CONFIDENTIAL

REPORT

Western Ridge – Crusher Study Area Baseline Assessment

PFAS and TRH Groundwater Baseline Assessment

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1.0 INTRODUCTION

BHP Billiton Iron Ore Pty Ltd (BHP) engaged Golder Associates Pty Ltd (Golder) to conduct a groundwater baseline assessment of per- and poly-fluoroalkyl substances (PFAS) and total recoverable hydrocarbons (TRH) at the Western Ridge exploration area (the site). For this baseline assessment purposes, Western Ridge site is divided into three zones: the Western Ridge Crusher Study (WRCS), the Eastern Syncline, and Afghan Springs. This report presents the baseline findings for the WRCS area (the study area) conducted in April 2021. The baseline assessment for the Eastern Syncline and the Afghan Springs areas are provided under separate covers.

The location plan is presented in Figure 1 and a site plan is presented in Figure 2.

2.0 BACKGROUND

BHP intends to develop the Western Ridge for active mining. The site is located west of the Mount Whaleback mine site where PFAS and TRH contamination have been identified within the groundwater. Therefore, BHP requires a baseline assessment of PFAS and TRH concentrations in the groundwater at the Western Ridge prior to development for mining.

3.0 OBJECTIVES

The objective of the baseline assessment was as follows:

- To evaluate the concentrations of PFAS and TRH in the groundwater at the site to establish a baseline, using the existing bores at the site.

This baseline assessment is not to meet environmental assessment requirements as set out in the Department of Water and Environmental Regulation (DWER) Contaminated Sites Guidelines and the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (ASC NEPM). However, the methodologies applied for this assessment are generally consistent with the above guidelines.

This report presents the findings of the baseline assessment for the WRCS area only.

4.0 SCOPE OF WORKS

The scope of works conducted at the study area included the following:

- Obtain groundwater samples using Hydrasleeve® from nine existing groundwater monitoring wells:
  - HWSR0014M
  - HWSR0019M
  - HWSR0020M
  - HWSR0021M
  - HXAN0002M
  - WSR0296M
  - WSR0299M
  - WSR0597M
  - WSR1193RM
- Submit groundwater samples to NATA-accredited environmental testing laboratories for PFAS (to meet the 99% species protection criteria) and TRH analyses.
- Preparation of a factual report (this report) to present baseline PFAS and TRH contamination at the WRCS area.

5.0 SITE OVERVIEW

The site overview information below has been obtained through a desktop review, including from the BHP 'Western Ridge and OB29/30/35 Detailed Hydrogeological Assessment' (BHP, 2020). Additional information obtained during the site visit has also been included. This section covers the bigger Western Ridge exploration area and not specifically focus on the WRCS area.

5.1 Site Identification

The Western Ridge exploration area is located approximately 2 km southwest of the Mount Whaleback mine site, both of which are owned and operated by BHP. These mine sites are located approximately 5 to 7 km west of the Newman Township and approximately 1200 km north-east of Perth, in the Pilbara region of Western Australia. The WRCS area is located in the western portion of the Western Ridge exploration area, as presented in Figure 1 and displayed in more detail on Figure 2.

The site identification details are summarised in Table 1 below.

Table 1: Site Identification

Item	Description		
Site Location	Approximately 5 to 7 km west of Newman		
Allotment/DP	Lot 101 on Deposited Plan 220388 and Crown Land		
Local Government Authority	Shire of East Pilbara		
Zoning	Rural		
Previous Land Use	Rural		
Proposed Land Use	Mining tenement		
WRCS Boundary Coordinates	*Easting (m)*	*Northing (m)*	
	766300.5441	7412151.856	
	766191.8121	7410776.535	
	765957.9788	7409508.813	
	766053.3028	7407932.114	
	764937.4409	7407955.016	
	764891.7837	7407349.476	
	761014.8316	7407422.014	
	761064.1658	7409851.799	
	762412.2678	7410822.888	

5.2 Site Description

The topography of the Western Ridge is undulating with raised elevation to the north (Bill's Hill and Mount Helen) running east to west and raised elevation to the south (Silver Knight) as displayed in Figure 1.

The WRCS area is predominantly covered by native vegetation with unsealed roads and drill pads from past and current exploration activities throughout the area. Some observed access tracks and areas of drill related clearing have been rehabilitated.

It is important to note that the Western Ridge site is located within a Priority 1 drinking water catchment area (DoW, 2014), which has the fundamental water quality objective of risk avoidance to protect the drinking water source.

5.3 Climate

The Newman Airport weather station (007176) is the nearest weather station to the site and is located approximately 12 km away from the site. The data indicated the mean maximum temperature range is from 22.9°C (July) to 39.1°C (December) and the mean minimum temperature range is from 6.4°C (July) to 25.0°C (January). The mean annual rainfall is 332.6 mm, with the highest mean rainfall during February (71.0 mm) and the lowest during September (3.9 mm). January and February were recorded as the wettest months, with higher mean rainfall data than the remaining months.

The Pilbara climate and subsequent rainfall is typically dominated by the influence of subtropical highs located to the south of the Pilbara. During summer (November to April) the high-pressure cell moves further south, resulting in the Pilbara receiving approximately 70% of its annual precipitation during these summer months. Annual precipitation figures for these zones are much less than the annual potential evaporation (BHP, 2020).

The Pilbara is characterised by high local evaporation rates and a generally low soil infiltration capacity. This results in recharge occurring exclusively during major rainfall events (15-25 mm/d). The closest station that records evaporation is the Wittenoom BoM station, located approximately 190 km north-west of Newman. Annual average evaporation for Wittenoom is 3,142 mm/year, which exceeds annual rainfall by as much as 2,800 mm/year.

5.4 Hydrogeological Setting

5.4.1 Geology

The geological conditions in the region can be summarised as:

- The Silver Knight and Eastern Syncline are mainly hosted by the upper Marra Mamba members, but mineralisation of the overlying Wittenoom and underlying Jeerinah formations can also be seen in the orebodies.
- Bill's Hill and Mount Helen orebodies are hosted in the mineralised Brockman Iron Formation. The orebody aquifer is usually well delineated by the extent of the high-grade ore (assumed high permeability), with a halo of lower grade ore (assumed moderate permeability) around it.

5.4.2 Topography and Surface Water Drainage

The site is located within the Whaleback Creek catchment. The main drainage features are the Whaleback Creek, and its southern tributary which drains the Western Ridge area (referred to as Southern Creek). The Whaleback Creek drains into the Fortescue River, upstream of Ethel Gorge. The Gorge is located downstream (north) of Ophthalmia Dam at the confluence of Homestead, Shovelanna, and Warrawandu Creeks, which merge within the Fortescue River and flow through the Ophthalmia Range in a northerly direction (BHP, 2020).

5.4.3 Aquifer

There are two main aquifer types (BHP, 2020):

1) The regional aquifers; which generally comprise weathered dolomite of the Paraburdoo Member of the Wittenoom Formation, which occurs in sub-crop along the Whaleback and Southern Creek valleys.
2) The orebody aquifers; which comprise the mineralised Brockman Iron Formation that make up the Bill's Hill and Mount Helen orebodies and the mineralised Marra Mamba that make up Silver Knight and Eastern Syncline orebodies.

5.5 Groundwater Abstraction

Groundwater abstraction at the Western Ridge is currently regulated through the RiWI Act 5C License to Take Water GWL170659(3) which allows the annual abstraction of 45,000 kL/a to be used for exploration drilling operations as well as dust suppression for earthworks and construction purposes only (BHP, 2020).

In order to achieve progressive dewatering to allow mining below the water table, BHP is seeking to amend the 5C licence in the near future.

6.0 PREVIOUS LAND USE

Golder is of the understanding that the area has no known previous land use except for exploration activities and hydrogeological drilling purposes. This is supported by the available historical aerial photographs of the site (see Figures 3A – 3D), which did not indicate any major historical activities or infrastructures at the site.

Based on *pers comm. Andrew Cottrell (BHP hydrogeologist), April 2021*, the Afghan Springs pools were historically used for stock water purposes. There were previously some infrastructures in the area for keeping cattle, i.e., water tanks. Andrew also indicated that there has been a creek diversion, approximately 12 to 24 months ago, which can also be seen on the historical aerial photographs. He indicated that there is no known potentially contaminating activities or events reported at the Western Ridge site.

