-2019	13-Jun-2019	08-Dec-2019	✓	13-Jun-2019	08-Dec-2019	✓



Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

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Samples collected High AS Comparison

COC NO. 1788

Relinquished by:

10/6/19 1000 AM

Environmental Division
Brisbane

Work Order Reference
EB1914939



Telephone : +61-7-3243 7222

sch4p4(6) Personal information

sch4p4(6) Personal information

REC - DW
11-6-19
12-00

 CHAIN OF CUSTODY COC#: 1788 ALS Laboratory: EB Brisbane		RELINQUISHED BY: DATE TIME:	RECEIVED BY: DATE TIME:	RELINQUISHED BY: DATE TIME:	RECEIVED BY: DATE TIME:
CLIENT: EPIENV - EPIC ENVIRONMENTAL PROJECT: New Chum PFAS SITE: new chum-2 ORDER NO: PROJECT MANAGER: sch4p4(6) P PRIMARY SAMPLER: sch4p4(6) Pe EMAIL REPORTS TO: EMAIL INVOICES TO:		TURNAROUND REQUIREMENTS : 2 Days Biohazard info:		LABORATORY USE ONLY (Circle) Custody Seal intact? Yes No N/A Free ice / frozen ice bricks present upon receipt? Yes No N/A Random Sample Temperature on Receipt: C Other comments:	
		CONTACT PH: sch4p4(6) Pe SAMPLER MOBILE: sch4p4(6) QUOTE NO: BN/021/19 V3 / EB2019EPIENV0004			

SAMPLE DETAILS							ANALYSIS REQUIRED		
SAMPLE	NAME	DESCRIPTION	DATE / TIME	MATRIX	TOTAL BOTTLES	ON HOLD	Table 1: Groundwater - Quarterly GROUNDWATER	ALTERNATIVE ANALYSIS	ADDITIONAL INFORMATION
001	SMC2		11/06/2019 08:28 AM	Water	ALS: 3 Non ALS: 0	No	Partial 1/11		
002	SMC3		11/06/2019 08:29 AM	Water	ALS: 2 Non ALS: 0	No	Partial 1/11		

**CHAIN OF CUSTODY**

COC#: 1788

ALS Laboratory: EB Brisbane

RELINQUISHED BY:

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY:

DATE TIME:

DATE TIME:

DATE TIME:

DATE TIME:

CLIENT: EPIENV - EPIC ENVIRONMENTAL

PROJECT: New Chum PFAS

SITE: new chum-2

ORDER NO:

PROJECT MANAGER: sch4p4(6) P

PRIMARY SAMPLER: sch4p4(6) P

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 2 Days

Biohazard info:

CONTACT PH: sch4p4(6) P

SAMPLER MOBILE: sch4p4(6) P

QUOTE NO: BN/021/19 V3

/ EB2019EPIENV0004

LABORATORY USE ONLY (Circle)

Custody Seal intact? Yes No N/A

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

Random Sample Temperature on Receipt: °C

Other comments:

SAMPLE	SAMPLE NAME	PARTIAL ANALYSIS GROUP NAME	MATRIX	SELECTED ANALYSIS NAME
001	SMC2	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)
002	SMC3	Table 1: Groundwater - Quarterly GROUNDWATER	Water	- EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (28 analytes)



ALS Laboratory: EB Brisbane

RECEIVED BY:

DATE TIME:

Other comments:

CERTIFICATE OF ANALYSIS 219420

Client Details

Client	Epic Environmental Pty Ltd
Attention	sch4p4(6) Pe
Address	Level 6, 193 North Quay, Brisbane, QLD, 4000

Sample Details

Your Reference	BC190012.01, New Chum
Number of Samples	2 WATER
Date samples received	12/06/2019
Date completed instructions received	12/06/2019

Analysis Details

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

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

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

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	17/06/2019
Date of Issue	17/06/2019
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

sch4p4(6) Personal information Senior Chemist

Authorised By

sch4p4(6) Personal information

sch4p4(6) Personal information Laboratory Manager

PFAS in Waters Trace Extended			
Our Reference		219420-1	219420-2
Your Reference	UNITS	SQA1A	GQA1A
Date Sampled		07/06/2019	05/06/2019
Type of sample		WATER	WATER
Date prepared	-	13/06/2019	13/06/2019
Date analysed	-	14/06/2019	14/06/2019
Perfluorobutanesulfonic acid	µg/L	0.012	<0.0004
Perfluoropentanesulfonic acid	µg/L	0.003	<0.001
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.013	<0.0002
Perfluoroheptanesulfonic acid	µg/L	<0.001	<0.001
Perfluorooctanesulfonic acid PFOS	µg/L	0.015	<0.0002
Perfluorodecanesulfonic acid	µg/L	<0.002	<0.002
Perfluorobutanoic acid	µg/L	0.031	<0.02
Perfluoropentanoic acid	µg/L	0.01	<0.02
Perfluorohexanoic acid	µg/L	0.012	<0.0004
Perfluoroheptanoic acid	µg/L	0.0042	<0.0004
Perfluorooctanoic acid PFOA	µg/L	0.0057	<0.0002
Perfluorononanoic acid	µg/L	<0.001	<0.001
Perfluorodecanoic acid	µg/L	<0.002	<0.002
Perfluoroundecanoic acid	µg/L	<0.002	<0.002
Perfluorododecanoic acid	µg/L	<0.005	<0.005
Perfluorotridecanoic acid	µg/L	<0.01	<0.01
Perfluorotetradecanoic acid	µg/L	<0.05	<0.05
4:2 FTS	µg/L	<0.001	<0.001
6:2 FTS	µg/L	<0.0004	<0.0004
8:2 FTS	µg/L	<0.0004	<0.0004
10:2 FTS	µg/L	<0.001	<0.001
Perfluorooctane sulfonamide	µg/L	<0.01	<0.01
N-Methyl perfluorooctane sulfonamide	µg/L	<0.005	<0.005
N-Ethyl perfluorooctanesulfonamide	µg/L	<0.01	<0.01
N-Me perfluorooctanesulfonamid oethanol	µg/L	<0.005	<0.005
N-Et perfluorooctanesulfonamid oethanol	µg/L	<0.05	<0.05
MePerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
EtPerfluorooctanesulf- amid oacetic acid	µg/L	<0.002	<0.002
Surrogate ¹³ C ₈ PFOS	%	102	95
Surrogate ¹³ C ₂ PFOA	%	93	90
Extracted ISTD ¹³ C ₃ PFBS	%	95	86
Extracted ISTD ¹⁸ O ₂ PFHxS	%	97	98
Extracted ISTD ¹³ C ₄ PFOS	%	93	96
Extracted ISTD ¹³ C ₄ PFBA	%	43	69

PFAS in Waters Trace Extended			
Our Reference		219420-1	219420-2
Your Reference	UNITS	SQA1A	GQA1A
Date Sampled		07/06/2019	05/06/2019
Type of sample		WATER	WATER
Extracted ISTD ¹³ C ₃ PFPeA	%	46	78
Extracted ISTD ¹³ C ₂ PFHxA	%	88	68
Extracted ISTD ¹³ C ₄ PFHpA	%	92	92
Extracted ISTD ¹³ C ₄ PFOA	%	101	110
Extracted ISTD ¹³ C ₅ PFNA	%	107	115
Extracted ISTD ¹³ C ₂ PFDA	%	92	92
Extracted ISTD ¹³ C ₂ PFUnDA	%	72	77
Extracted ISTD ¹³ C ₂ PFDoDA	%	60	64
Extracted ISTD ¹³ C ₂ PFTeDA	%	66	61
Extracted ISTD ¹³ C ₂ 4:2FTS	%	128	84
Extracted ISTD ¹³ C ₂ 6:2FTS	%	188	173
Extracted ISTD ¹³ C ₂ 8:2FTS	%	139	104
Extracted ISTD ¹³ C ₈ FOSA	%	58	56
Extracted ISTD d ₃ N MeFOSA	%	44	39
Extracted ISTD d ₅ N EtFOSA	%	46	42
Extracted ISTD d ₇ N MeFOSE	%	54	49
Extracted ISTD d ₉ N EtFOSE	%	53	51
Extracted ISTD d ₃ N MeFOSAA	%	104	109
Extracted ISTD d ₅ N EtFOSAA	%	84	106
Total Positive PFHxS & PFOS	µg/L	0.028	<0.0002
Total Positive PFOS & PFOA	µg/L	0.020	<0.0002
Total Positive PFAS	µg/L	0.11	<0.02

Method ID	Methodology Summary
Org-035	<p>Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. Analysis is undertaken with LC-MS/MS.</p> <p>PFAS results include the sum of branched and linear isomers where applicable.</p> <p>Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.1 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components.</p> <p>Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.</p>

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QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			13/06/2019	[NT]	[NT]	[NT]	[NT]	13/06/2019	[NT]
Date analysed	-			14/06/2019	[NT]	[NT]	[NT]	[NT]	14/06/2019	[NT]
Perfluorobutanesulfonic acid	µg/L	0.0004	Org-035	<0.0004	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluoropentanesulfonic acid	µg/L	0.001	Org-035	<0.001	[NT]	[NT]	[NT]	[NT]	115	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-035	<0.0002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Perfluoroheptanesulfonic acid	µg/L	0.001	Org-035	<0.001	[NT]	[NT]	[NT]	[NT]	118	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-035	<0.0002	[NT]	[NT]	[NT]	[NT]	110	[NT]
Perfluorodecanesulfonic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	90	[NT]
Perfluorobutanoic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	105	[NT]
Perfluoropentanoic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	108	[NT]
Perfluorohexanoic acid	µg/L	0.0004	Org-035	<0.0004	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoroheptanoic acid	µg/L	0.0004	Org-035	<0.0004	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-035	<0.0002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluorononanoic acid	µg/L	0.001	Org-035	<0.001	[NT]	[NT]	[NT]	[NT]	94	[NT]
Perfluorodecanoic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	99	[NT]
Perfluoroundecanoic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	93	[NT]
Perfluorododecanoic acid	µg/L	0.005	Org-035	<0.005	[NT]	[NT]	[NT]	[NT]	104	[NT]
Perfluorotridecanoic acid	µg/L	0.01	Org-035	<0.01	[NT]	[NT]	[NT]	[NT]	80	[NT]
Perfluorotetradecanoic acid	µg/L	0.05	Org-035	<0.05	[NT]	[NT]	[NT]	[NT]	110	[NT]
4:2 FTS	µg/L	0.001	Org-035	<0.001	[NT]	[NT]	[NT]	[NT]	110	[NT]
6:2 FTS	µg/L	0.0004	Org-035	<0.0004	[NT]	[NT]	[NT]	[NT]	101	[NT]
8:2 FTS	µg/L	0.0004	Org-035	<0.0004	[NT]	[NT]	[NT]	[NT]	108	[NT]
10:2 FTS	µg/L	0.001	Org-035	<0.001	[NT]	[NT]	[NT]	[NT]	98	[NT]
Perfluorooctane sulfonamide	µg/L	0.01	Org-035	<0.01	[NT]	[NT]	[NT]	[NT]	113	[NT]
N-Methyl perfluorooctane sulfonamide	µg/L	0.005	Org-035	<0.005	[NT]	[NT]	[NT]	[NT]	115	[NT]
N-Ethyl perfluorooctanesulfonamide	µg/L	0.01	Org-035	<0.01	[NT]	[NT]	[NT]	[NT]	109	[NT]
N-Me perfluorooctanesulfonamid oethanol	µg/L	0.005	Org-035	<0.005	[NT]	[NT]	[NT]	[NT]	118	[NT]
N-Et perfluorooctanesulfonamid oethanol	µg/L	0.05	Org-035	<0.05	[NT]	[NT]	[NT]	[NT]	117	[NT]
MePerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	108	[NT]
EtPerfluorooctanesulf- amid oacetic acid	µg/L	0.002	Org-035	<0.002	[NT]	[NT]	[NT]	[NT]	103	[NT]
Surrogate ¹³ C ₈ PFOS	%		Org-035	98	[NT]	[NT]	[NT]	[NT]	105	[NT]
Surrogate ¹³ C ₂ PFOA	%		Org-035	97	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD ¹³ C ₃ PFBS	%		Org-035	89	[NT]	[NT]	[NT]	[NT]	93	[NT]
Extracted ISTD ¹⁸ O ₂ PFHxS	%		Org-035	97	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD ¹³ C ₄ PFOS	%		Org-035	79	[NT]	[NT]	[NT]	[NT]	77	[NT]
Extracted ISTD ¹³ C ₄ PFBA	%		Org-035	98	[NT]	[NT]	[NT]	[NT]	97	[NT]
Extracted ISTD ¹³ C ₃ PFPeA	%		Org-035	93	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD ¹³ C ₂ PFHxA	%		Org-035	98	[NT]	[NT]	[NT]	[NT]	98	[NT]
Extracted ISTD ¹³ C ₄ PFHpA	%		Org-035	96	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD ¹³ C ₄ PFOA	%		Org-035	98	[NT]	[NT]	[NT]	[NT]	94	[NT]
Extracted ISTD ¹³ C ₅ PFNA	%		Org-035	89	[NT]	[NT]	[NT]	[NT]	86	[NT]
Extracted ISTD ¹³ C ₂ PFDA	%		Org-035	71	[NT]	[NT]	[NT]	[NT]	76	[NT]
Extracted ISTD ¹³ C ₂ PFUnDA	%		Org-035	58	[NT]	[NT]	[NT]	[NT]	64	[NT]
Extracted ISTD ¹³ C ₂ PFDoDA	%		Org-035	52	[NT]	[NT]	[NT]	[NT]	59	[NT]
Extracted ISTD ¹³ C ₂ PFTeDA	%		Org-035	85	[NT]	[NT]	[NT]	[NT]	78	[NT]
Extracted ISTD ¹³ C ₂ 4:2FTS	%		Org-035	96	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD ¹³ C ₂ 6:2FTS	%		Org-035	143	[NT]	[NT]	[NT]	[NT]	143	[NT]
Extracted ISTD ¹³ C ₂ 8:2FTS	%		Org-035	53	[NT]	[NT]	[NT]	[NT]	56	[NT]
Extracted ISTD ¹³ C ₈ FOSA	%		Org-035	71	[NT]	[NT]	[NT]	[NT]	69	[NT]
Extracted ISTD d ₃ N MeFOSA	%		Org-035	58	[NT]	[NT]	[NT]	[NT]	58	[NT]
Extracted ISTD d ₅ N EtFOSA	%		Org-035	55	[NT]	[NT]	[NT]	[NT]	54	[NT]
Extracted ISTD d ₇ N MeFOSE	%		Org-035	69	[NT]	[NT]	[NT]	[NT]	68	[NT]

QUALITY CONTROL: PFAS in Waters Trace Extended					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Extracted ISTD d ₉ N EtFOSE	%		Org-035	69	[NT]	[NT]	[NT]	[NT]	67	[NT]
Extracted ISTD d ₃ N MeFOSAA	%		Org-035	62	[NT]	[NT]	[NT]	[NT]	71	[NT]
Extracted ISTD d ₅ N EtFOSAA	%		Org-035	55	[NT]	[NT]	[NT]	[NT]	66	[NT]

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Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).