Golder considers that exploration and hydrogeological assessment activities have the potential to introduce contamination. However, the impacts are likely to be minimal and with groundwater levels considerably deep, contamination impacts to groundwater from site activities on and above ground are considered to be unlikely. It is important to note that the use of additives during drilling (i.e., drilling muds and/or glue for the PVC casing installation of the bores) may result in cross-contamination to the groundwater samples collected and give false positives with regards to PFAS and TRH in groundwater.

7.0 ANALYTICAL SCHEDULE

Groundwater samples collected were analysed for PFAS, which comprised the 28 PFAS suite with appropriate limit of reporting (LOR) for comparison against the 99% species protection level. In addition, groundwater samples were also analysed for TRH and benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN) analyses.

8.0 ASSESSMENT CRITERIA

A summary of the relevant groundwater assessment criteria is provided in Table 2.

Table 2: Groundwater Assessment Criteria

Potential Receptor	TRH, BTEXN	PFAS/PFOA
Human Health	ASC NEPM HSL-D* DER (2014) Drinking Water Health Value**	PFAS National Environmental Management Plan (NEMP) 2.0 (2020) Human Health guideline values: - Drinking water quality guideline value**, and - Recreational water quality guideline value*
Ecological	ANZG (2018) Fresh Water 95%*	PFAS NEMP 2.0 (2020) Ecological water quality guideline values: - Freshwater 99% species protection – high conservation value system*, and - Freshwater 95% species protection – slightly to moderately disturbed system*

Note: * Assessment criteria was selected based on the current and the intent future land use for the site. 99% species protection level for PFAS has also been adopted to account for potential bioaccumulation.

** Assessment criteria was selected as the site is located within a Priority 1 drinking water catchment area.

9.0 GROUNDWATER SAMPLING METHODOLOGY

The groundwater sampling was undertaken between 13 and 16 April 2021 by two Golder field personnel.

Groundwater samples were collected from nine existing groundwater wells within the WRCS area. Groundwater wells WSR1270RM, WSR1241RM, WSR1153RM, WSR0663RM, WSR1248RM, WSR1150RM were dry and WSR1139RM could not be located and therefore these wells could not be sampled. The nine wells which were sampled, HWSR0014M, HWSR0019M, HWSR0020M, HWSR0021M, WSR0296M, WSR0299M, WSR0597M, WSR1193RM, and HXAN0002M were selected to assess the area laterally. While this baseline assessment is limited by the availability of existing bores, Golder considers that the locations of the bores selected are sufficient to provide a 'snapshot' of PFAS and TRH concentrations in groundwater at the site, which is the intention of this baseline assessment. Groundwater well construction logs are provided in Appendix A.

The groundwater monitoring wells were sampled using HDPE Hydrasleeves® (Super/SkinnySleeve). Prior to sampling, an electronic water level meter (BHP supplied 1550T2 BHP 200 m) was used to determine assess the standing water level (SWL). The SWL measurements are displayed in Appendix B.

In general, the HDPE Hydrasleeves® were set to target the well screen, at approximately 3 to 5 m below the groundwater level. For monitoring wells with well screen deeper than the groundwater level, the HDPE Hydrasleeves® were set at approximately 1 m below the top of the screen level. The HDPE Hydrasleeves® were then left for at least a 24-hour period except at HXAN0002M which was left for at least 23 hours to allow the groundwater, within the well column, to stabilise. The HDPE Hydrasleeves® were then retrieved and the groundwater transferred directly into laboratory supplied bottles using Hydrasleeves® straws.

Groundwater field parameters (pH, reduction-oxygen potential (redox), conductivity, temperature, and dissolved oxygen (DO)) were measured using a calibrated YSI water quality meter (19L1002399) by placing the probes into a small aliquot of retrieved groundwater which was poured from the Hydrasleeves® into a container for measurement. Field groundwater monitoring sheets are provided in Appendix B. The YSI calibration certificate and daily bump checks are provided in Appendix C.

New nitrile gloves were worn while preparing the HDPE Hydrasleeves® for deployment and during retrieval. Samples were placed in laboratory supplied eskies and cooled with bags of ice (ice bricks were not used). Between each location, the water level meter was decontaminated with a Liquinox/water solution and deionised water, to reduce the potential of cross contamination.

Groundwater samples were dispatched under chain-of custody (CoC) procedures to ALS (primary laboratory) and Eurofins (secondary laboratory) which are both NATA-accredited laboratories. The CoCs and laboratory certificates are included in Appendix D.

9.1 Sampling Quality Assurance and Quality Control (QA/QC)

The following quality assurance control measures were undertaken during the sampling program:

- Field duplicate or triplicate samples were collected at a minimum rate of 20% (10% duplicates and 10% triplicates).
- Primary and duplicate samples were submitted to NATA-accredited laboratory ALS Environmental. Triplicate samples collected were submitted to an alternate NATA-accredited laboratory Eurofins.
- Water samples were collected whilst wearing a new pair of disposable nitrile gloves for each sample.
- Samples collected were placed in laboratory-supplied bottles appropriate for the relevant analyte.
- No rinsate samples were collected as no non-dedicated sampling equipment was used.

- Trip blanks were submitted for analysis at a rate of one per esky.
- Samples collected in the field were placed in an esky with ice in bags (no ice bricks were used) and delivered to the NATA accredited laboratories for analysis.

9.2 PFAS Sampling Considerations

Due to the widespread use of PFAS compounds in everyday items, the following considerations were implemented by field staff prior and during the collection of samples as per guidance provided by Department of Water and Environmental Regulation (DWER) *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances* (2017):

1) No new clothing, or clothing with rain or waterproof coatings/treated fabric.
2) No food or snack containers wrapped with non-compliant materials.
3) No Teflon® containing or coated field equipment.
4) No Teflon® lined lids on the laboratory supplied sample bottle.
5) No Decon or detergent decontamination solutions. Liquinox® was used for decontaminating equipment.
6) No ice bricks for sample storage.
7) No PFAS containing sun cream.

10.0 RESULTS

10.1 Groundwater Levels and Field Parameters

Groundwater monitoring wells were gauged using an electronic water level meter prior to sampling and groundwater parameters obtained from a sample aliquot using a YSI water quality meter. The depth to groundwater and bore installation details are summarised in Table 3 and the groundwater field parameters recorded of the sampled wells are presented in Table 4.

Table 3: Summary of Groundwater Levels (April 2021) and Borehole Details

Well ID	Depth to Groundwater (m btoc)	Top of PVC Pipe Survey Level (m AHD)	Groundwater Level (m AHD)	Top of Screened Interval (m AHD)	Base of Screened Interval (m AHD)	Drilled/ Installation Date
HWSR0014M	151.77	667.43	515.66	492.50	480.50	October 2020
HWSR0019M	49.35	632.36	583.01	571.52	478.52	October 2020
HWSR0020M	27.93	630.71	602.78	617.93	527.93	October 2020
WSR0296M	117.40	625.26	507.86	523.72	427.72	November 2015
WSR0299M	112.11	621.51	509.40	521.13	437.13	November 2015
WSR0597M	135.37	651.68	516.31	518.70	470.70	May 2016
WSR0663RM	Dry	608.54	-	523.86	517.86	May 2016
WSR1139RM	n/a	634.52	-	572.77	530.77	November 2016
WSR1150RM	Dry	649.23	-	545.78	527.78	November 2016
WSR1153RM	Dry	641.27	-	528.91	504.91	November 2016
WSR1193RM	67.55	636.44	568.89	572.69	548.69	November 2016
WSR1270RM	Dry	606.69	-	521.89	503.89	November 2016
WSR1241RM	Dry	618.37	-	533.35	515.35	December 2016
WSR1248RM	Dry	615.05	-	542.16	524.16	November 2016

Well ID	Depth to Groundwater (m btoc)	Top of PVC Pipe Survey Level (m AHD)	Groundwater Level (m AHD)	Top of Screened Interval (m AHD)	Base of Screened Interval (m AHD)	Drilled/ Installation Date
HWSR0021M	107.91	615.99	508.08	472.63	388.63	March/ April 2021
HXAN0002M	76.70	624.56	547.86	563.63	473.63	February 2021

Notes: n/a = not accessible/could not locate

m btoc = metre below top of casing

m bgl = metre below ground level

It is noted that the water level is above the screen interval for some wells (i.e., HWSR0014M and HWSR0019M). While having the well screen lower than the groundwater level is not ideal, given there is no known previous land use with the exception for exploration and hydrogeological assessment activities, light non-aqueous phase liquid (LNAPL) impacts in groundwater are not expected. Additionally, groundwater level is considerably deep (down to 151 m btoc at HWSR0014M) and subsequently contamination impacts in groundwater from the minimalistic nature of the site activities are unlikely. Therefore, these selected wells are considered to be suitable for the baseline assessment purposes; however, for future environmental and contaminated sites assessment works, Golder recommends the installation of groundwater monitoring wells that meet the requirements as set out in the DWER and NEPM guidelines.