PFAS_trace: PQLs have been raised for PFBA and PFPeA for sample 219420-2 due to low SPE internal standard recovery.

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Chain of Custody Record

Project No: BC190012.01				Lab: envirolab				ANALYSIS REQUIRED																			
Project/Site: New Chum				Lab Quote No:																							
Sampled By: sch4p4(6)				Lab Batch No:																							
Phone: sch4p4(6)				Date Results Required: 3 Day																							
Page 1 of 1				Sample Disposal After:																							
Number of Eskies: 1				CONTAINER TYPE & PRESERVATIVE																							
LAB ID	SAMPLE ID	DATE	MATRIX	Soil	Soil	Soil	Water					PFAS extended suite (super Ultra Trace)	HOLD														
				0.1-0.2 L	-	0.1-0.2 L	0.5-1.0 L	40-50ml	0.25-1 L	0.2-1.0L																	
				Glass jar, unpreserved	Plastic bag	Plastic jar	Amber glass, unpreserved	Glass, unpreserved	Plastic, unpreserved	Plastic, sterile																	
1	SQA1A	07-06-19								X		X															
2	GQA1A	05-06-19								X		X															
<div style="text-align: center;"> Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200 Job No: 219420 Date Received: 12/6/19 Time Received: 11:27 Received by: SJB Temp: Cool/Ambient Cooling: Ice/icepack Security: Intact/Broken/None</div>																											
TOTALS																											
Relinquished By: sch4p4(6) Personal info				Received By: Envirolab Brisbane				Custody Seals Intact																			
NAME: sch4p4(6)				NAME: sch4p4(6)				Samples Received Chilled																			
SIGNATURE: MW				SIGNATURE: sch4p4(6) Person				Method of Shipment: Carrier																			
DATE: 28-06-19				DATE: 10/6/19																							
NOTES:																											

SAMPLE RECEIPT ADVICE

Client Details

Client	Epic Environmental Pty Ltd
Attention	sch4p4(6) Pers

Sample Login Details

Your reference	BC190012.01, New Chum
Envirolab Reference	219420
Date Sample Received	12/06/2019
Date Instructions Received	12/06/2019
Date Results Expected to be Reported	17/06/2019

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	2 WATER
Turnaround Time Requested	3 days
Temperature on Receipt (°C)	8.5
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

sch4p4(6) Pers

Phone: sch4p4(6) Pers

Fax: sch4p4(6) Pers

Email: sch4p@envirolab.com.au

sch4p4(6) Personal in

Phone: sch4p4(6) Pers

Fax: sch4p4(6) Pers

Email: sch4p4(6) envirolab.com.au

Analysis Underway, details on the following page:



Envirolab Services Pty Ltd

ABN 37 112 535 645

12 Ashley St Chatswood NSW 2067

ph 02 9910 6200 fax 02 9910 6201

customerservice@envirolab.com.au

www.envirolab.com.au

Sample ID	
SQA1A	✓
GQA1A	✓

PFAS in Waters Trace Extended

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CERTIFICATE OF ANALYSIS

Work Order : **EB1918998**
Client : **EPIC ENVIRONMENTAL**
Contact : sch4p4(6) Pers
Address : BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY
 BRISBANE QLD, AUSTRALIA 4000
Telephone : ----
Project : BC190012.01
Order number :
C-O-C number : 2669
Sampler : sch4p4(6) Pers
Site : New chum
Quote number : BN/021/19 V4
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 5
Laboratory : Environmental Division Brisbane
Contact : sch4p4(6) Pers
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : sch4p4(6) Person
Date Samples Received : 23-Jul-2019 14:00
Date Analysis Commenced : 25-Jul-2019
Issue Date : 26-Jul-2019 13:23



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Perso	LCMS Coordinator	Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

- Super Ultra Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).

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Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH12	----	----	----	----
Client sampling date / time				22-Jul-2019 17:05	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1918998-001	-----	-----	-----	-----
				Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	0.0010	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0074	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0012	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	----	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH12	----	----	----	----
Client sampling date / time				22-Jul-2019 17:05	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1918998-001	-----	-----	-----	-----
Result				----	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	0.009	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	----	----	----	----
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0084	----	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0174	----	----	----	----
^ Sum of PFAS	----	0.0002	µg/L	0.0174	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	74.0	----	----	----	----
13C8-PFOA	----	0.0005	%	82.0	----	----	----	----



Surrogate Control Limits

Sub-Matrix: GROUNDWATER

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

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QUALITY CONTROL REPORT

Work Order	: EB1918998	Page	: 1 of 4
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: [redacted]	Contact	: [redacted]
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: [redacted]
Project	: BC190012.01	Date Samples Received	: 23-Jul-2019
Order number	:	Date Analysis Commenced	: 25-Jul-2019
C-O-C number	: 2669	Issue Date	: 26-Jul-2019
Sampler	: [redacted]		
Site	: New chum		
Quote number	: BN/021/19 V4		
No. of samples received	: 1		
No. of samples analysed	: 1		



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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	Position	Accreditation Category
[redacted]	LCMS Coordinator	Sydney Organics, Smithfield, NSW



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

- **No Laboratory Duplicate (DUP) Results are required to be reported.**

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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2485934)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	74.8	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	93.2	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	89.6	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	94.0	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	82.4	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	62.6	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2485934)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	33.4	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	97.4	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	94.4	50	130
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	105	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	107	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	102	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	87.2	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	69.2	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	55.0	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	42.4	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	82.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2485934)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	71.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	65.0	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	53.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	57.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	65.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	68.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	78.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2485934)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	102	50	130

Released



Sub-Matrix: **WATER**

				Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit					
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2485934) - continued								
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	104	50	130
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	87.4	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	78.2	50	130
EP231P: PFAS Sums (QCLot: 2485934)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

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QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1918998	Page	: 1 of 4
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Telephone	: sch4p4(6) Persona
Project	: BC190012.01	Date Samples Received	: 23-Jul-2019
Site	: New chum	Issue Date	: 26-Jul-2019
Sampler	: sch4p4(6) Pers	No. of samples received	: 1
Order number	:	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-SUT) BH12	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-SUT) BH12	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-SUT) BH12	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-SUT) BH12	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-SUT) BH12	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓



Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	0	7	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	0	7	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard

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Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1918998**

Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: [redacted]	Contact	: [redacted]
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: [redacted] @epicenvironmental.com.au	E-mail	: [redacted] @alsglobal.com
Telephone	: ----	Telephone	: [redacted]
Facsimile	: ----	Facsimile	: [redacted]
Project	: BC190012.01	Page	: 1 of 2
Order number	:	Quote number	: EB2019EPIENV0006 (BN/021/19 V4)
C-O-C number	: 2669	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: New chum		
Sampler	: [redacted]		

Dates

Date Samples Received	: 23-Jul-2019 14:00	Issue Date	: 23-Jul-2019
Client Requested Due Date	: 26-Jul-2019	Scheduled Reporting Date	: 26-Jul-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 10.2°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **A 10% surcharge applies for results returned within 3 days.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Super Ultra Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	
EB1918998-001	22-Jul-2019 17:05	BH12	✓

WATER - EP231X-SUT
PFAS - Super Ultra Trace Waters Long Suite (28)

Proactive Holding Time Report

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

Requested Deliverables

INVOICES & RESULTS

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - XTab (XTAB)

Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au
Email	labs@epicenvironmental.com.au



Custody Document

ALS USE ONLY (Circle)

Custody Seal Intact?	YES	NO	N/A
Free ice / frozen ice bricks present upon receipt?	YES	NO	N/A
Random Sample Temperature on receipt		°C	

Project: BC190012.01 Client: _____ Project Manager: sch4p4(6) Personal information
 Phone: (_____ sch4p4(6) Personal information
 ALS Compass COC Ref: 2669 # Samples: 1 Sampler: sch4p4(6) Personal information
 Phone: (_____

Turnaround Requirement: Standard _____ Urgent 3 2

Special Instructions:

Custody:

Relinquished by: <u>LA</u>	Received by: <u>sch4p4(6) Personal information</u>	Relinquished by:	Received by:
Date / Time: <u>23/7/19</u>	Date / Time: <u>23-7-19 1400</u>	Date / Time:	Date / Time:

CERTIFICATE OF ANALYSIS

Work Order : **EB1918999**
Client : **EPIC ENVIRONMENTAL**
Contact : sch4p4(6) Pers
Address : BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY
 BRISBANE QLD, AUSTRALIA 4000
Telephone : ----
Project : BC190012.01
Order number :
C-O-C number : 2706
Sampler : sch4p4(6) Pers
Site : New chum b
Quote number : BN/021/19 V4
No. of samples received : 2
No. of samples analysed : 2

Page : 1 of 7
Laboratory : Environmental Division Brisbane
Contact : sch4p4(6) P
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : sch4p4(6) Persor
Date Samples Received : 23-Jul-2019 14:00
Date Analysis Commenced : 24-Jul-2019
Issue Date : 26-Jul-2019 14:14



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
sch4p4(6) Pers	LCMS Coordinator	Sydney Organics, Smithfield, NSW
sch4p4(6)	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

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

- Super Ultra Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).

Published on DES Disclosure Log
RTI Act 2009



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH3	BH18	----	----	----
Client sampling date / time				22-Jul-2019 17:07	22-Jul-2019 17:08	----	----	----
Compound	CAS Number	LOR	Unit	EB1918999-001	EB1918999-002	-----	-----	-----
				Result	Result	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH3	BH18	----	----	----
Client sampling date / time				22-Jul-2019 17:07	22-Jul-2019 17:08	----	----	----
Compound	CAS Number	LOR	Unit	EB1918999-001	EB1918999-002	-----	-----	-----
				Result	Result	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	----	----	----
EP231_TOP_P: PFAS Sums								
Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	----	----	----
^ Sum of TOP C4 - C14 as Fluorine	----	0.002	µg/L	<0.002	<0.002	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.002	µg/L	<0.002	<0.002	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH3	BH18	----	----	----
Client sampling date / time				22-Jul-2019 17:07	22-Jul-2019 17:08	----	----	----
Compound	CAS Number	LOR	Unit	EB1918999-001	EB1918999-002	-----	-----	-----
				Result	Result	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	0.0003	<0.0002	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	<0.0020	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	----	----	----



Analytical Results

Sub-Matrix: GROUNDWATER
 (Matrix: WATER)

Client sample ID

				BH3	BH18	----	----	----
Client sampling date / time				22-Jul-2019 17:07	22-Jul-2019 17:08	----	----	----
Compound	CAS Number	LOR	Unit	EB1918999-001	EB1918999-002	-----	-----	-----
				Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	----	----	----
EP231P: PFAS Sums								
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	0.0003	<0.0002	----	----	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	0.0003	<0.0002	----	----	----
^ Sum of PFAS	----	0.0002	µg/L	0.0003	<0.0002	----	----	----
EP231_TOP_S: PFAS Surrogate								
13C4-PFOS	----	0.002	%	65.1	92.6	----	----	----
13C8-PFOA	----	0.002	%	98.8	115	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	69.2	72.7	----	----	----
13C8-PFOA	----	0.0005	%	86.4	104	----	----	----



Surrogate Control Limits

Sub-Matrix: GROUNDWATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

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Environmental

QUALITY CONTROL REPORT

Work Order	: EB1918999	Page	: 1 of 6
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Contact	: sch4p4(6) Per
Address	: BP HOUSE SUITE 3, LEVEL 6 193 NORTH QUAY BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: sch4p4(6) Person
Project	: BC190012.01	Date Samples Received	: 23-Jul-2019
Order number	:	Date Analysis Commenced	: 24-Jul-2019
C-O-C number	: 2706	Issue Date	: 26-Jul-2019
Sampler	: sch4p4(6) Per		
Site	: New chum b		
Quote number	: BN/021/19 V4		
No. of samples received	: 2		
No. of samples analysed	: 2		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
sch4p4(6) Pe	LCMS Coordinator	Sydney Organics, Smithfield, NSW
sch4p4(6)	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2482501)									
EB1918999-001	BH3	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2482501)									
EB1918999-001	BH3	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2482501)									

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2482501) - continued									
EB1918999-001	BH3	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2482501)									
EB1918999-001	BH3	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2482501)									
EB1918999-001	BH3	EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of TOP C4 - C14 as Fluorine	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit



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

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

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2482501)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.473 µg/L	79.8	50	150
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.464 µg/L	54.4	50	150
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2482501)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	----	----	----	----
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.5 µg/L	66.9	50	150
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2482501)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2482501)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.0474 µg/L	4.85	0	200

Released



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2482501) - continued								
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	----	----	----	----
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2482501)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of TOP C4 - C14 as Fluorine	----	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.002	µg/L	<0.002	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2485934)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.0025 µg/L	74.8	50	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.0025 µg/L	93.2	50	130
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.0025 µg/L	89.6	50	130
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.0025 µg/L	94.0	50	130
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.0025 µg/L	82.4	50	130
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.0025 µg/L	62.6	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2485934)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.0125 µg/L	33.4	30	130
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.0025 µg/L	97.4	50	130
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.0025 µg/L	94.4	50	130
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.0025 µg/L	105	50	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.0025 µg/L	107	50	130
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.0025 µg/L	102	50	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.0025 µg/L	87.2	50	130
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	69.2	40	130
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.0025 µg/L	55.0	40	130
EP231X-SUT: Perfluorotridecanoic acid (PFTTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.0025 µg/L	42.4	40	130
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.00625 µg/L	82.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2485934)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.0025 µg/L	71.2	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.00625 µg/L	65.0	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.00625 µg/L	53.8	40	130
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.00625 µg/L	57.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.00625 µg/L	65.2	40	130