Table 4: Summary of Groundwater Field Parameters – April 2021

Well ID	pH	Temperature (°C)	Redox (mV)	DO (%)	Specific Conductivity (µS/cm at 25°C)	Notes
HWSR0014M	7.15	24.9	164.3	3.76	545	Sample was clear, no odour/sheen, low turbidity.
HWSR0019M	7.47	29.2	-70.0	1.20	3022	Sample was clear, no odour/sheen, low turbidity
HWSR0020M	8.11	27.6	-332.6	0.28	1540	Sample was clear, no sheen, low turbidity
WSR0296M	7.56	29.5	-16.7	2.22	983	Sample was clear, rotten egg odour, no sheen, low turbidity
WSR0299M	7.50	31.2	-1.6	1.85	513	Sample was clear, no odour/sheen, low turbidity
WSR0597M	7.18	25.8	105.9	3.83	1194	Sample was cloudy grey, no odour/sheen, medium turbidity
WSR1193RM	7.42	28.1	-155.1	1.22	1422	Sample was cloudy brown, no odour/sheen, medium turbidity
HWSR0021M	7.27	30.5	17.6	3.24	961	Sample was cloudy brown, no odour, high turbidity
HXAN0002M	7.79	26.7	-205.0	0.66	892	Sample was clear, rotten egg odour, no sheen, low turbidity

10.2 Analytical Results

The following section summaries the laboratory analytical results. The results are presented in Tables A and B at the end of this report and the laboratory reports are displayed in Appendix D.

10.2.1 PFAS

PFAS was detected above laboratory LOR in one groundwater well, HXAN0002M. At the other locations sampled, PFAS was not detected above the LOR.

Concentrations above laboratory LORs are summarised in Table 5 below. No exceedance of adopted assessment criteria (where available) was reported.

Table 5: PFAS Concentration above LOR

Analytes	Concentrations (µg/L)
HXAN0002M	
6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	0.002
Sum of PFAS	0.002

10.2.2 TRH

TRH was detected above laboratory LOR within samples obtained from four locations HWSR0014M, HWSR0019M, HWSR0020M, and HXAN0002M. Toluene was also reported at two locations (HWSR0020M at and HXAN0002M). TRH C_6-C_{10} F1 was reported at HWSR0014M and HWSR0019M, but from the presence of compounds other than BTEX. Reported concentrations did not exceed relevant screening criteria and are summarised in Table 6.

Table 6: TRH Concentrations above LOR (mg/L)

Well ID	TRH C_6-C_{10} F1	TRH >C_{10}-C_{16} F2	TRH >C_{16}-C_{34} F3	TRH >C_{34}-C_{40} F4	Toluene
HWSR0014M	0.17	<0.1	<0.1	<0.1	<0.002
HWSR0019M	0.15	<0.1	0.13	<0.1	<0.002
HWSR0020M	0.54	<0.1	0.11	<0.1	0.007
HXAN0002M	0.4	<0.1	<0.1	<0.1	0.007

10.2.3 Summary

While there is no known previous land use (except for exploration activities and hydrogeological drilling purposes), the results from this groundwater baseline assessment indicated that there are detections of PFAS, TRH, and toluene in groundwater at the site. It is noted that PFAS and TRH contamination have been reported within the groundwater at the Mount Whaleback mine site, located 2 km east of the site; however, Golder does not consider for these reported concentrations at the Western Ridge site to be related to those contaminations at the Mount Whaleback mine site.

It is considered likely that the reported PFAS, TRH, and toluene concentrations are related to the drilling additives that were used during drilling and installation of the groundwater wells (i.e., drilling muds and/or glue for the PVC casing installation). This consideration is supported by the following:

- Sarah Stegena (BHP) indicated that the groundwater wells recently installed have not been developed. Given the low yield of the groundwater wells, it is likely that the additives used during drilling and installation are still present within the groundwater. These wells were drilled using reverse circulation (RC) drilling methodology and PVC casing were glued and screwed and were hung from the top of the bore to the correct depth in the drill hole with no annulus backfill.
- The reported contamination appeared only at the recently installed groundwater wells except for HWSR0021M, as also shown in the results from the Afghan Springs area within the Western Ridge site (Golder, 2021). Groundwater wells that were installed over a year ago were not reported with any detectable concentrations of PFAS, TRH and toluene above laboratory LOR. HWSR0021M was recently installed in March/April 2021 and is understood to have been drilled as a production bore. Visual observation of this borehole on site indicates it to be potentially a different construction to the monitoring wells and may explain why TRH and PFAS were not detected at this location despite it being a newer well.

- The chromatographs did not show the typical unresolved complex mixture (UCM) associated with refined petroleum hydrocarbon (diesel, petrol) impacts, which are the typical hydrocarbon contamination identified at a mine site, including at Mount Whaleback. Chromatographs are included as Appendix E.
- Given the depth to groundwater at the site is relatively deep (>25 m bgl), it is unlikely for volatile compounds (i.e., toluene and TRH C_6-C_{10}) to leach to the groundwater from contamination events at surface.

Nevertheless, no exceedance of adopted assessment criteria was reported for any contaminants analysed as part of this groundwater baseline assessment.

11.0 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance/quality control (QA/QC) procedures adopted during this project are based on the ASC NEPM, DER 2014 guidelines (DER 2014), *AS 4482.1 – 2005* (Standards Australia 2005), *AS 4482.2 – 1999* (Standards Australia 1999), and PFAS NEMP (HEPA, 2020).

QA involves all the actions, procedures, checks, and decisions undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analytical results (ASC NEPM). QC involves protocols to monitor and measure the effectiveness of QA procedures.

The precision of the results for each analyte between the primary sample and the field duplicate/triplicate is determined by calculating the RPD. A quantitative measure of the accuracy of the analytical results reported is made by calculating the RPDs in accordance with the procedure described in AS 4482.1 – 2005 using the below calculation.

$$\%RPD = \left|\frac{A-B}{A+B}\right| \times 200$$

For the purposes of this assessment and in accordance with guidance in the NEPM 2013, an RPD less than or equal to 30% represents good correlation between laboratory results. Where the RPD is greater than 30% and the analytical results are less than five times the LOR, the precision and accuracy are also considered acceptable because the accuracy of laboratory analyses decreases as concentrations approach the LOR.

11.1 Fieldwork Program

RPD results are presented in Table C and trip blank results are presented in Table D at the end of this report. Field QA/QC procedures and compliance during the assessment are summarised in Table 7.

Table 7: Summary of Field QA/QC Compliance

QA/QC Element	Requirement	Requirement Adhered to?	Information/ Data Acceptable?
Equipment calibration	Where relevant, all field equipment is to be calibrated by the equipment supplier and certification provided	Yes (Appendix C)	Yes
Sampling methods	All sampling methods outlined in the methodology must be adhered to.	Yes	Yes
Record keeping	Detailed records of field activities were maintained with the use of daily record sheets, and quality control sample registers.	Yes	Yes
Chain of custody documentation	The CoC documentation was completed for each batch of samples, identifying the names of the samplers, the type of sample, the collection date and the analyses performed.	Yes	Yes
Sample labelling	Samples were properly labelled, showing reference number, sample ID, date of collection and sampler.	Yes	Yes

QA/QC Element	Requirement	Requirement Adhered to?	Information/ Data Acceptable?
Sample containers	Samples were collected in appropriate laboratory-supplied containers with suitable preservation methods (where required).	Yes	Yes
Sample storage and transport	Samples were stored in a chilled, insulated container immediately after sampling and delivered to the laboratory with CoC documentation.	Yes	Yes (See Note 1)
Analysis of trip blanks	No contamination of trip blanks reported.	Yes	Yes
Decontamination	Reusable field equipment (i.e., water level meter) were appropriately decontaminated using potable water and Liquinox® solution between each sampling location.	Yes	Yes
Duplicate samples	Duplicate and triplicate samples were collected for analysis by the primary and secondary laboratories, respectively (at a frequency of at least one pair per 10 samples).	Yes	Yes
	Relative percent difference (RPD) assessment to adhere to the following protocols: ■ 1-5 × laboratory LOR: no limit; ■ >5 × laboratory LOR: 0-30%.	Yes	Yes (See Note 2)

Notes: 1. Samples were all sent in an insulated container (esky) on ice. However, the ideal temperature could not be maintained throughout transport and elevated temperature inside the esky was noted upon receipt by the laboratory. The temperature of samples on arrival at the laboratory was reported at 21.9°C. This elevated temperature was associated with the remote nature of the site and the heat experienced by the site conditions in the Pilbara, which may affect the results.

2. Three RPDs were reported above 30% for results>5 × laboratory LOR. These RPD breaches are for TRH C_6-C_9 and TRH C_6-C_{10} F1 and TRH C_6-C_{10} less BTEX F1 between primary and triplicate samples collected at HWSR0019M. Higher triplicate results have been adopted in Table B to be conservative. All primary and triplicate results for these analytes are below the assessment criteria and therefore these RPD breaches are not considered to affect the outcome of the investigation.

11.2 Laboratory Quality Data Assessment

All samples were submitted to NATA-accredited laboratories in Perth for laboratory analysis. Laboratory QA/QC analysis were reviewed to assess data integrity and confirm reliability of the analytical data. Laboratory QA/QC analysis results were compared to laboratory acceptance criteria.

11.2.1 Holding Time

No analysis holding time outliers were reported.

11.2.2 Laboratory Control Spike

No laboratory control outliers were reported.

11.2.3 Surrogates

No surrogate recovery outliers were reported.

11.2.4 Matrix Spikes

No matrix spike outliers were reported.

11.2.5 Duplicates

No duplicate outliers were reported.

11.2.6 Method Blanks

No method blank value outliers were reported.

11.2.7 Laboratory QC Sample Frequency

Laboratory QC samples frequency outliers were reported for laboratory duplicates for PFAS analysis. Only one laboratory duplicate sample was analysed out of 14 primary samples (7.14%), which did not meet the 10% target. Note that samples not collected by Golder were included in the frequency rate calculation. The one laboratory duplicate analysed was collected by Golder and the 10% target criteria would have been met if no other non-Golder samples included in the frequency rate calculation. Matrix spike frequency outliers for PFAS and TRH – semi volatile fraction were reported as no samples were analysed (0.00%) of an expected 5% target.

As stated in Section 11.2.5, no duplicate outliers were reported in this duplicate sample; therefore, these laboratory QC sample frequency outliers are not considered to have significant impact on the overall data quality or outcome of the investigation.

11.3 Summary

A review of the field and laboratory QA/QC data and procedures confirms an acceptable level of compliance with the general requirements and DQOs. As such, there is an acceptable level of confidence in the data upon which the conclusions in this report have been made.

12.0 CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

The following conclusions are drawn from the data obtained during the baseline assessment:

- The results from this groundwater baseline assessment indicated that there are detections of PFAS, TRH, and toluene in groundwater at the site. It is considered likely that the reported PFAS, TRH, and toluene concentrations are related to the drilling additives that were used during drilling and installation of the groundwater wells (i.e., drilling muds and/or glue for the PVC casing installation).
- The reported contamination appeared only at the recently installed groundwater wells. Groundwater wells that were installed over a year ago were not reported with any detectable concentrations of PFAS, TRH, and toluene above laboratory LOR.
- No exceedance of adopted assessment criteria was reported for any contaminants analysed as part of this groundwater baseline assessment.

12.2 Recommendations

It is considered that the site is suitable to be developed for active mining from contaminated sites perspective.

It is recommended to develop and resample groundwater wells with PFAS, TRH, and toluene detections to confirm the presence of these contaminants prior to development.

13.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – “Important Information Relating to this Report”, which is included in Appendix F of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder has under the contract between it and its client.

14.0 CLOSING

Should you have any queries concerning this report, please do not hesitate to contact the under-signed.

15.0 REFERENCES

ANZECC & ARMCANZ, 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Australian and New Zealand Guidelines (ANZG), 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Available at: https://www.waterquality.gov.au/guidelines/anz-fresh-marine.

BHP (2020). *Western Ridge and OB29/30/35 Detailed Hydrogeological Assessment. Water Planning – Planning & Technical – Minerals Australia*. March 2020.

Department of Environment Regulation, 2017. *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Version 2.1*, *Contaminated Sites Guideline*. DER. January 2017.

Department of Water and Environment Regulations (DWER, previously DER), 2014. *Assessment and management of Contaminated Sites, Contaminated Sites Guidelines*. Department of Environment Regulation. December 2014.

Golder, 2021. *Western Ridge – Afghan Springs Baseline Assessment, PFAS and TRH Groundwater Baseline Assessment*. May 2021. Golder Document Ref. 21464272-003R-Rev0.

Heads of EPAs Australia and New Zealand (HEPA), 2020. *PFAS National Environmental Management Plan Version 2.0*. January 2020.

Johnson, S.L. & Wright, A.H. (2001). Central Pilbara Groundwater Study. Water and Rivers Commission, Hydrogeological Record Series, Report HG 8,102p. November 2001.

National Environment Protection Amendment (NEPM), 2013. *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), Schedule B1*. Issued by the National Environment Protection Council (NEPC), 11 April 2013.

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Table A: Western Ridge – WRCS
Groundwater PFAS Analytical Results

				Per- and polyfluoroalkyl substances (PFAS)																															
				Perfluorodecane sulfonic acid (PFDS)	N-Methyl PFO sulfonamidoethanol (MeFOSE)	N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	Perfluorooctanoic Acid (PFOA)	Perfluorooctane sulfonic acid (PFOS)	Perfluorohexane sulfonic acid (PFHxS)	Sum of PFHxS and PFOS (lab reported)	Sum of WA DER PFAS (n=10)	Sum of PFASs (n=28 - Lab Reported)	Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorodecanoic acid (PFDA)	Perfluoropentanoic acid (PFPeA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorododecanoic acid (PFDoDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorobutane sulfonic acid (PFBS)	4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	N-Ethyl PFO sulfonamide (EtFOSA)	N-Ethyl PFO sulfonamidoethanol (EtFOSE)	N-Methyl PFO sulfonamide (MeFOSA)	Perfluorooctane sulfonamide (FOSA)	N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR				0.0005	0.001	0.0005	0.0005	0.0002	0.0005	0.0002	0.0002	0.0002	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0005	0.0005
PFAS NEMP 2.0 2020 95% Eco Fresh Water							220	0.13																											
PFAS NEMP 2.0 2020 99% Eco Fresh Water							19	0.00023																											
PFAS NEMP 2.0 2020 Drinking Water							0.56	0.07	0.07	0.07																									
PFAS NEMP 2.0 2020 Recreational Water							10	2	2	2																									
Site ID	**Location**	**Sampled Date**	**Lab Report**																																
WRCS	HWSR0014M	16/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	HWSR0019M	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	HWSR0020M	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	HWSR0021M	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	HXAN0002M	16/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	0.002	0.002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	WSR0296RM	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	WSR0299RM	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	WSR0597RM	16/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
WRCS	WSR1193RM	15/04/2021	EP2104244	<0.0005	<0.001	<0.0005	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005

Table B: Western Ridge – WRCS
Groundwater Organic Analytical Results

				MAH							PAH	Total Recoverable Hydrocarbons											
				Benzene	Toluene	Ethylbenzene	Xylenes (m & p)	Xylene (o)	Xylenes (Sum of total) (Lab Reported)	Total BTEX	Naphthalene	TRH C_6-C_9 Fraction	TRH C_{10}-C_{14} Fraction	TRH C_{15}-C_{28} Fraction	TRH C_{29}-C_{36} Fraction	TRH+C_{10}-C_{36} (Sum of total) (Lab Reported)	TRH+C_{10}-C_{40} (Sum of total) (Lab Reported)	TRH C_6-C_{10} Fraction F1	TRH C_6-C_{10} Fraction Less BTEX F1	TRH >C_{10}-C_{16} Fraction F2	TRH >C_{10}-C_{16} Fraction Less Naphthalene F2	TRH >C_{16}-C_{34} Fraction F3	TRH >C_{34}-C_{40} Fraction F4
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR				0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.005	0.02	0.05	0.1	0.05	0.05	0.1	0.02	0.02	0.1	0.1	0.1	0.1
DER (2014) Drinking Water Health Value				0.001	0.8	0.3			0.6														
ANZG (2018) Freshwater 95%				0.95				0.35			0.016												
NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand																							
2-4m				5	NL	NL			NL		NL								6		NL		
4-8m				5	NL	NL			NL		NL								6		NL		
>8m				5	NL	NL			NL		NL								7		NL		
Site ID	**Location**	**Sampled Date**	**Lab Report**																				
Western Ridge Crusher Study - 21464272	HWSR0014M	16/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	0.18	<0.05	<0.1	<0.05	<0.05	<0.1	0.17	0.17	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	HWSR0019M	15/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	0.31*	<0.05	0.12	<0.05	0.12	0.13	0.33*	0.33*	<0.1	<0.1	0.13	<0.1
Western Ridge Crusher Study - 21464272	HWSR0020M	15/04/2021	EP2104244	<0.001	0.007	<0.002	<0.002	<0.002	<0.002	0.007	<0.005	0.6	0.11	0.12	<0.05	0.23	0.11	0.54	0.53	<0.1	<0.1	0.11	<0.1
Western Ridge Crusher Study - 21464272	HWSR0021M	15/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	HXAN0002M	16/04/2021	EP2104244	<0.001	0.007	<0.002	<0.002	<0.002	<0.002	0.007	<0.005	0.44	0.09	<0.1	<0.05	0.09	<0.1	0.4	0.39	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	WSR0296RM	15/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	WSR0299RM	15/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	WSR0597RM	16/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
Western Ridge Crusher Study - 21464272	WSR1193RM	15/04/2021	EP2104244	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1