Released



Sub-Matrix: **WATER**

				Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit					
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2485934) - continued								
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.0025 µg/L	68.4	40	130
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.0025 µg/L	78.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2485934)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.0025 µg/L	102	50	130
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.0025 µg/L	104	50	130
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.0025 µg/L	87.4	50	130
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.0025 µg/L	78.2	50	130
EP231P: PFAS Sums (QCLot: 2485934)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

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QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1918999	Page	: 1 of 5
Client	: EPIC ENVIRONMENTAL	Laboratory	: Environmental Division Brisbane
Contact	: sch4p4(6) Pers	Telephone	: sch4p4(6) Person
Project	: BC190012.01	Date Samples Received	: 23-Jul-2019
Site	: New chum b	Issue Date	: 26-Jul-2019
Sampler	: sch4p4(6) Pers	No. of samples received	: 2
Order number	:	No. of samples analysed	: 2

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL (TOP)) BH3,	BH18	22-Jul-2019	24-Jul-2019	18-Jan-2020	✓	24-Jul-2019	18-Jan-2020	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-LL (TOP)) BH3,	BH18	22-Jul-2019	24-Jul-2019	18-Jan-2020	✓	24-Jul-2019	18-Jan-2020	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-LL (TOP)) BH3,	BH18	22-Jul-2019	24-Jul-2019	18-Jan-2020	✓	24-Jul-2019	18-Jan-2020	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-LL (TOP)) BH3,	BH18	22-Jul-2019	24-Jul-2019	18-Jan-2020	✓	24-Jul-2019	18-Jan-2020	✓
EP231_TOP_P: PFAS Sums								
HDPE (no PTFE) (EP231X-LL (TOP)) BH3,	BH18	22-Jul-2019	24-Jul-2019	18-Jan-2020	✓	24-Jul-2019	18-Jan-2020	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) BH3,	BH18	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT) BH3,	BH18	22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT) BH3, BH18		22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) BH3, BH18		22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT) BH3, BH18		22-Jul-2019	25-Jul-2019	18-Jan-2020	✓	25-Jul-2019	18-Jan-2020	✓

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Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	0	7	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after SPE and oxidation (TOP)	EP231X-LL (TOP)	1	3	33.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after SPE and oxidation (TOP)	EP231X-LL (TOP)	1	3	33.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after SPE and oxidation (TOP)	EP231X-LL (TOP)	1	3	33.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	0	7	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard

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Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
PFAS by LCMSMS after SPE and oxidation (TOP)	EP231X-LL (TOP)	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by oxidation per Houtz, Erika F.; Sedlak, David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342;9349. Sample extracts are analysed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house
Total Oxidisable Precursor Digest for PFAS - Low Level	* ORG70-SPE	WATER	In-House SPE followed by oxidation per Houtz, Erika F.; Sedlak, David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342;9349: A 50 mL sample is concentrated by SPE, taken to near dryness and made up to 5 mL in a reagent solution. The sample is digested with persulfate under alkaline conditions, neutralised and prepared for analysis per EP231.



Environmental Division
Brisbane
Work Order Reference
EB1918999



Telephone : + 61-7-3243 7222

Custody Document

ALS USE ONLY (Circle)

Custody Seal Intact?	YES	NO	N/A
Free ice / frozen ice bricks present upon receipt?	YES	NO	N/A
Random Sample Temperature on receipt		°C	

Project: BK190012.01 Client: _____ Project Manager: sch4p4(6) Personal information
 Phone: (sch4p4(6) Personal information)
 ALS Compass COC Ref: 2796 # Samples: 2 Sampler: sch4p4(6) Personal information
 Phone: (_____)

Turnaround Requirement Standard _____ Urgent 3 Days

Special Instructions:

Custody:

Relinquished by: <u>LA</u>	Received by: <u>sch4p4(6) Personal information</u>	Relinquished by:	Received by:
Date / Time: <u>23/7/14</u>	Date / Time: <u>23-7-14 140</u>	Date / Time:	Date / Time:

Attachment 2 – New Chum Landfill – Qualitative PFAS Risk Assessment, Epic Environmental Pty Ltd, Revision 0, 26 July 2019.

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**NEW CHUM LANDFILL -
QUALITATIVE PFAS RISK
ASSESMENT**





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**NEW CHUM LANDFILL -
QUALITATIVE PFAS RISK
ASSESSMENT**

26 JULY 2019

NEW CHUM LANDFILL

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1 Introduction

Cleanaway Solid Waste Pty Ltd (CWS) has submitted a development application to the Ipswich City Council (ICC) for a Material Change of Use (MCU) for the redesign and rehabilitation of the landform of the existing New Chum Waste Management Facility located at 100 Chum Street, New Chum. As part of the MCU application, the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) issued a Request for Information (RFI) relating to environmental relevant activities – groundwater and surface water on 17 June 2019.

Epic Environmental Pty Ltd (Epic) were commissioned by CSW to undertake a qualitative risk assessment for per- and poly-fluoroalkyl substances (PFAS) to support the RFI response.

The site comprises the New Chum Landfill and is legally identified as Lot 268 SP103913 and Lot 227 SP103913 (the site).

1.1 Background and Objectives

CSW previously submitted a Leachate, Surface Water and Hydrogeological Assessment (GHD 2019a)¹ as part of the MCU application. GHD (2019a) reported detectible concentrations of PFAS in leachate and onsite surface water bodies, with no PFAS detected above the laboratory's limit of reporting (LOR) in groundwater monitoring wells. However, the laboratory LORs adopted were above the PFAS NEMP² 99% Species Protection Freshwater Guideline Values (High conservation value systems).

Following the receipt of the RFI, Epic were engaged and completed a supplementary monitoring program at the support, as reported in Epic (2019)³. The supplementary monitoring program reported detectible concentrations of PFAS compounds in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18), with concentrations of PFOS reported above the PFAS NEMP 99% Species Protection Freshwater Guideline Values in BH03, BH12 and BH18. Concentrations of PFAS compounds were reported in all of the onsite, upstream and downstream surface water monitoring locations, with all locations reporting detectible concentrations of PFOS.

The objective of this Qualitative PFAS Risk Assessment is to present an updated Conceptual Site Model (CSM) that discusses PFAS and undertake a qualitative risk assessment in accordance with the NEPM⁴ risk assessment methodology (Schedule B4) and the PFAS NEMP (section 9.1.7) utilising the source-

¹ GHD (2019a). Redesign & Rehabilitation of the New Chum Waste Management Facility: Leachate, Surface water and Hydrogeological Assessment, April 2019.

² Heads of EPAs Australia and New Zealand (HEPA), PFAS National Environmental Management Plan (NEMP), January 2018.

³ Epic (2019). New Chum Landfill – Environmental Monitoring (PFAS), 26 July 2019.

⁴ National Environmental Protection Council (NEPC), 2013, National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM).

pathway-receptor model to identify and prioritise potential risks associated with PFAS to inform the New Chum landform design and MCU application.

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2 Conceptual Site Model - PFAS

A CSM and qualitative assessment of risk have been prepared in relation to potential risks and impacts associated with PFAS at the site. The CSM has been prepared based on pertinent information contained in GHD (2019a) and GHD (2019b)⁵, with a summary of key information presented below.

Assessment of PFAS risks and impacts has been completed utilising the findings of PFAS investigations (GHD 2019 and Epic 2019) utilising the source-pathway-receptor model presented below.

2.1 Physical Environment

With reference to published geological information, the primary geological unit underlying the site and surrounding areas is the Blackstone Formation (Ipswich Coal Measures), comprising shale, siltstone, coal and sandstone. GHD 2019 reports that surficial geological units mapped at the site have mostly been removed as part of historical open cut mining activities, with shallow Quaternary alluvial sediments comprising clay, silt, sand and gravel are anticipated to be present in the vicinity of the existing alignment of Six Mile Creek.

Coal measures beneath the site comprise several seams which are reported to have been mined through both open cut and underground mining techniques over the last approximately 100 years. Several fault lines are reported in the vicinity of the site, with historical mining influenced by the presence of faults, terminating where seams were displaced by faults. A cross-section of the hydrogeological conditions has been prepared by GHD (2019) and presented as **Figure 1**.

⁵ GHD (2019b). Memorandum: Redesign and Rehabilitation of the New Chum Waste Management Facility Response to Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, Reference no. 1807-6501 SRA, 26 July 2019.

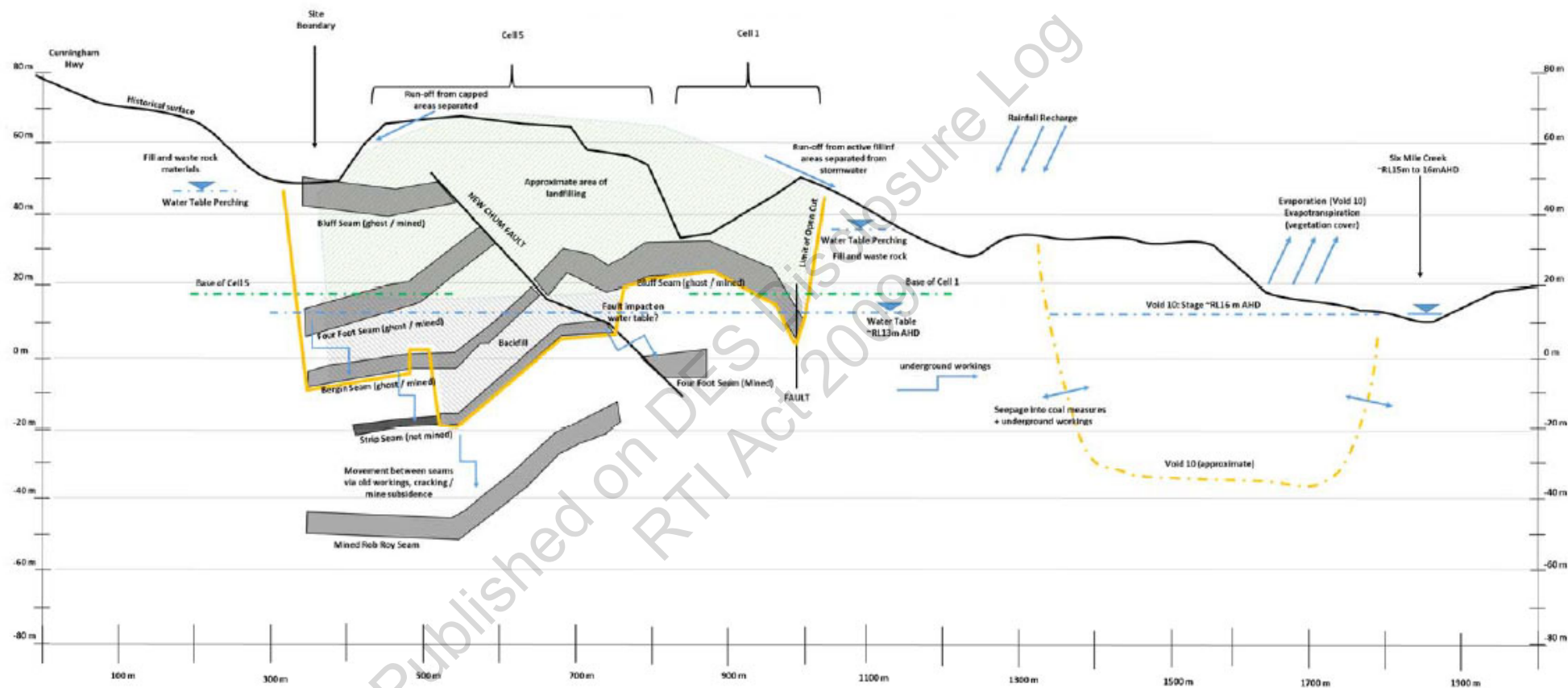


Figure 1: Hydrogeological Conceptualisation (GHD 2019) (west to east section through site)

The majority of existing landfill cells are located above the groundwater level across the site (~14m Australian Height Datum (AHD)), with the exception of Cell 2B (9m AHD). Cells 1 and 2B are understood to include compacted clay perimeter bunds with no basal liner, with remaining cells comprising composite (double) lined systems (compacted clay, with geosynthetic clay liners) with drainage blankets and leachate collection systems. It is understood that most cells are no deeper than RL+18 m AHD, and parts of Cell 2B and Cell 3 are RL+9 m AHD and RL+15 m AHD respectively. All new landfill cells proposed to be constructed at the site will be composite lined.

Where historical single lined cells interface with the landform redesign proposal, the construction works will include a piggyback lining system which ensures new waste, and resulting leachate is managed through a composite (double) lined system.

2.2 Hydrology

Onsite hydrology is managed as part of current site operations and includes diversion and/or separation of upstream surface water run-on, and collection and treatment of surface water runoff within the site through a series of onsite sediment/retention basins, which are managed in accordance with the current environmental authority (EPPR00445713) (EA) and site-based management plan.

It is understood that the future development of alternative water retention basins at the site will be constructed to include controlled release mechanisms, allowing the site to be operated as a closed surface-water system.

Six Mile Creek is located adjacent to the eastern site boundary, with smaller tributaries passing through southern portions of Lot 227 SP103913. Six Mile Creek is considered to be an urban creek, with the majority of the catchment located within an urbanised setting. Land uses within the catchment include former open cut coal mines, current and historical landfill sites, light industrial uses, road corridors and residential uses. An investigation completed in the local area reports that the existing environmental health of Six Mile Creek is between 'fair and good'.

Surface water levels within Six Mile Creek adjacent to the site are reported between 15.6m AHD (DWN monitoring point) and 16.2m AHD (SMC monitoring point). Elevations of Six Mile Creek decrease downstream of the site, with surface water levels below 5mAHD at where Six Mile Creek discharges to the Brisbane River approximately 2.2km north-east of the site.

Six Mile Creek is considered to be an ephemeral waterway, supported by site observations and monitoring data from the Six Mile Creek monitoring station (Bureau of Meteorology Station 540664) located approximately 2km upstream of the site. During dryer months large portions of the creek remain dry, however, deeper pools can be observed year-round.

Six Mile Creek is considered likely to be located above the groundwater level in close proximity to the site, however, some connectivity between perched groundwater and onsite water bodies (i.e. Void 10) is anticipated. The regional groundwater system is anticipated to discharge to Six Mile Creek downstream of the site, or directly to the Brisbane River north of the site.