Note: NL indicates the HSL is not limiting

* Higher triplicate concentrations are adopted to be conservative

Table C: Groundwater Relative Percentage Differences

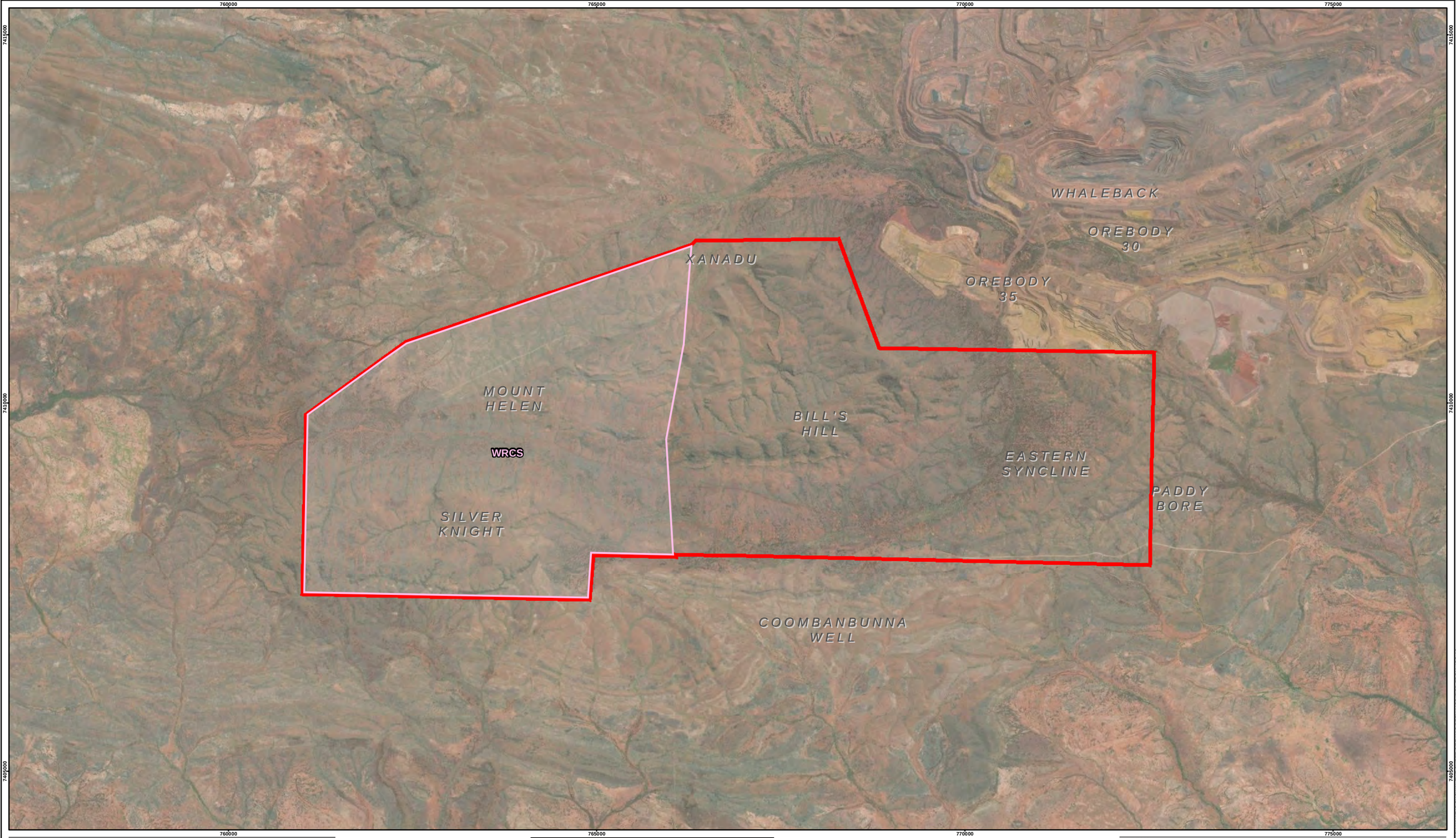
RPD ≥30% and one or more values ≥5 × LOR
RPD ≥30% and both values <5 × LOR
RPD ≥30% due to differing LORs

			Lab Report Number	EP2104244	EP2104244		EP2104244	789525	
			Field ID	HWSR0020M	FD01	**RPD**	HWSR0019M	HWSR0019/59150421	**RPD**
			Sample Type	Primary	Duplicate		Primary	Triplicate	
			Sampled Date/Time	############	############		############	4/15/2021 12:00	
Chemical Group	**Chemical Name**	**Units**	**LOR**						
Per- and polyfluoroalkyl substances (PFAS)	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	N-Methyl PFO sulfonamidoethanol (MeFOSE)	µg/L	0.001 : 0.005 (Interlab)	<0.001	<0.001	<30	<0.001	<0.005	<30
	N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	µg/L	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.005	<30
	Perfluorooctanoic Acid (PFOA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	<30	<0.0002	<0.001	<30
	Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Sum of PFHxS and PFOS (lab reported)	µg/L	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	<30	<0.0002	<0.001	<30
	Sum of WA DER PFAS (n=10)	µg/L	0.0002 : 0.005 (Interlab)	<0.0002	<0.0002	<30	<0.0002	<0.005	<30
	Sum of PFASs (n=28 - Lab Reported)	µg/L	0.0002 : 0.005 (Interlab)	<0.0002	<0.0002	<30	<0.0002	<0.005	<30
	Perfluorobutanoic acid (PFBA)	µg/L	0.002 : 0.005 (Interlab)	<0.002	<0.002	<30	<0.002	<0.005	<30
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorononanoic acid (PFNA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorotridecanoic acid (PFTrDA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorododecanoic acid (PFDoDA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.001	<30
	4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	µg/L	0.001	<0.001	<0.001	<30	<0.001	<0.001	<30
	6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	µg/L	0.001 : 0.005 (Interlab)	<0.001	<0.001	<30	<0.001	<0.005	<30
	8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	µg/L	0.001	<0.001	<0.001	<30	<0.001	<0.001	<30
	10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	µg/L	0.001	<0.001	<0.001	<30	<0.001	<0.001	<30
	N-Ethyl PFO sulfonamide (EtFOSA)	µg/L	0.001 : 0.005 (Interlab)	<0.001	<0.001	<30	<0.001	<0.005	<30
	N-Ethyl PFO sulfonamidoethanol (EtFOSE)	µg/L	0.001 : 0.005 (Interlab)	<0.001	<0.001	<30	<0.001	<0.005	<30
	N-Methyl PFO sulfonamide (MeFOSA)	µg/L	0.001 : 0.005 (Interlab)	<0.001	<0.001	<30	<0.001	<0.005	<30
	Perfluorooctane sulfonamide (FOSA)	µg/L	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.005	<30
	N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)	µg/L	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	<30	<0.0005	<0.005	<30
MAH	Benzene	mg/L	0.001	<0.001	<0.001	<30	<0.001	N/A	-
	Toluene	mg/L	0.002	0.007	0.008	13	<0.002	N/A	-
	Ethylbenzene	mg/L	0.002	<0.002	<0.002	<30	<0.002	N/A	-
	Xylenes (m & p)	mg/L	0.002	<0.002	<0.002	<30	<0.002	N/A	-
	Xylene (o)	mg/L	0.002	<0.002	<0.002	<30	<0.002	N/A	-
	Xylenes (Sum of total) (Lab Reported)	mg/L	0.002	<0.002	<0.002	<30	<0.002	N/A	-
	Total BTEX	mg/L	0.001	0.007	0.008	13	<0.001	N/A	-
PAH	Naphthalene	mg/L	0.005 : 0.01 (Interlab)	<0.005	<0.005	<30	<0.005	<0.01	<30
Total Recoverable Hydrocarbons	TRH C_6-C_9 Fraction	mg/L	0.02	0.6	0.78	26	0.17	0.31	58
	TRH C_{10}-C_{14} Fraction	mg/L	0.05	0.11	<0.05	126	<0.05	0.26	165
	TRH C_{15}-C_{28} Fraction	mg/L	0.1	0.12	<0.1	82	0.12	<0.1	82
	TRH C_{29}-C_{36} Fraction	mg/L	0.05 : 0.1 (Interlab)	<0.05	<0.05	<30	<0.05	<0.1	<30
	TRH+C_{10}-C_{36} (Sum of total) (Lab Reported)	mg/L	0.05 : 0.1 (Interlab)	0.23	<0.05	161	0.12	0.26	74
	TRH+C_{10}-C_{40} (Sum of total) (Lab Reported)	mg/L	0.1	0.11	<0.1	75	0.13	<0.1	89
	TRH C_6-C_{10} Fraction F1	mg/L	0.02	0.54	0.71	27	0.15	0.33	75
	TRH C_6-C_{10} Fraction Less BTEX F1	mg/L	0.02	0.53	0.7	28	0.15	0.33	75
	TRH >C_{10}-C_{16} Fraction F2	mg/L	0.1 : 0.05 (Interlab)	<0.1	<0.1	<30	<0.1	<0.05	<30
	TRH >C_{10}-C_{16} Fraction Less Naphthalene F2	mg/L	0.1 : 0.05 (Interlab)	<0.1	<0.1	<30	<0.1	<0.05	<30
	TRH >C_{16}-C_{34} Fraction F3	mg/L	0.1	0.11	<0.1	75	0.13	<0.1	89
	TRH >C_{34}-C_{40} Fraction F4	mg/L	0.1	<0.1	<0.1	<30	<0.1	<0.1	<30