2.3 Hydrogeology

Prior to mining, the primary aquifers beneath the site comprised poor sedimentary aquifers (sandstone, shale, coal) of low primary permeability. Groundwater flow was predominantly via fractures and joints. However, the creation of voids by underground mining, and the increase in permeability via backfilling of the open cuts are likely to have significantly increased the permeability and storage potential of the overall rockmass. The extent of mining appears to have been controlled by the presence of faults, with workings terminating against the faulted coal seams. The faults mapped in GHD (2019a) are of relatively short extent, do not appear to intersect Six Mile Creek, and are therefore unlikely to provide a direct conduit for groundwater flow from the site to the Creek.

The recent installation of monitoring bores at the site indicate the presence of perched groundwater in some locations, however this appears to be of limited lateral extent as it was not encountered at all locations.

Water level elevations across the site are generally in the range 13-16 mAHD, however at BH15 which is outside of the extent of the formerly mined area, the groundwater elevation is approximately 40 mAHD. Groundwater elevations presented in GHD (2019a) indicate a centripetal groundwater flow direction towards the landfill (and formerly mined) area. Incorporating the site-specific monitoring data with a wider dataset gleaned from the Queensland Groundwater Bore Database and surrounding sites (e.g. ATC Williams, 2018 in GHD, 2019a) allows an understanding of the sub-regional flow directions. **Figure 2** confirms a northerly groundwater flow direction toward the Brisbane River, however it also suggests that the water table elevation at the site is low relative to its surrounds, and that groundwater is locally flowing toward the formerly mined areas. The steep hydraulic gradients in the immediate vicinity of the site are supportive of low permeability host rocks, and the converse is true within the site, where the flat hydraulic gradients indicate relatively high bulk permeabilities. The groundwater elevation across the site will ultimately be controlled by the relative elevation of Six Mile Creek (approximately 16mAHD) which represents a spill point at the eastern extent of the site.

The timeseries water level data from some bores across the site presented in GHD (2019a) exhibit slowly rising water level trends (**Figure 3**). While it is recognised that these data only correspond to a period of average or above rainfall, as represented by the cumulative deviation from the mean monthly rainfall, it is possible that they represent the recovery of water levels within the formerly mined - and dewatered - voids via groundwater inflows from the surrounding regional system. Some monitoring bores also respond to rainfall events (i.e. BH03), suggesting local infiltration of rainfall recharge.

While groundwater flow direction appears to currently be away from Six Mile Creek, it is plausible that with groundwater elevations continuing to rise, the flow direction could change toward the Creek. However, due to the high permeabilities within the anthropogenically altered sub-surface, the hydraulic gradients would be expected to remain relatively flat, and potential rates of discharge to Six Mile Creek would be concomitantly low.

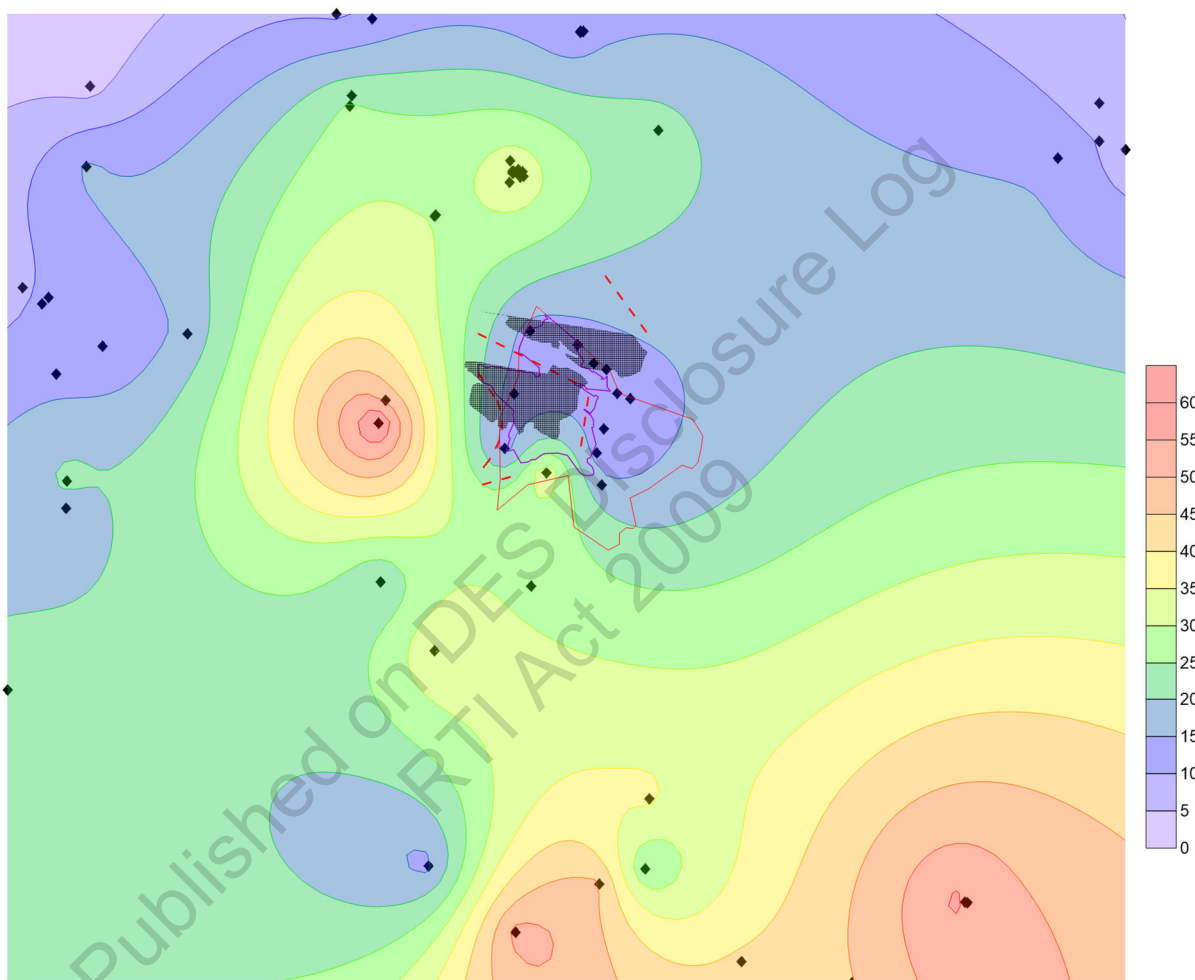


Figure 2: Sub-regional Potentiometric Surface⁶ (mAHd)

⁶ Potentiometric surface contours shown in mAHd. Site boundary shown in red, with former open cut (purple) and underground (hatched) mining extents overlain. Regional groundwater monitoring wells shown as black diamond. Geological faults shown as red dash.

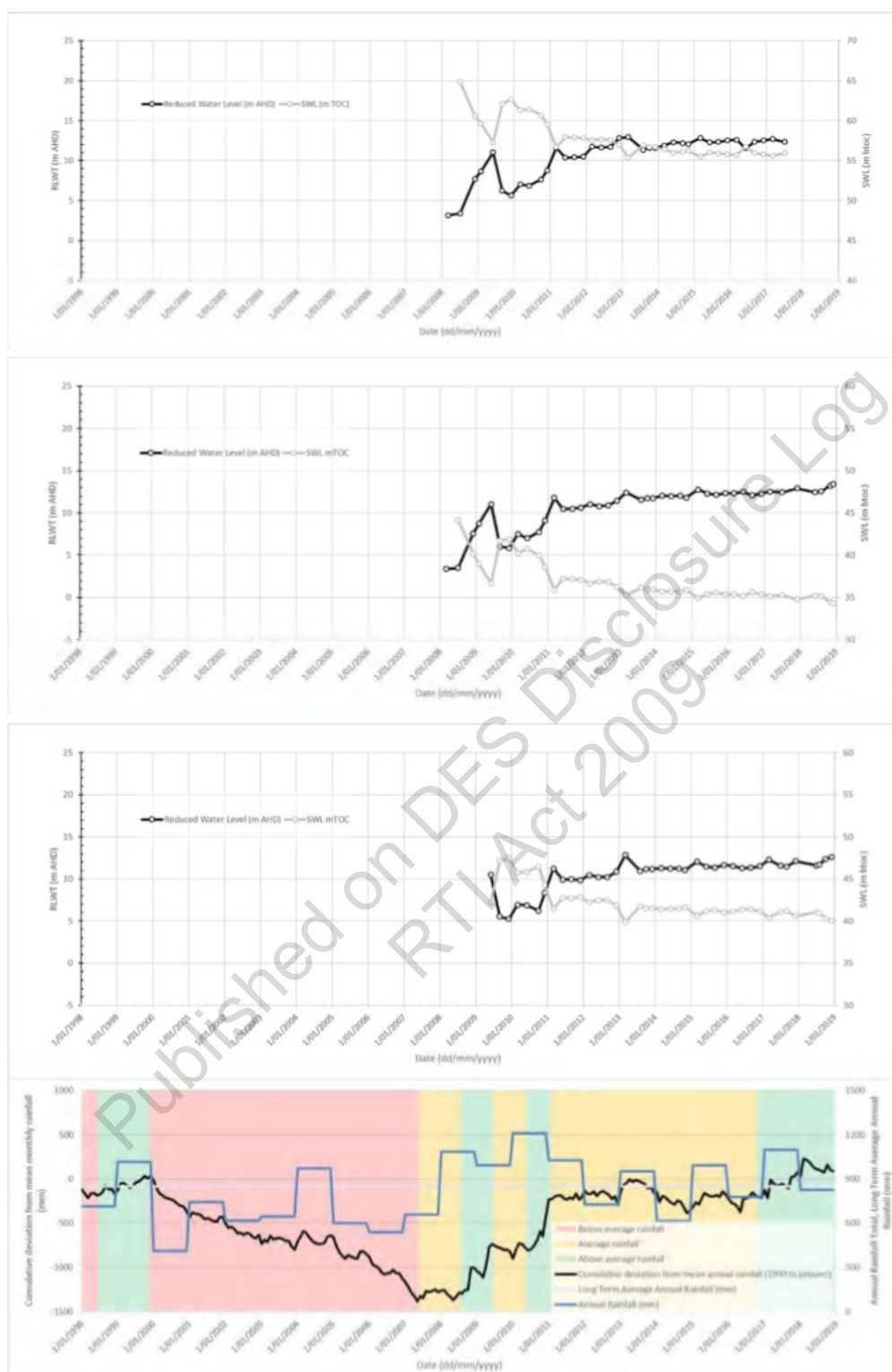


Figure 3: Selected timeseries water level data (BH7, BH6, BH2) (after GHD, 2019a)

2.4 Potential Sources of Contamination

Due to their widespread use and persistence many types of PFAS are ubiquitous in the environment, and multiple sources of PFAS are likely, with offsite potential sources likely to be present based on detection

of PFAS in upstream portions of Six Mile Creek and regional land uses which include current and historical landfill sites and light industrial uses.

For the purpose of the qualitative risk assessment of onsite groundwater, potential onsite sources of PFAS at the site would include leachate and contact water generated as part of site operations as follows:

- **Leachate** - generated through the infiltration of water into the waste profile at the site which is undergoing aerobic and anerobic processes. The composition of leachate is based on the waste materials encountered, however, is typically elevated in contaminants including nutrients (nitrogen and phosphorus), organics and hydrocarbons and PFAS. Leachate at the site is managed in accordance with the current EA, which includes a leachate collection system and associated evaporation ponds; and
- **Contact Water** – generated through stormwater runoff from active landfilling areas (i.e. recently placed and not undergoing significant aerobic and anerobic processes). The composition of contact water is based on the waste materials encountered, however, it generally possesses a low contaminant loading. PFAS has been reported in the sites retained surface water, with investigations (GHD 2019a) indicating the presence of PFAS is likely to be associated with contact water mechanism, due to the highly soluble nature of PFAS compounds.

Based on the supplementary monitoring completed at site (Epic 2019) PFAS concentrations in groundwater above the LOR were reported in BH03, BH11, BH12 and BH18, with concentrations exceeding the adopted guideline value in BH03, BH12 and BH18.

All four locations are located on the north-eastern margin of the site adjacent to Cells 1 and 2B. GHD (2019a) indicates that Cell 2B was used for containment of inert solid asbestos waste, extends below the water table and was constructed prior to cessation of dewatering works at the site, after which groundwater levels recovered to current levels.

The absence of more widespread PFAS detection in other groundwater monitoring bores suggests a potential localised source or, since PFAS is not believed to be attenuated by natural process, significant dilution by the greater groundwater volume. It is noted that the localised groundwater flow direction from the vicinity of the impacted bores is to the south or west, i.e. into the landfill. If groundwater flow directions at the site were to shift toward Six Mile Creek, observed PFAS concentrations discharging to the creek would be further diluted via advection-dispersion processes (not attenuation) compared with BH03, BH12 and BH18.

2.5 Sensitive Receptors

With reference to the Environmental Protection (Water) Policy 2009 (EPP Water) for Six Mile Creek⁷, prescribed Environmental Values (EVs) for surface waters include the protection of aquatic ecosystems, stock water, secondary recreation, visual recreation and cultural and spiritual values, with EVs for groundwater including the protection of aquatic ecosystems, irrigation, farm supply/use, stock water and drinking water.

Based on the CSM outlined by GHD (2019a & 2019b), and as summarised above, no groundwater or surface water users (including irrigation, farm supply/use, stock water and drinking water) have been identified in proximity to the site, and remaining environmental values (secondary recreation, visual recreation and cultural and spiritual values) are not considered to be impacted by PFAS. On this basis, sensitive receptors potentially impacted by PFAS include:

- Aquatic Ecosystems of Six Mile Creek (and the Brisbane River); and
- Groundwater (potentially discharging to surface water).

2.6 Exposure Pathways

As outlined in GHD (2019a), likely exposure pathways identified at the site include migration via groundwater or surface water pathways. A summary of the primary potential exposure pathways are:

- Release of leachate to the uppermost aquifer beneath the site;
- Groundwater discharging to surface water; and
- Release of leachate and/or contact water to Six Mile Creek.

It is noted that additional exposure pathways may exist at the site, as summarised below, however based on preliminary information along with the current CSM (GHD 2019a), these exposure pathways are not considered to present a significant risk.

- Bioaccumulation/biomagnification within aquatic ecosystems. Human ingestion of aquatic organisms, stock and produce grown in groundwater or surface water associated with the site is unlikely;
- Recreational use of Six Mile Creek including fishing, boating and paddling/rowing activities, along with direct contact with surface water is considered to be unlikely. Concentrations of PFAS reported within Six Mile Creek were reported below the PFAS NEMP recreational and drinking water guideline values indicating a low risk; and

⁷ Environmental Protection (Water) Policy 2009: Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks environmental values and water quality objectives Basin No. 143 (part), including all tributaries of the creeks, July 2010

- Use of groundwater and surface water has not been identified in proximity to the site, with surrounding areas serviced by reticulated water supply. Concentrations of PFAS reported within Six Mile Creek were reported below the PFAS NEMP recreational and drinking water guideline values indicating a low risk.

2.7 Identified Pathway and Receptor Linkages

Based on a review of potential risks and impacts associated with PFAS, and utilising the source-pathway-receptor model, a summary of identified pathway and receptor linkages are presented in **Table 1**.

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Table 1: Pathway and Receptor Linkage Summary

Potential Source	Potential Pathway	Potential Receptor	Receptor Linkage	Considerations / Comments
Leachate	Release of leachate to groundwater	Groundwater (uppermost aquifer)	Possible	<p>Current operations have been undertaken in accordance with the EA and specific regulatory requirements pertaining to waste types received in each landfill cell. The majority of existing landfill cells are located above the regional groundwater level (13mAHD), with the exception of Cell 2B (9mAHD). Cells 1 and 2B are understood to include compacted clay perimeter bund with no basal liner, with remaining cells comprising composite (double) lined systems (compacted clay, with geosynthetic clay liners) with drainage blankets and leachate collection systems.</p> <p>Design of the new landfill indicates that new cells will be lined, or have 'piggyback' linings where they overlie previously landfilled areas and as such is unlikely to increase risk of release. Specific controls to minimise leachate generation are outlined in GHD (2019a, Section 7.5 and Appendix S – Risk Register).</p> <p>GHD (2019a) concluded that the groundwater monitoring network established at the site 'is considered reasonable for the early detection of any significant release of leachate from the landfill', and that there 'are no obvious leachate impacts to groundwater quality at the site'.</p> <p>Concentrations of PFAS have been reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18), with concentrations of PFOS reported above the PFAS NEMP Freshwater 99% Species Protection Freshwater Guideline Values in BH03 and BH18 (0.0005µg/L & 0.0006µg/L respectively). All four locations are on the north-eastern margin of the site, adjacent to Cells 1 and 2B, with Cell 2B reported to extend below the water table. GHD (2019a) indicates that Cell 2B was used for containment of inert asbestos waste with a piggyback double liner installed over asbestos wastes in 2018. Review of groundwater analytical information by GHD (2019a) reported no obvious evidence of impact to groundwater quality from leachate contamination, with BH03 reporting a decreasing Mulvey Ratio</p> <p>The absence of more widespread PFAS detection in other groundwater monitoring bores suggests a potential localised source or, since PFAS is not believed to be attenuated by natural process, significant dilution by the greater groundwater volume. The groundwater flow direction from the vicinity of the impacted bores is to the south or west, i.e. into the landfill. If groundwater flow directions at the site were to shift toward Six Mile Creek, observed PFAS concentrations discharging to the creek would be further diluted via advection-dispersion processes (not attenuation).</p>

Potential Source	Potential Pathway	Potential Receptor	Receptor Linkage	Considerations / Comments
	Groundwater discharge to surface water	Six Mile Creek and/or Brisbane River	Possible	<p>Review of regional groundwater potentiometry indicates that current groundwater levels at the site are likely to be controlled by the extent of historical mine working beneath the site and within surrounding areas. A northly groundwater flow direction toward the Brisbane River is observed, however the water table elevation observed at the site is low relative to its surrounds, indicating that groundwater is locally flowing toward the formerly mined areas.</p> <p>Several inactive geological faults are reported beneath or within close proximity to the site, however faults are of relatively short extent, do not appear to intersect Six Mile Creek, and are therefore unlikely to provide a direct conduit for groundwater flow from the site to Six Mile Creek.</p> <p>While groundwater flow directions appear to currently be away from Six Mile Creek, it is plausible that with groundwater elevations continuing to rise, the flow direction could change toward the creek. However, due to the high permeabilities within the anthropogenically altered sub-surface, the hydraulic gradients would necessarily remain relatively flat, and potential rates of discharge to Six Mile Creek would be concomitantly low. If groundwater flow directions at the site were to shift toward Six Mile Creek, observed PFAS concentrations discharging to the creek would be diluted via advection-dispersion processes (not attenuation).</p> <p>Concentrations of PFAS compounds were reported in upstream and downstream surface water monitoring locations, with upstream locations (SMC2 & SMC3) reporting PFOS concentrations of 0.0004-0.0005µg/L, comparable to concentrations reported within onsite groundwater monitoring wells (0.0005-0.0006µg/L). Based on background (upstream) PFAS concentrations, groundwater potentiometric and reported concentrations of PFAS in groundwater, groundwater is not considered to be impacting on downstream surface water.</p>
Contact Water	Release of contact water to surface water.	Six Mile Creek	Possible	<p>Future development of alternative water retention basins at the site will be constructed to include controlled release mechanisms, allowing the site to be operated as a closed surface-water system.</p> <p>Concentrations of PFAS were reported in all leachate and onsite surface water bodies, with concentrations of PFOS reported PFAS NEMP 99% Species Protection Freshwater Guideline Values at all locations sampled.</p> <p>Concentrations of PFAS compounds were reported in upstream and downstream surface water monitoring locations, with upstream locations (SMC2 & SMC3) reporting PFOS concentrations of 0.0004-0.0005µg/L, compared with downstream locations (DWN3) which reported PFOS concentrations of 0.0054µg/L. Concentrations of PFAS were reported to be elevated (compared to upstream and downstream locations) in Void10 (locations DIS (PFOS 0.0108µg/L) and SMC (PFOS 0.0140µg/L)). It is considered that concentrations of PFAS observed within Void10 may be attributable to historical surface water pathways.</p>

3 Conclusions

Based on the review of the CSM and development of the qualitative risk assessment for the site, the following conclusions are made:

- Based on a review of available information, the hydrogeological conceptualisation presented by GHD (2019a) is considered to adequately represent conditions at the site;
- GHD (2019a) have reported that:
 - risk of leachate/contact water impacts to surface water is considered low-moderate, however the likelihood of significant impact is unlikely; and
 - there 'are no obvious leachate impacts to groundwater quality at the site';
- Potential onsite sources of PFAS contamination at the site include leachate and contact water generated as part of site operations, noting that due to their widespread use and persistence many types of PFAS are ubiquitous in the environment, with offsite potential sources likely to be present based on detection of PFAS in upstream portions of Six Mile Creek;
- Whilst it is acknowledged that current guidelines recommend the adoption of 99% Species Protection Guideline Values (high conservation value systems) for chemicals that have the potential to bioaccumulate (including PFAS), it is noted that all surface and groundwater monitoring locations reported concentrations below the 95% Species Protection Freshwater Guideline Values. Upstream surface water monitoring locations reported concentrations above 99% Species Protection Guideline Values, with upstream surface water concentrations comparable to concentrations reported within onsite groundwater;
- Concentrations of PFAS have been reported in four of the onsite groundwater monitoring wells (BH03, BH11, BH12 and BH18), located on the north-eastern margin of the site. Review of groundwater analytical information by GHD (2019a) reported no obvious evidence of impact to groundwater quality from leachate contamination, with BH03 reporting a decreasing Mulvey Ratio;
- The absence of more widespread PFAS detection in other groundwater monitoring bores suggests a potential localised source (i.e. historical inert waste disposed in Cell 2B), or since PFAS is not believed to be attenuated by natural process, significant dilution by the greater groundwater volume. The groundwater flow direction from the vicinity of the impacted bores is to the south or west, i.e. into the landfill. If groundwater flow directions at the site were to shift toward Six Mile Creek, observed PFAS concentrations discharging to the creek would be further diluted via advection-dispersion processes (not attenuation);
- Based on the reported concentrations of PFAS in onsite groundwater monitoring wells, and in consideration of the reported regional geology and regional groundwater potentiometry, discharge of groundwater to surface water is considered unlikely;

- Based on background (upstream) concentrations of PFAS within Six Mile Creek, concentrations of PFAS in groundwater at the site is unlikely to result in an increased risk to environmental values of surface water if discharge of groundwater was to occur; and
- The proposed redesign and progressive rehabilitation is considered to further mitigate the risk to groundwater and surface water through the design and implementation of engineered lining systems and drainage layers for each cell, and increasing the efficiency and capacity in sediment basins.

Based on the findings of the current assessment, it is considered that implementation of the proposed landform redesign and MCU application will not result in an increased risk to identified sensitive receptors including EVs of Six Mile Creek and groundwater beneath the site with regards to PFAS.

4 Limitations and Disclaimer

Epic Environmental Pty Ltd (Epic) has prepared the following report for the exclusive benefit of Cleanaway Solid Waste (Client) and for the singular purpose of detailing findings of this Qualitative PFAS Risk Assessment for the New Chum Landfill Facility (Lots 227 SP103913 & 268 SP103913). All interpretations, finding or recommendations outlined in this report should be read and relied upon only in the context of the report as a whole.

With the exception of the Administering Authority and Council assessing the Material Change of Use application for the proposed landform redesign and rehabilitation, the following report cannot be relied upon for any other purpose, at any other location or for the benefit of any other person, without the prior written consent of Epic. Except with Epic's prior written consent, this report may not be:

- a. released to any other person, whether in whole or in part;
- b. used or relied upon by any other party; or
- c. filed with any Governmental agency or other person or quoted or referred to in any public document.

This report has been prepared based on information provided by the Client and other parties. In preparing this report Epic:

- a. presumed the accuracy of the information provided by the Client (including its representatives);
- b. has not undertaken any verification to the accuracy or reliability included in this information (with the exception where such verification formed part of the scope of works);
- c. has not undertaken any independent investigations or enquiries outside the scope of works with respect to information provided for this report; and
- d. provides no warranty or guarantee, expressed or implied, as to the accuracy or reliability of the information provided in this report.

In recognition of the limited use of this report, the Client agrees that, to the maximum extent permitted by law, Epic (including its representatives and related entities) is not liable for any losses, claims, costs, expenses, damages (whether pursuant to statute, in contract or tort, for negligence or otherwise) suffered or incurred by the Client or any third party as a result of the information, findings, opinions, estimates, recommendations and conclusions provided in this report.

Without limiting the above, Epic (including its representatives and related entities) is not liable, in any way whatsoever:

- a. for the use or reliance of this report for any purpose other than that for which it has been prepared;
- b. for any use or reliance upon this report by any person other than the Client;
- c. where another person has a different interpretation of the same information contained in the report;
- d. for any consequential or indirect losses, or for loss of profit or goodwill or any loss or corruption of any data, database or software.

If a section of this disclaimer is determined by any court or other competent authority to be unlawful and/or unenforceable, the other sections of this disclaimer continue in effect. Where further information becomes available, or additional assumptions need to be made, Epic reserves its right to amend this report, but is not obliged to do so.

5 References

- Australian Standard AS 4482. 1-2005 Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi Volatile Compounds;
- Australian Standard 4482.2—1999 Guide to the Sampling and Investigation of potentially contaminated soil. Part 2: Volatile substances;
- Australian Standard AS 5667.11-1998 Water quality - Sampling - Guidance on sampling of groundwaters;
- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), October 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 - The Guidelines (Chapters 1-7);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG). Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, 2018;
- Department of Environment and Science (DES), Environmental Authority EPPR00445713, 24 September 2018;
- Department of Science, Information Technology and Innovation (DSITI, now DES) (2017) Using Monitoring Data to Assess Groundwater Quality and Potential Environmental Impacts;
- Environmental Protection Act, 1994;
- Environmental Protection (Water) Policy, 2009;
- Epic (2019). New Chum Landfill – Environmental Monitoring (PFAS), 26 July 2019;
- GHD (2019a). Redesign & Rehabilitation of the New Chum Waste Management Facility: Leachate, Surface water and Hydrogeological Assessment, April 2019;
- GHD (2019b). Memorandum: Redesign and Rehabilitation of the New Chum Waste Management Facility Response to Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, Reference no. 1807-6501 SRA, 26 July 2019;
- Heads of EPAs Australia and New Zealand (HEPA), PFAS National Environmental Management Plan (NEMP), January 2018;
- Monitoring and Sampling Manual, Version 2, 2010 (Department of Environment and Heritage Protection);
- National Environmental Protection Council (NEPC), 2013, National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) (No 1); and
- Queensland Auditor Handbook for Contaminated Land (Department of Environment and Heritage Protection, Queensland Government, 2018).

Attachment 3 – New Chum Landfill – Groundwater, Surface Water and Leachate Monitoring Program, Epic Environmental, Revision 2, 26 July 2019.

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**NEW CHUM LANDFILL -
GROUNDWATER, SURFACE
WATER AND LEACHATE
MONITORING PLAN**





CLEANAWAY SOLID WASTE PTY LTD

NEW CHUM LANDFILL - GROUNDWATER, SURFACE WATER AND LEACHATE MONITORING PLAN

26 JULY 2019

NEW CHUM LANDFILL

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1 Introduction

This Groundwater, Surface Water and Leachate Monitoring Plan (Monitoring Plan) has been prepared for Cleanaway Solid Waste Pty Ltd (CSW) to outline monitoring requirements for the New Chum Landfill Facility located at 100 Chum Street, New Chum (Lot 227 SP103913) and 20 Rhondda Road, New Chum (Lot 268 SP103913).

Specifically, this monitoring plan has been developed for the future activities associated with the New Chum landform redesign associated with the Material Change of Use (MCU) development application.

1.1 Background and Objectives

The facility is located within a waste management and recycling precinct in the Ipswich City Council (ICC) local government area. The facility has been used for landfilling of general (non-putrescible) waste since 1996. The existing operational landfilling areas of the facility are contained within the western allotment, Lot 268 on SP103913. Lot 277 on SP103913 on the eastern side is largely used for storage of stormwater.

The site is being developed and filled in a progressive manner, which involves developing new disposal cells, filling the cells with waste and rehabilitation of the disposal cells. Construction of landfill cells and associated leachate systems have been undertaken in accordance with regulatory requirements pertaining to the specific waste types received in each cell.