Note: N/A = Not Analysed

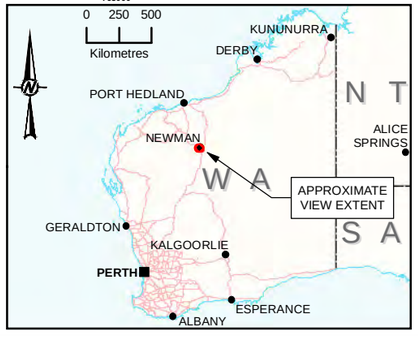
Lab Report Number	EP2104244	EP2104244
Field ID	TB319	TBW325
Sampled Date/Time	4/16/2021 15:00	4/16/2021 15:00
Sample Type	Trip Blank	Trip Blank

Chemical Group	Chemical Name	Units	LOR		
MAH	Benzene	mg/L	0.001	<0.001	
	Toluene	mg/L	0.002	<0.002	
	Ethylbenzene	mg/L	0.002	<0.002	
	Xylenes (m & p)	mg/L	0.002	<0.002	
	Xylene (o)	mg/L	0.002	<0.002	
	Xylenes (Sum of total) (Lab Reported)	mg/L	0.002	<0.002	
	Total BTEX	mg/L	0.001	<0.001	
PAH	Naphthalene	mg/L	0.005	<0.005	
Total Recoverable Hydrocarbons	TRH C_6-C_9 Fraction	mg/L	0.02	<0.02	
	TRH C_6-C_{10} Fraction F1	mg/L	0.02	<0.02	
	TRH C_6-C_{10} Fraction Less BTEX F1	mg/L	0.02	<0.02	
Per- and polyfluoroalkyl substances (PFAS)	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005		<0.0005
	N-Methyl PFO sulfonamidoethanol (MeFOSE)	µg/L	0.001		<0.001
	N-methyl-PFO sulfonamidoacetic acid (MeFOSAA)	µg/L	0.0005		<0.0005
	Perfluorooctanoic Acid (PFOA)	µg/L	0.0005		<0.0005
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002		<0.0002
	Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.0005		<0.0005
	Sum of PFHxS and PFOS (lab reported)	µg/L	0.0002		<0.0002
	Sum of WA DER PFAS (n=10)	µg/L	0.0002		<0.0002
	Sum of PFASs (n=28 - Lab Reported)	µg/L	0.0002		<0.0002
	Perfluorobutanoic acid (PFBA)	µg/L	0.002		<0.002
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005		<0.0005
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005		<0.0005
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005		<0.0005
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005		<0.0005
	Perfluorononanoic acid (PFNA)	µg/L	0.0005		<0.0005
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005		<0.0005
	Perfluorotridecanoic acid (PFTrDA)	µg/L	0.0005		<0.0005
	Perfluorododecanoic acid (PFDoDA)	µg/L	0.0005		<0.0005
	Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0005		<0.0005
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005		<0.0005
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005		<0.0005
	Perfluorobutane sulfonic acid (PFBS)	µg/L	0.0005		<0.0005
	4:2 Fluorotelomer sulfonic acid (4:2 FTSA)	µg/L	0.001		<0.001
	6:2 Fluorotelomer sulfonic acid (6:2 FTSA)	µg/L	0.001		<0.001
	8:2 Fluorotelomer sulfonic acid (8:2 FTSA)	µg/L	0.001		<0.001
	10:2 Fluorotelomer sulfonic acid (10:2 FTSA)	µg/L	0.001		<0.001
	N-Ethyl PFO sulfonamide (EtFOSA)	µg/L	0.001		<0.001
	N-Ethyl PFO sulfonamidoethanol (EtFOSE)	µg/L	0.001		<0.001
	N-Methyl PFO sulfonamide (MeFOSA)	µg/L	0.001		<0.001
	Perfluorooctane sulfonamide (FOSA)	µg/L	0.0005		<0.0005
	N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA)	µg/L	0.0005		<0.0005



LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CLIENT
BHP

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-04-28
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

PROJECT
PFAS BASELINE ASSESSMENT - WRCS

TITLE
SITE LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	1

PATH: B:\BHP_Billiton\Pilbara\09_PROJECTS\21464272_WaterQuality\02_PRODUCTION\MXD\903\R\21464272-003-R-F001-RevA.mxd PRINTED ON: 2021-04-28 AT: 10:52:09 AM
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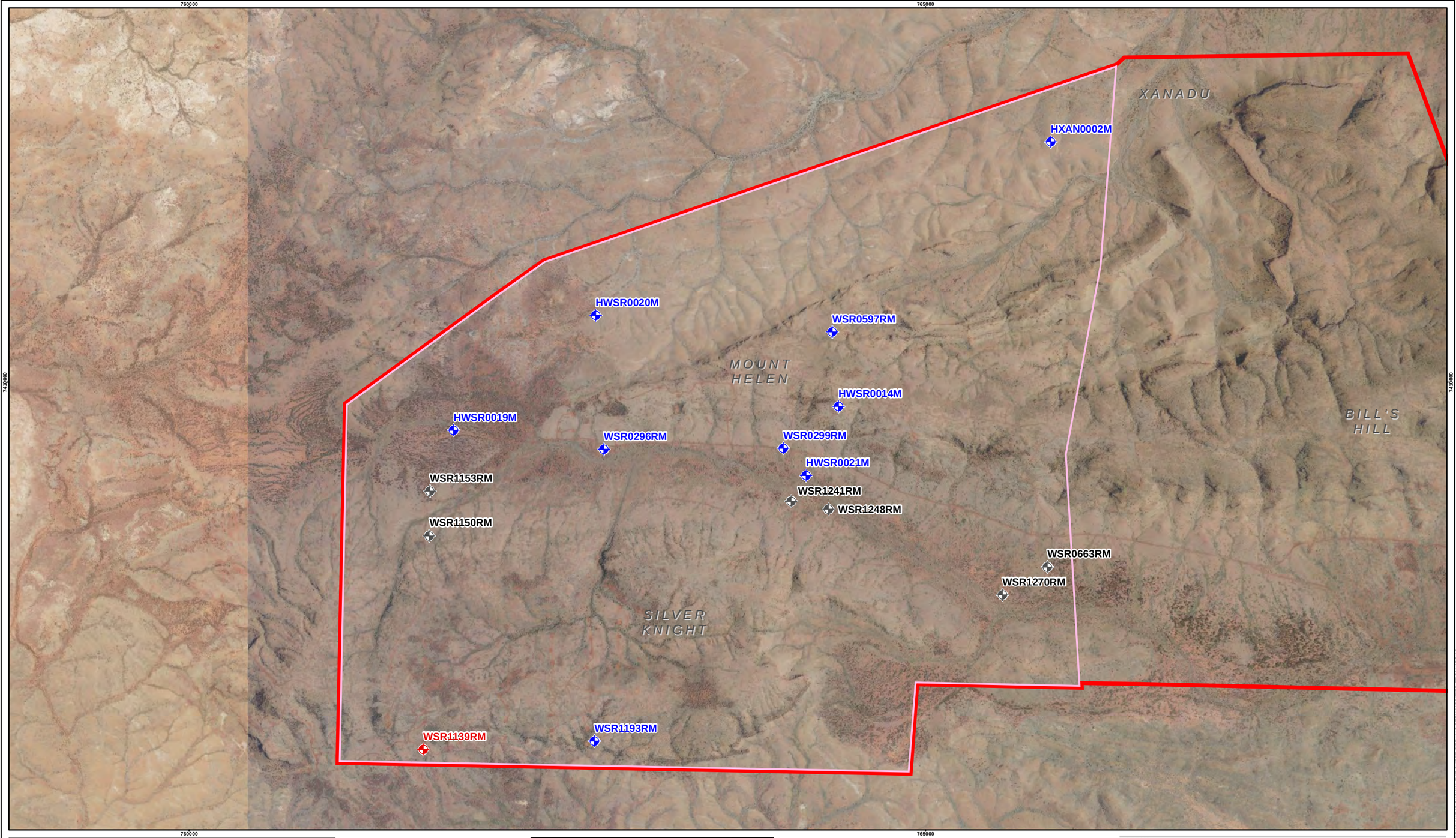
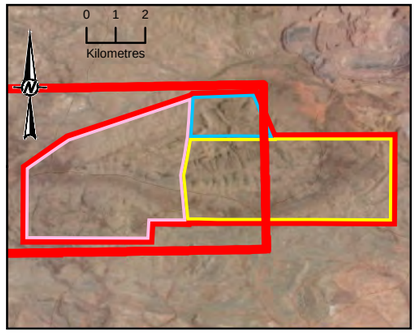


LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)

BOREHOLE

- BOREHOLE DRY
- BOREHOLE NOT LOCATED
- GROUNDWATER SAMPLED



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2018)

CLIENT
BHP

PROJECT
PFAS BASELINE ASSESSMENT - WRCS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-04-28
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

TITLE
SITE PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	2

PATH: B:\BHP_Billiton\Pilbara\99_PROJECTS\21464272_WaterQuality\02_PRODUCTION\MXD\003-R\21464272-003-R-F002-Rev A.mxd PRINTED ON: 2021-04-28 AT: 5:10:55 PM
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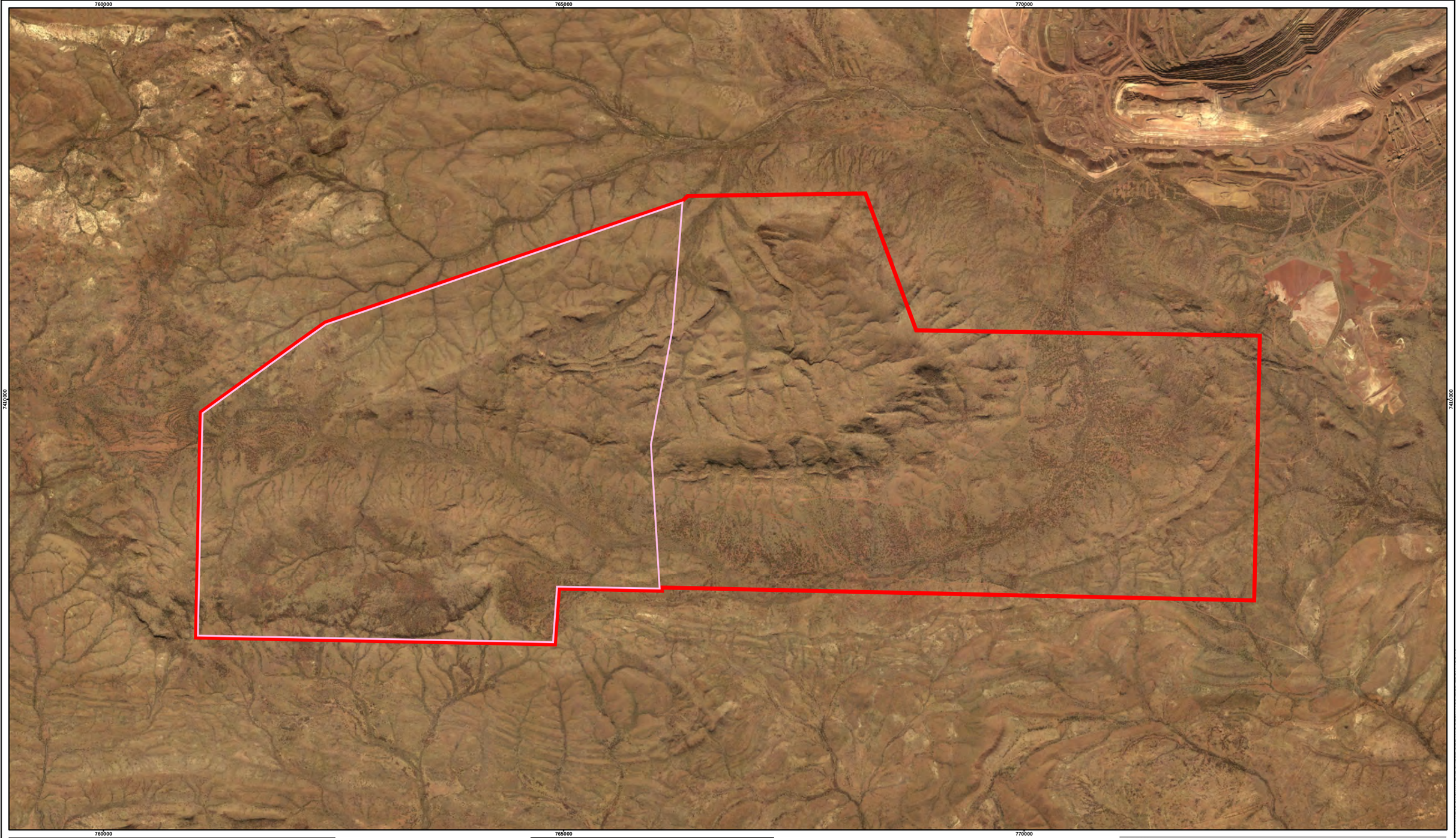
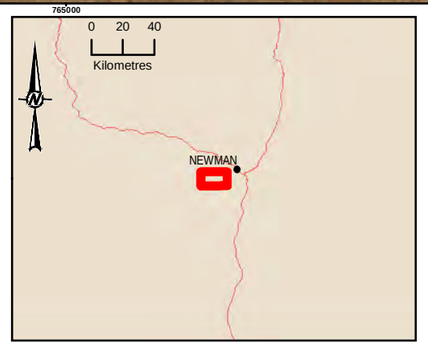


LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2018)

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PROJECT
PFAS BASELINE ASSESSMENT - WRCS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-03
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