Environmental monitoring is currently completed at the site in accordance with Conditions H5 to H15 (groundwater) and WT1 to WT2 (surface water) of the current site Environmental Authority (EA) EPPR00445713 (dated 1 May 2019). It is understood that through the MCU approval, a new EA will be issued (but will not come into effect until the DA approval is received).

The objective of this Monitoring Plan is to detail the monitoring activities which will appropriately assess environmental risk to water (including both receiving surface water and groundwater) and propose relevant conditions for consideration in drafting the EA associated with the future MCU approval.

The monitoring program has been developed in consideration of the current site EA conditions, relevant common EA conditions and recent assessments and reports submitted as part of the MCU approval process.

Relevant site background and site-specific monitoring infrastructure details are provided in GHD (2019a)¹ and GHD (2019b)².

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¹ GHD (2019a). Redesign & Rehabilitation of the New Chum Waste Management Facility: Leachate, Surface water and Hydrogeological Assessment, April 2019.

² GHD (2019b). Memorandum: Redesign and Rehabilitation of the New Chum Waste Management Facility Response to Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, Reference no. 1807-6501 SRA, 26 July 2019.

2 Proposed Groundwater, Surface Water and Leachate Monitoring Methodology

Table 1 outlines the proposed groundwater, surface water and leachate monitoring program and conditions for consideration during Environmental Authority drafting.

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Table 1: Proposed Monitoring Program / Conditions for Environmental Authority consideration

Proposed Program	Condition Reference	Comments
General		
An appropriately qualified person(s) must monitor, record and interpret all parameters that are required to be monitored by the environmental authority and in the manner specified by this environmental authority.	ERA 60 Common condition. PMG015 (G6) (ESR/2015/1667). EPPR00445713 condition G5.	Consistent with current and common condition. As proposed by DES as preliminary general condition G7 (correspondence dated 6/03/2019).
All analysis required under this environmental authority must be carried out by a laboratory that has National Association of testing Authorities (NATA) certification, or an equivalent certification, for such analyses.	ERA 60 Common condition. PMG009 (G8) (ESR/2015/1667). EPPR00445713 condition G6.	Consistent with current and common condition. As proposed by DES as preliminary general condition G8 (correspondence dated 6/03/2019).
Leachate		
<p>A leachate collection system must be designed, installed and maintained by an appropriately qualified person to:</p> <ol style="list-style-type: none"> 1. Collect leachate generated in the landfill unit; 2. Convey the collected leachate out of the landfill unit to an appropriate leachate storage facility; 3. Restrict the height of leachate above the liner system to a maximum level of 300mm or another value with equivalent leachate minimisation performance as agreed with the administering authority; and 4. Measure and record the height of the leachate above the liner system on a daily basis where this level is greater than 300mm, or at least weekly at other times. 	EPPR00445713 condition G10. Consistent with ERA60 common condition PMG022 (G11).	Consistent with current and common condition. As proposed by DES as preliminary general condition G16 (correspondence dated 6/03/2019) – with the addition of a point 4 (as per current EA).
<p>Leachate and stormwater runoff which has been in contact with waste materials in the landfill unit must be collected in the leachate storage system and be:</p> <ol style="list-style-type: none"> 1. Treated in the leachate treatment plant and discharged to sewer in accordance with the requirement of the relevant water utility; or 2. Recirculated through the landfill unit; or 3. Treated by alternative technologies agreed by the administering authority for offsite disposal, discharge, or onsite reuse; or 4. Disposed of at a facility that is approved to receive such waste. 	EPPR00445713 condition G11. Consistent with ERA60 common condition PMG023 (G12).	Consistent with current and common condition. As proposed by DES as preliminary general condition G17 (correspondence dated 6/03/2019)

Proposed Program				Condition Reference	Comments
Water					
The only contaminants to be released to receiving surface waters are settled treated water of a quality and from release points stated in <i>Table – Surface water release limits</i>				EPPR00445713 condition WT1.	Consistent with current EA. Consistent format with ERA 60 common condition PMW009 (WT1). Release points to remain the same as current EA (no change to release locations). ADDITION: PFAS monitoring and proposed wording for criteria
Quality Characteristic	Quality characteristic Limit	Release Points and receiving water reference points	Frequency of monitoring	EPPR00445713 condition WT1.	Consistent with current EA. Consistent format with ERA 60 common condition PMW009 (WT1). Release points to remain the same as current EA (no change to release locations). ADDITION: PFAS monitoring and proposed wording for criteria
Suspended Solids	50 mg/L (or more than 10% of the up-current receiving waters)	Final sedimentation basin to Void 10	In the event of a release		
	N/A	An up-current point for comparison	In conjunction with and whenever monitoring is carried out for release from final sed basin to Void 10		
	50mg/L (max)	Chum Street High Efficiency Sediment (HES) pond	In the event of a release		
pH	6.5-9 (range)	Final sed basin to Void 10	In the event of a release		
	6.5-9 (range)	Chum Street HES pond	In the event of a release		
Specific Conductance	more than 10% of the up-current receiving waters	Final sed basin to Void 10	In the event of a release		
	N/A	An up-current point for comparison	In conjunction with and whenever monitoring is carried out for release from final sed basin to Void 10		

Proposed Program				Condition Reference	Comments
	more than 10% of the up-current receiving waters	Chum Street HES pond	In the event of a release		
Dissolved Oxygen	6 mg/L (min)	Final sed basin to Void 10	In the event of a release		
	6 mg/L (min)	Chum Street HES pond	In the event of a release		
Total Organic Carbon	20 mg/L (max)	Final sed basin to Void 10	In the event of a release		
	20 mg/L (max)	Chum Street HES pond	In the event of a release		
PFAS (12 analytes)	TBD*	Final sed basin to Void 10	In the event of a release		
		Chum Street HES pond	In the event of a release		
Notes: * to include criteria consistent with the PFAS NEMP, or site specific criteria agreed to in writing by the administering authority					
Associated monitoring requirements					
<div><div>1.</div><div>Monitoring location OR release points must be in accordance with (consistent with current EA plan).</div></div> <div><div>2.</div><div>Monitoring must be in accordance with the methods prescribed in the current edition of the Department of Environment and Science <i>Monitoring and Sampling Manual</i>.</div></div> <div><div>3.</div><div>Samples must be taken using representative samples.</div></div> <div><div>4.</div><div>All determinations must employ analytical practical quantification limits sufficiently low enough to enable comparisons to be made against water quality objectives / limits relevant to the particular water quality characteristic.</div></div> <div><div>5.</div><div>Monitoring must be undertaken during a release as per the frequency states.</div></div> <div><div>6.</div><div>All monitoring devices must be correctly calibrated and maintained.</div></div>					
Monitoring of contaminant release to waters must be undertaken in accordance with condition (WT1) and records of the results must be kept.				EPPR00445713 condition WT2.	Consistent with current EA condition WT2 and ERA 60 Common condition PMW010 (WT2).

Proposed Program	Condition Reference	Comments
The stormwater runoff from disturbed areas, generated by (up to and including) a 24 hour storm event with an average reoccurrence interval of 1 in 10 years must be retained on site or managed to remove contaminants before release.	EPPR00445713 condition WT3.	Consistent with current EA condition WT3 and ERA 60 Common condition PMW008 (WT5).
Receiving Environment Monitoring Program		
A receiving environment monitoring program (REMP) must be designed and implemented by an appropriately qualified person (s) to monitor the effects of the activity on waters, groundwater, air shed and land. The REMP is to be submitted to the Administering Authority within 3 months of the EA commencement date.	-	As proposed by DES as general condition G10 (correspondence dated 6/03/2019). Consistent with Current EA condition H14, with the addition of specifics to be included.
The REMP must include at least the following: a) For release to waters, a receiving environment monitoring program design document produced in accordance with the 'Receiving Environment Monitoring Program guideline – for use with environmental relevant activities under the Environmental Protection Act 1994' (ESR/2016/2399). b) A groundwater monitoring program; c) A surface water monitoring program; d) Dust monitoring program; and e) Landfill gas monitoring program.	-	As proposed by DES as general condition G11 (correspondence dated 6/03/2019), with "odour" removed from part (d) as not applicable to this site.
An annual monitoring report must be prepared by an appropriately qualified person(s) and submitted to the administering authority with the annual return each year. The annual monitoring report must include: a) A summary of the previous 12 months monitoring data obtained in accordance with any of the monitoring requirements of this approval; and b) An evaluation/explanation of the data from any monitoring programs, including graphical representations showing relevant limits and trends; and c) An outline of actions taken, and proposed to be taken, to minimise the environmental risk from any deficiency identified by the monitoring or recording programs.	-	As proposed by DES as general condition G12 (correspondence dated 6/03/2019).

2.1 Specifically relating to the REMP

A concurrent groundwater, receiving surface water and leachate monitoring program will be included which comprises the following:

- The concurrent monitoring program will be undertaken at a frequency to be defined in the development of the REMP, but will not be less than every 6 months;
- The REMP will include the number and spatial distribution of monitoring locations for surface water, groundwater and leachate, but will include:
 - A groundwater monitoring network which includes a sufficient number of wells installed at the locations and depths that yield representative groundwater samples from the uppermost aquifer and that establishes:
 - Background groundwater quality in hydraulically upgradient or background well(s) that have not been affected by any potential leakage of contaminants to groundwater from the premises to which this environmental authority relates; and
 - Quality of groundwater down-gradient of any potential leakage of contaminants to groundwater from the premises to which this environmental authority relates, including groundwater passing the point(s) of compliance that must be situated not more than 150 metres from the landfill cell or the boundary of the landfill facility, whatever is the closest.
 - Surface water monitoring locations to include sufficient up and down gradient locations within the receiving surface water;
 - Leachate monitoring locations appropriate to allow a comparison of leachate onsite to receiving surface water and local groundwater quality.
- The REMP will include a detailed analytical program for surface water, groundwater and leachate monitoring locations, which will include at a minimum, parameters outlined in **Table 2**.

Table 2: REMP Analytical Parameter Requirements

Requirement	Groundwater	Surface Water	Leachate
Field Parameters	<ul style="list-style-type: none"> pH Specific Conductance/Electrical Conductivity (EC) Dissolved Oxygen Oxidation-Reduction Potential (ORP) Total Dissolved Solids (TDS) Temperature 		
	N/A	Turbidity	N/A
Water Quality Characteristics	<ul style="list-style-type: none"> pH Specific Conductance Nitrogen (Ammonia, ammonium, nitrate, nitrite, TKN, total N) Phosphorus (total and reactive) Total Organic Carbon (TOC) Cations - dissolved (calcium, sodium, potassium) Anions – dissolved (chloride, sulfate) Alkalinity (bicarbonate, carbonate) Metals – dissolved (arsenic, cadmium, chromium, copper, lead, nickel and zinc) Metals – total (iron (Fe)) PFAS (12 analytes) 		
	N/A	Hydrocarbons (TRH and BTEXN)	
	N/A	Total Suspended Solids (TSS)	N/A
Other	All determinations must employ analytical practical quantification limits sufficiently low enough to enable comparisons to be made against water quality objectives / limits relevant to the particular water quality characteristic.		

3 Limitations and Disclaimer

Epic Environmental Pty Ltd (Epic) has prepared the following report for the exclusive benefit of Cleanaway Solid Waste (Client) and for the singular purpose of detailing environmental monitoring requirements at the New Chum Landfill Facility (Lots 227 SP103913 & 268 SP103913). All interpretations, finding or recommendations outlined in this report should be read and relied upon only in the context of the report as a whole.

With the exception of the Administering Authority assessing Environmental Authority conditions, the following report cannot be relied upon for any other purpose, at any other location or for the benefit of any other person, without the prior written consent of Epic. Except with Epic's prior written consent, this report may not be:

- a. released to any other person, whether in whole or in part;
- b. used or relied upon by any other party; or
- c. filed with any Governmental agency or other person or quoted or referred to in any public document.

This report has been prepared based on information provided by the Client and other parties. In preparing this report Epic:

- a. presumed the accuracy of the information provided by the Client (including its representatives);
- b. has not undertaken any verification to the accuracy or reliability included in this information (with the exception where such verification formed part of the scope of works);
- c. has not undertaken any independent investigations or enquiries outside the scope of works with respect to information provided for this report; and
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- a. for the use or reliance of this report for any purpose other than that for which it has been prepared;
- b. for any use or reliance upon this report by any person other than the Client;
- c. where another person has a different interpretation of the same information contained in the report;
- d. for any consequential or indirect losses, or for loss of profit or goodwill or any loss or corruption of any data, database or software.

If a section of this disclaimer is determined by any court or other competent authority to be unlawful and/or unenforceable, the other sections of this disclaimer continue in effect. Where further information becomes available, or additional assumptions need to be made, Epic reserves its right to amend this report, but is not obliged to do so.

4 References

- Australian Standard AS 4482. 1-2005 Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi Volatile Compounds;
- Australian Standard 4482.2—1999 Guide to the Sampling and Investigation of potentially contaminated soil. Part 2: Volatile substances;
- Australian Standard AS 5667.11-1998 Water quality - Sampling - Guidance on sampling of groundwaters;
- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), October 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 - The Guidelines (Chapters 1-7);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG). Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, 2018;
- Department of Environment and Science (DES), Environmental Authority EPPR00445713, 1 May 2019;
- Department of Science, Information Technology and Innovation (DSITI, now DES) (2017) Using Monitoring Data to Assess Groundwater Quality and Potential Environmental Impacts;
- Environmental Protection Act, 1994;
- Environmental Protection (Water) Policy, 2009;
- GHD (2019a). Redesign & Rehabilitation of the New Chum Waste Management Facility: Leachate, Surface water and Hydrogeological Assessment, April 2019;
- GHD (2019b). Memorandum: Redesign and Rehabilitation of the New Chum Waste Management Facility Response to Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, Reference no. 1807-6501 SRA, 26 July 2019;
- Monitoring and Sampling Manual, Version 2, 2010 (Department of Environment and Heritage Protection);
- National Environmental Protection Council (NEPC), 2013, National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) (No 1); and
- Queensland Auditor Handbook for Contaminated Land (Department of Environment and Heritage Protection, Queensland Government, September 2015).

Attachment 4 – Technical Memorandum – Redesign and Rehabilitation of the New Chum Waste Management Facility, Response to the Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues, GHD Pty Ltd, 1807-6501 SRA, 26 July 2019.

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Memorandum

26 July 2019

To Cleanaway Solid Waste Pty Ltd

From GHD Pty Ltd

Subject Redesign and Rehabilitation of the New Chum Waste Management Facility Job no. 4131525
Response to Department of State Development, Manufacturing, Infrastructure and Planning's Further Advice – Environmental Outstanding Issues
Reference no. 1807-6501 SRA

1 Introduction

GHD Pty Ltd (GHD) has been engaged by Cleanaway Solid Waste Pty Ltd (Cleanaway) to provide technical advice for a development application for a Material Change of Use (MCU) for redesign and rehabilitation of the landform at its existing New Chum Waste Management Facility (NCWMF) located at 100 Chum Street, New Chum, Queensland.

This memorandum relates to a further issues letter issued by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) dated 17 June 2019 (Reference No. 1807-6501 SRA) (RFI). Information in this memorandum responds specifically to Item 3c as relating to Conceptual site model in the RFI (refer Section 2 below).

2 DSDMIP information request

DSDMIP has requested that Cleanaway provides further information to respond to item 3C – Conceptual site model as outlined below:

The conceptual site model should be reviewed and updated and include groundwater to better describe this model to allow interpretation of uncertainties and assumptions so that leachate is managed appropriately.

Further clarification was provided by DSDMIP to Cleanaway about its RFI (via email from DES 28 May 2019) as follows:

Groundwater modelling was presented as cross-section and it was difficult to see groundwater contours and movements direction (though it was described in the report). In the future please provide groundwater contours and movement map in addition to cross-section.

4131525-8089/Techinical Memorandum - Further Advice to DSDMIP for Conceptual Site Model matters

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3 Response to information request

3.1 Information sources and reliance

GHD has relied upon information from the following sources:

- Epic Consulting (2019) Cleanaway Solid Waste: New Chum Landfill Groundwater Standing Water Levels, Epic file BC190012.01 dated 12 June 2019; and
- RPS (2019) New Chum Waste Management Facility June 2019 Survey Data.

The following matters are noted:

- RPS have clarified that the site survey information is accurate to ± 0.005 m;
- Groundwater levels have been presented from groundwater monitoring events (GME) completed by Epic Consulting (2019) in February and June 2019; and

Water level monitoring information included bores and sample locations monitored during the February and June 2019 GMEs. It is considered that sufficient groundwater water level measurements were available to assist with the interpretation of the direction of groundwater movement at the site.

3.2 Groundwater elevation contour methodology

Groundwater contour maps showing the interpolated groundwater contours and the inferred groundwater flow direction for the February 2019¹ and June 2019² GMEs are presented in Figure 1 and Figure 2 (refer Attachment 1). These periods are approximately 1 month and 5 months after the installation of additional monitoring bores by Cleanaway.

Monitoring locations and relevant data considered in developing the groundwater elevation contours are provided in Table 1 in Attachment 2.

3.3 Interpreted groundwater flow direction

The groundwater flow direction is interpreted to be generally in a northwards direction, as determined from both the February and June GMEs. This is consistent with the interpretation provided in Figure 2 in the Leachate, Surface water and Hydrogeological Assessment (GHD April 2019).

However, there remains some uncertainty attached to this interpretation arising from the low hydraulic gradients existing on the site and the potential for complex groundwater flow paths, i.e. connected systems in old workings relative to undisturbed native ground. Considering that there is typically less than 0.5 m groundwater elevation difference between monitoring bores located along the western and northern boundaries respectively, this makes interpreting the groundwater direction more challenging.

¹ 15 February 2019 standing water level monitoring results

² 5 and 6 June 2019 standing water level monitoring results



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Section 6 of Leachate, Surface water and Hydrogeological Assessment Report prepared by GHD in April 2019 addresses these uncertainties.

The following additional observations are noted:

- Bores BH17 and BH18 constitute a nested monitoring bore site. The shallow water elevations in monitoring bore BH17 (screened 6.5 m to 15.5 m) are considered to be perched, and therefore the deeper groundwater elevation obtained from bore BH18 (screened 35 m to 47 m) have been adopted in the contour interpretation;
- Groundwater elevations at nested site BH14 and BH15 are significantly greater than nearby bores e.g. compared to historical observations from bore BH09, and have strongly influenced the overall site hydraulic gradient. A source for groundwater mounding in this area has not been identified. Bore BH14 is screened from 34 m to 40 m below ground level, and bore BH15 is screened from 14 m to 20 m below ground level. A possible explanation is that both bores, despite having screen separations of 14 m and being separated by fine grained materials, are monitoring the same aquifer. When compared to the nested site at bores BH17 and BH18, elevations are greater, implying a northwards flow direction, however, more information would be of value to assess the overall groundwater flow interpretation as discussed in GHD April 2019;

Cleanaway have advised that this will be addressed through the continued monitoring program which will include standing water level monitoring for the groundwater network. Please refer to Attachment 3 of the Addendum Report (Cleanaway 2019);

- Water elevations at the Void 10 discharge location (DIS) is at around RL+16.2 m AHD in late February 2019. It is understood that water from Six Mile Creek flows directly into Void 10, and then overflows at the DIS location as it flows northwards towards the Brisbane River. The water elevation in Void 10 is greater than the nearby groundwater monitoring bores e.g. bores BH08, BH12 and BH18 (having groundwater elevations between 12 m to 14 m). This suggests that Void 10 may be acting as a localised groundwater recharge feature, which would locally distort the relatively flat lying regional groundwater flow; and
- This supplementary groundwater evaluation should be read in conjunction with the original conceptual site model in the Leachate, Surface water and Hydrogeological Assessment Report prepared by GHD in April 2019.



Memorandum

Attachment 1 Groundwater elevation contour figures

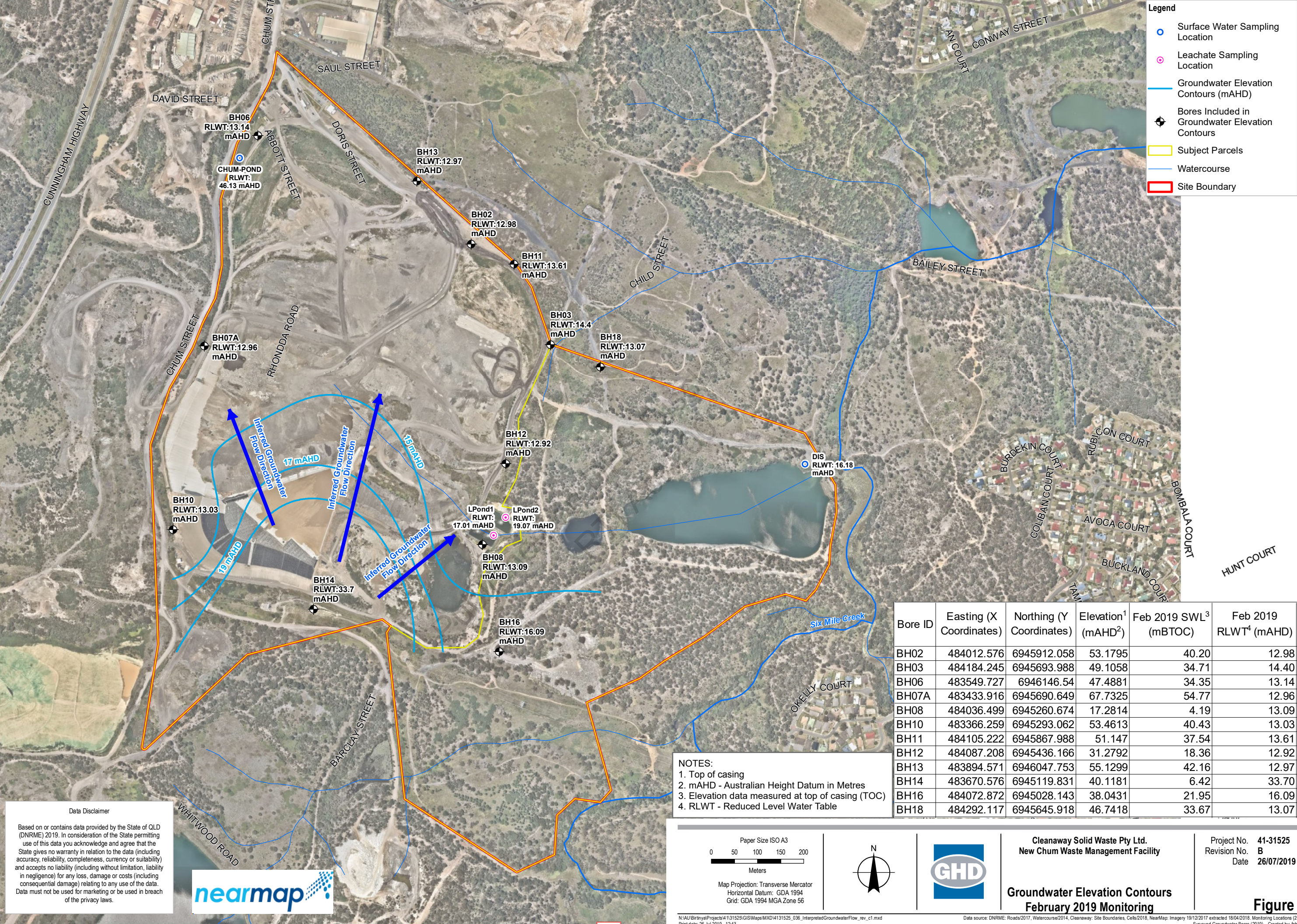
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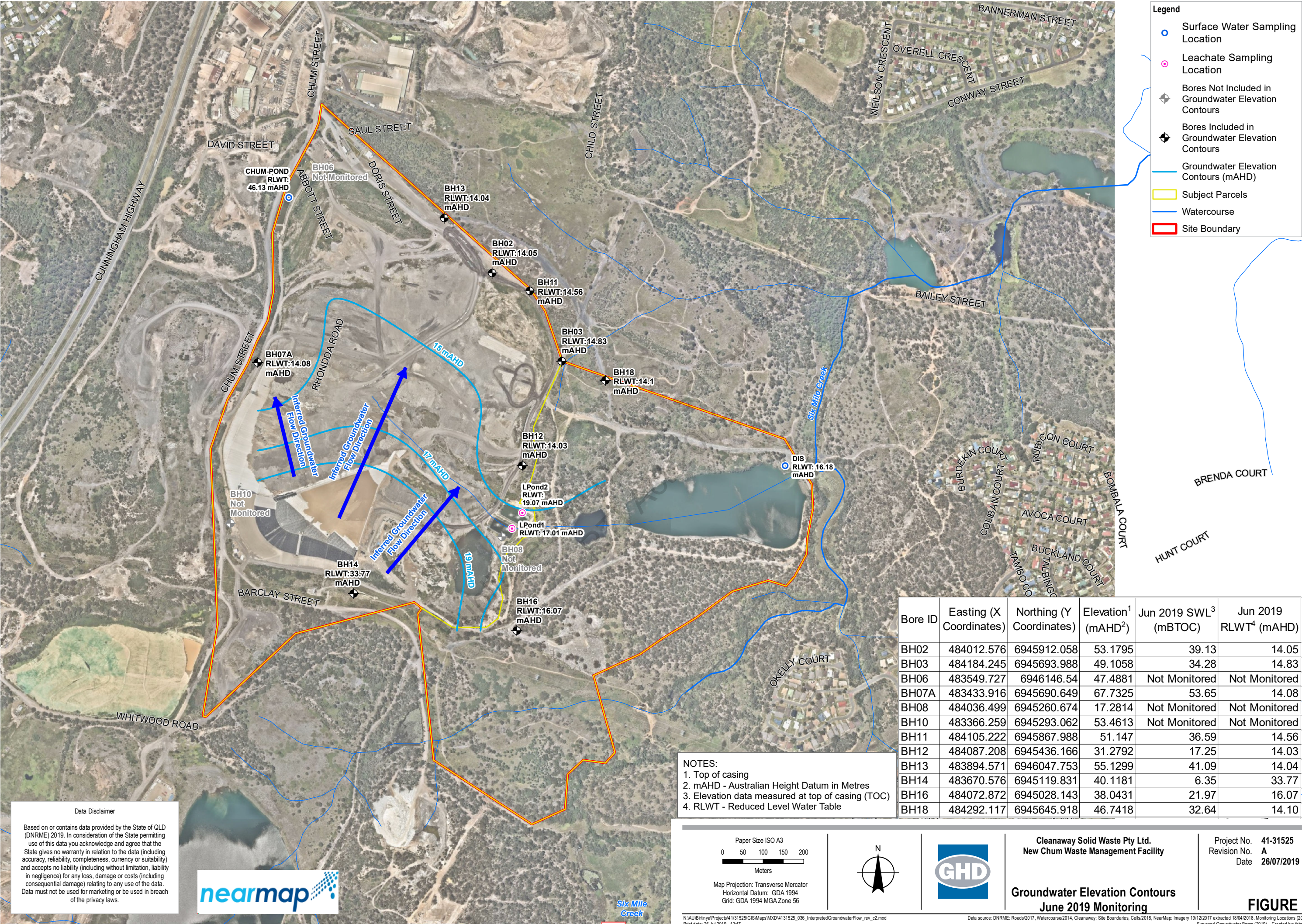
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Attachment 2 Details of bores and standing water level for February and June 2019

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Table 1 Details of bores and surface water

Bore ID	Easting (X Coordinates)	Northing (Y Coordinates)	Elevation ¹ (mAHD ²)	Feb 2019 SWL ³ (mBTC)	Feb 2019 RWLT ⁴ (mAHD)	Jun 2019 SWL (mBTC)	Jun 2019 RWLT (mAHD)
BH02	484012.576	6945912.058	53.1795	40.20	12.98	39.13	14.05
BH03	484184.245	6945693.988	49.1058	34.71	14.40	34.28	14.83
BH06	483549.727	6946146.54	47.4881	34.35	13.14	Not Monitored	Not Monitored
BH07A	483433.916	6945690.649	67.7325	54.77	12.96	53.65	14.08
BH08	484036.499	6945260.674	17.2814	4.19	13.09	Not Monitored	Not Monitored
BH10	483366.259	6945293.062	53.4613	40.43	13.03	Not Monitored	Not Monitored
BH11	484105.222	6945867.988	51.147	37.54	13.61	36.59	14.56
BH12	484087.208	6945436.166	31.2792	18.36	12.92	17.25	14.03
BH13/5A	483894.571	6946047.753	55.1299	42.16	12.97	41.09	14.04
BH14	483670.576	6945119.831	40.1181	6.42	33.70	6.35	33.77
BH15	483670.162	6945116.645	40.1999	6.34	33.86	6.53	33.67

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Memorandum

Bore ID	Easting (X Coordinates)	Northing (Y Coordinates)	Elevation ¹ (mAHD ²)	Feb 2019 SWL ³ (mBTC)	Feb 2019 RWLT ⁴ (mAHD)	Jun 2019 SWL (mBTC)	Jun 2019 RWLT (mAHD)
BH16	484072.872	6945028.143	38.0431	21.95	16.09	21.97	16.07
BH17	484280.062	6945655.534	47.3794	15.60	31.78	15.50	31.88
BH18	484292.117	6945645.918	46.7418	33.67	13.07	32.64	14.10
LPond 1	484020.026	6945307.808	17.0144	N/A	N/A	N/A	N/A
LPond 2	484033.366	6945317.628	19.0687	N/A	N/A	N/A	N/A
DIS	484755.845	6945421.23	16.1807	N/A	N/A	N/A	N/A
Chum St Sediment Pond	483529.915	6946155.556	46.1328	N/A	N/A	N/A	N/A

Notes:

1. Elevation data measured at bore top of casing or surface water level measured on 26 February 2019
2. Australian Height Datum in metres
3. Standing water levels
4. Relative Level Water Table

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Attachment 5 – Extract from Redesign and Rehabilitation of the New Chum Waste Management Facility, Site Based Management Plan, GHD Pty Ltd, 25 June 2019, pages 28 to 36 inclusive.

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5.3 Stormwater management

Issues and impacts	
Stormwater runoff from the landfill may contain contaminants, and cause sediment movement and erosion which could affect water quality downstream and cause environmental harm if not managed and contained.	
Agency interest	
Water	
Environmental objective	
<ul style="list-style-type: none"> Stormwater management system prevents, as far as is practicable, stormwater contamination, sediment movement and accelerated erosion processes. Stormwater management system is maintained to capture runoff generated by (up to and including) a 24 hour storm event with an average recurrence interval of 1 in 10 years must be retained on site or managed to remove contaminants before release. The only contaminants to be released to surface waters are settled treated water of acceptable quality and from approved release points. External stormwater is diverted around the site. Water quality of site stormwater meets EA requirements. 	
Performance criteria	
<ul style="list-style-type: none"> Stormwater discharge meets limits as described of the Stormwater Management Plan. No complaints are received from regulatory authorities in relation to erosion and sediment control and water quality issues. No uncontrolled releases of stormwater from the facility. 	
Control measures	Responsibility
Manage stormwater in accordance with the <i>Stormwater Management Plan</i> , GHD Pty Ltd, 2018 (refer Appendix B).	Site Operations Manager
Sediment captured in the sedimentation basin to be removed when the capacity of the sedimentation basin is compromised, and disposed of appropriately so that the sediment does not have potential to enter the waterways external to the site.	Site Operations Manager Cleanaway Employees
As required, a flocculant (such as gypsum) will be added to the storage such that the quality of discharge water meets acceptable limits. Refer to Section 3.6 of the Stormwater Management Plan (Appendix B).	Site Operations Manager

Control measures continued	Responsibility
<p>No release of stormwater to the environment shall occur, unless in accordance with the EA . The approved water quality objectives for release are:</p> <ul style="list-style-type: none"> • pH is between 6.5 and 9; • Dissolved oxygen is greater than 6 mg/L; • Total organic carbon is less than 20 mg/L; • Total suspended solids is less than the greater of the following: <ul style="list-style-type: none"> – 50 mg/L – 10 % greater than the concentration of suspended solids in the upstream point • No visible hydrocarbons or litter is present. 	Site Operations Manager
<p>For events larger than a 24 hour storm event with an ARI of 1 in 10 years, stormwater runoff is not all required to be contained on site, however reasonable and practicable measures shall be taken to minimise the release of prescribed contaminants.</p>	Site Operations Manager
<p>Erosion protection measures and sediment control structures must be provided and maintained to effectively minimise any likelihood of erosion and release of sediments from the premises.</p>	Site Operations Manager
<p>Sedimentation retention ponds and other sediment control measures must be operational and maintained on the site at all times until disturbed areas in the upstream catchment are stabilised and rehabilitated.</p>	Site Operations Manager
<p>Spills must be cleaned up immediately using appropriate spill kit and following the spill procedure:</p> <ul style="list-style-type: none"> • Identify the source of the spill, and contain where possible • Identify the spill material, and review risk controls if safety data sheets are available • Clean up spill using spill kit or appropriate absorbent material, and employing appropriate PPE. Dispose of waste appropriately • Notify the Site Operations Manager. If the spill leads to offsite contamination, the Site Operations Manager shall report the spill to DES (refer Section 4.3), and • Restock or replace the spill kit 	Cleanaway Employees
<p>Stormwater of appropriate quality may be beneficially utilised on site for dust management.</p>	Site Operations Manager

Monitoring	Responsibility
<p>All stormwater management structures to be inspected after each storm event.</p> <p>Observe levels of sediment and storage in relation to the level marker (sediment storage zone is the bottom third, and settling zone is the top two thirds of capacity).</p> <p>If required, water shall be treated and discharged from the storage basin such that the full settling zone is available for subsequent rainfall event. Water must be confirmed to be of a suitable quality by sampling prior to release.</p>	Site Operations Manager
All drainage, erosion and sediment management devices are to be checked weekly for the build up of accumulated sediment.	Site Operations Manager
<p>Monitoring of water quality characteristics as per the Stormwater Management Plan (Appendix B) and the Environmental Authority (Appendix A). The monitoring points are identified in Section 3.6 of the Stormwater Management Plan. These include monitoring points:</p> <ul style="list-style-type: none"> • At the overflow point from the sediment storage; • For any pumped discharges from the sediment storage; and • A specific upstream sampling point confirmed based on field observation, but located in Six Mile Creek between 20 and 40 metres upstream from the confluence of Void 1 and Six Mile Creek. <p>(Specific location of monitoring locations dependent upon project stage).</p> <p>Monitoring via an in-field probe or field observation of:</p> <ul style="list-style-type: none"> • Suspended Solids; • pH; • Specific Conductance; • Dissolved Oxygen; • Total Organic Carbon; • Conductivity ; • Nutrients (Total N, nitrate / nitrite, ammonium, total P and filterable reactive P); • Visual monitoring for any oil/grease slicks, floating oil, grease, scum or litter. <p>Frequency:</p> <ul style="list-style-type: none"> • When discharge is required – add flocculant (if required), then sample the sediment basin and the upstream point; • Establish a relationship between turbidity and TSS by sampling on a monthly basis for the first 12 months of establishment of a new sediment pond; • Sample for TOC and ammonia on a six monthly basis. 	Site Operations Manager
Monitoring to be undertaken if complaints are received or visual observations indicate that the stormwater quality may not be meeting the <i>Urban Stormwater Quality Planning Guidelines December</i> (DERM, 2010) and Queensland State Planning Policy (2014).	Site Operations Manager Cleanaway Employees

Monitoring continued	Responsibility
In the event that release of stormwater runoff is required, sampling and analysis shall be carried out to confirm that contaminants are either absent, or are present at acceptable concentrations that would be unlikely to cause environmental harm, as compared with <i>Queensland Water Quality Guidelines</i> default objectives or specific receiving environment data.	Site Operations Manager
Reporting	Responsibility
Maintain a record of inspections, monitoring and corrective actions.	Site Operations Manager
Maintain an incident and complaints register.	Site Operations Manager
Corrective action	Responsibility
All complaints relating to water quality will be investigated promptly. Monitoring will be undertaken and appropriate corrective actions taken in consideration of the results.	Site Operations Manager
Clean out of the sediment storage shall be undertaken before the full sediment storage zone becomes full of sediment.	Site Operations Manager
Cleaning of drainage, erosion and sediment management devices as identified from weekly inspections.	Site Operations Manager Cleanaway Employees
Where investigations show unacceptable stormwater pollutant concentrations, revision of treatment train and management plan will be undertaken and further controls implemented as necessary.	Site Operations Manager

5.4 Erosion management

Issues and impacts	
Erosion and resulting sediment movement could affect water quality downstream and cause environmental harm if not contained on the site.	
Agency interest	
Water	
Environmental objective	
Erosion controls prevent or reduce movement of sediment, or contain sediment to within the facility boundary.	
Performance criteria	
<ul style="list-style-type: none"> No complaints are received from regulatory authorities in relation to erosion and sediment control and water quality issues. No erosion of landfill batters that results in exposure of the underlying material. 	
Control measures	Responsibility
Manage stormwater in accordance with the <i>Stormwater Management Plan</i> , GHD Pty Ltd, November 2018 (refer Appendix B).	Site Operations Manager
Daily and intermediate cover placement to be well compacted and as even as practicable.	Site Operations Manager
Install bunds along longer flow paths to reduce flow path lengths.	Site Operations Manager
Install small sediment sumps, check dams or sediment fences where practicable to reduce sediment loads via collection of larger particles.	Site Operations Manager
Install formalised drainage infrastructure, with protection layers (vegetation, geofabric, etc.) where relevant to reduce scouring and direct surface water flow, as per the <i>Stormwater Management Plan</i> , GHD Pty Ltd, November 2018 (refer Appendix B).	Site Operations Manager
Monitoring	Responsibility
Weekly observation of cover areas will be undertaken and any locations where concentrated flow paths or rill erosion is occurring will be inspected and repaired where applicable.	Site Operations Manager
Reporting	Responsibility
Maintain a record of observations and corrective actions undertaken.	Site Operations Manager
Corrective action	Responsibility
Undertake remedial work to cover where flow paths and rill erosion are identified.	Site Operations Manager
Install additional controls if deficiencies are identified.	Site Operations Manager

5.5 Leachate management

Issues and impacts	
Leachate from the landfill may contain contaminants, and could affect downstream surface water quality and/or groundwater and cause environmental harm if not contained on the site.	
Agency interest	
General , Waste management	
Environmental objective	
Leachate management system prevents contamination of surface waters and groundwater.	
Performance criteria	
<ul style="list-style-type: none"> No complaints are received from regulatory authorities in relation to water quality issues. No releases of leachate from the facility to surface water or groundwater. 	
Control measures	Responsibility
Leachate is collected in the leachate collection system and conveyed from the landfill cell to the leachate storage facility	Site Operations Manager
If the height of the leachate above the liner system reaches 300 mm above the liner system, implement a management / pumping plan.	Site Operations Manager
Routine groundwater monitoring for the identification of leachate impacts.	Site Operations Manager
Leachate is managed as follows: <ul style="list-style-type: none"> Recirculated through the landfill unit; Treated by alternative technologies as agreed by the administering authority; Disposed of at a facility that is approved to receive such waste; and Leachate be managed in accordance with leachate quality management strategy. 	Site Operations Manager
Monitoring	Responsibility
Height of the leachate above the liner system is measured and recorded in accordance with the EA conditions, as follows: <ul style="list-style-type: none"> On a weekly basis when the height of the leachate is below 300 mm above the liner system On a daily basis when the level of the leachate is above 300 mm 	Site Operations Manager
The leachate storage level within the leachate pond shall be monitored on a weekly basis by a depth marker, or similar. The appropriate rate and method of disposal will be decided based upon the leachate pond depth.	Site Operations Manager
Routine groundwater monitoring for the identification of leachate impacts. Refer to Groundwater management plan (Section 5.6).	Site Operations Manager
Reporting	Responsibility
Maintain a record of monitoring, observations and corrective actions undertaken.	Site Operations Manager

Corrective action	Responsibility
Pump excess leachate to leachate pond for evaporation.	Site Operations Manager
If freeboard capacity of the leachate ponds is exceeded, then excess leachate should be removed via tanker to a suitably licenced facility.	Site Operations Manager
If leachate indicators are identified in the groundwater, DES should be notified and further investigations undertaken.	Site Operations Manager

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5.6 Groundwater management

Issues and impacts	
Groundwater contamination could result from poorly managed leachate and surface water, which could result in environmental harm.	
Agency interest	
Waste management, Self-Monitoring and Reporting	
Environmental objective	
Groundwater conditions are not detrimentally affected by the operation of the facility.	
Performance criteria	
<ul style="list-style-type: none"> No complaints are received from regulatory authorities in relation to groundwater quality <p>Monitored parameters from the groundwater bores are within acceptable limits based upon statistical analysis, in consideration of historical data</p> <ul style="list-style-type: none"> No uncontrolled releases of stormwater or leachate from the landfill Monitoring is conducted as required by the EA 	
Control measures	Responsibility
Implement and maintain controls as per the stormwater management plan (Section 5.3).	Site Operations Manager
Implement and maintain controls as per the leachate management plan (Section 5.5).	Site Operations Manager
Conduct groundwater monitoring from the groundwater monitoring system as required by the EA.EPPR00445713:	Site Operations Manager Environmental Business Partner
•	•
Monitoring	Responsibility
Maintain the groundwater monitoring system and monitor groundwater quality on at least a six monthly basis.	Site Operations Manager Environmental Business Partner
Reporting	Responsibility
<p>Reporting of results of the Groundwater Monitoring Program, including</p> <ul style="list-style-type: none"> Identification of whether statistically significant increase over background values at locations hydraulically down-gradient of the landfill unit for any water quality characteristic required to be monitored; and Standing groundwater levels accurate to 0.01 m, with the elevation of the reference point relative to the Australian Height Datum to an accuracy of 0.005 m. This must be recorded prior to sampling and reported as the depth in metres from the established reference point to the water surface within the bore <p>Sampling and reporting must be undertaken in accordance with the current version of the <i>Water Quality Sampling Manual</i>.</p>	Site Operations Manager Environmental Business Partner
Corrective action	Responsibility

Implement corrective actions as per the Stormwater Management Plan (Section 5.3).	Site Operations Manager
Implement corrective actions as per the Leachate Management Plan (Section 5.5).	Site Operations Manager
Conduct follow up groundwater monitoring to identify the success of the corrective actions where statistically significant increases are identified from the baseline data.	Site Operations Manager

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