TITLE
HISTORICAL IMAGERY - 2003

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	3A

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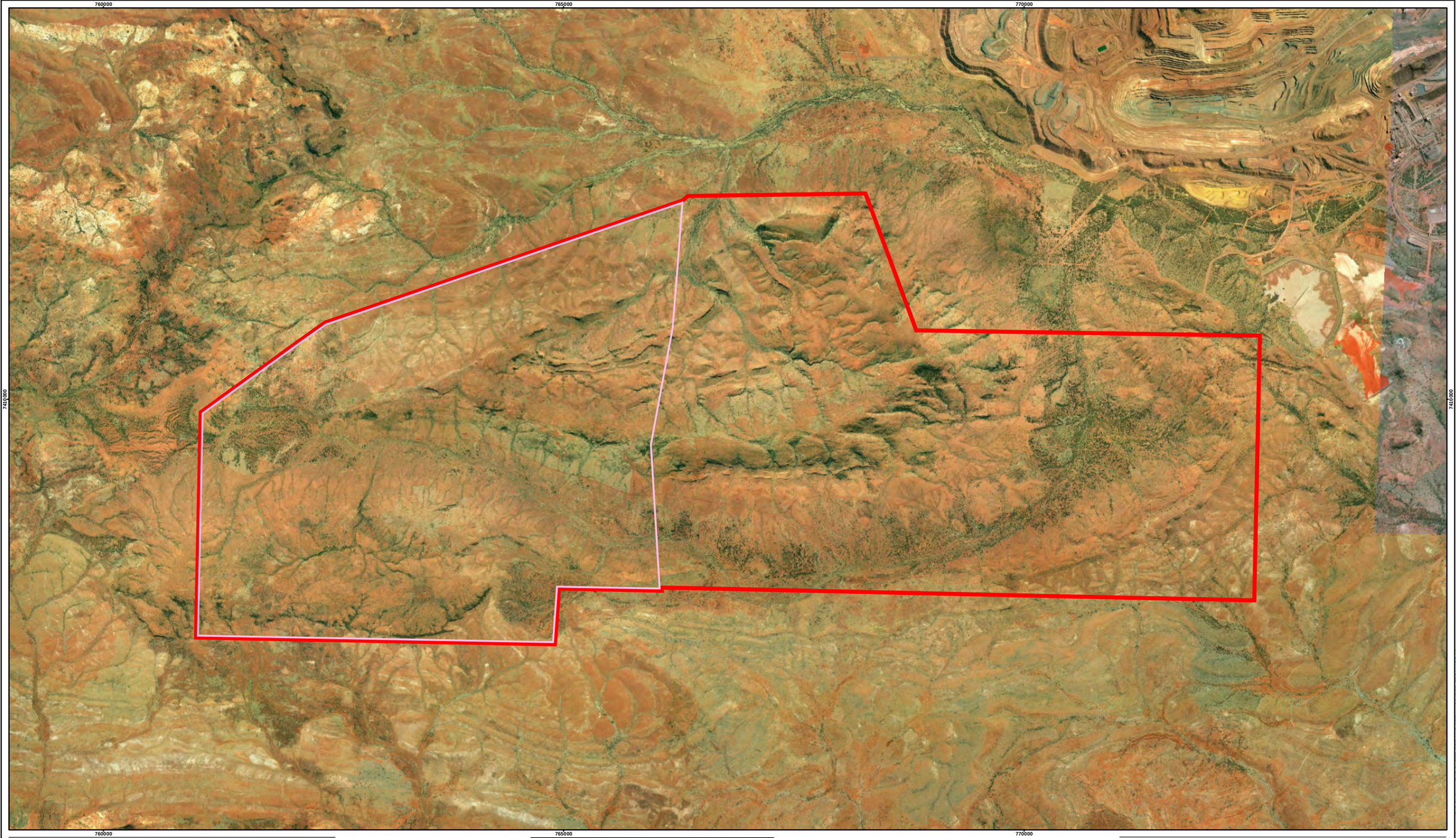
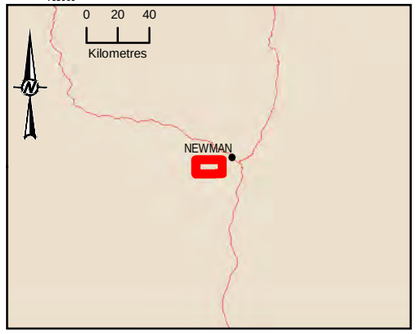


LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2018)

CLIENT
BHP

PROJECT
PFAS BASELINE ASSESSMENT - WRCS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-03
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

TITLE
HISTORICAL IMAGERY - 2007

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	3B

PATH: B:\BHP_Billiton\Pilbara\99_PROJECTS\21464272_WaterQuality\02_PRODUCTION\MXD\003-R\21464272-003-R-F003-Rev A_WRCS.mxd PRINTED ON: 2021-05-03 AT: 4:18:56 PM
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25mm
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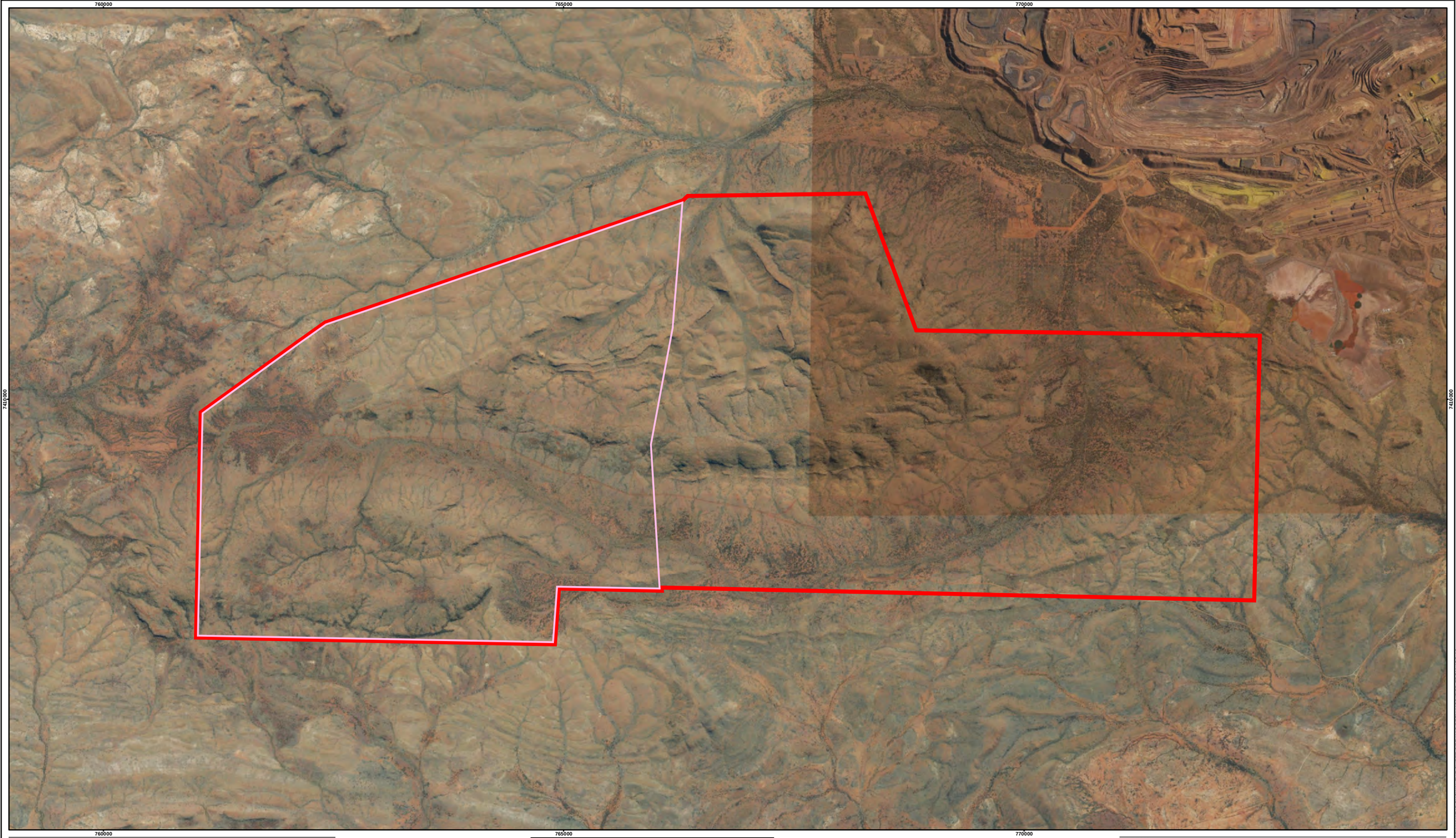
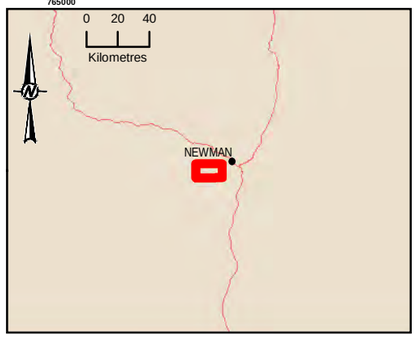


LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2018)

CLIENT
BHP

PROJECT
PFAS BASELINE ASSESSMENT - WRCS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-03
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

TITLE
HISTORICAL IMAGERY - 2013

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	3C

PATH: B:\BHP_Billiton\Pilbara\9_PROJECTS\21464272_WaterQuality\02_PRODUCTION\MXD\903\R\21464272-003-R-F003-RevA_WRCS.mxd PRINTED ON: 2021-05-03 AT: 4:08:58 PM
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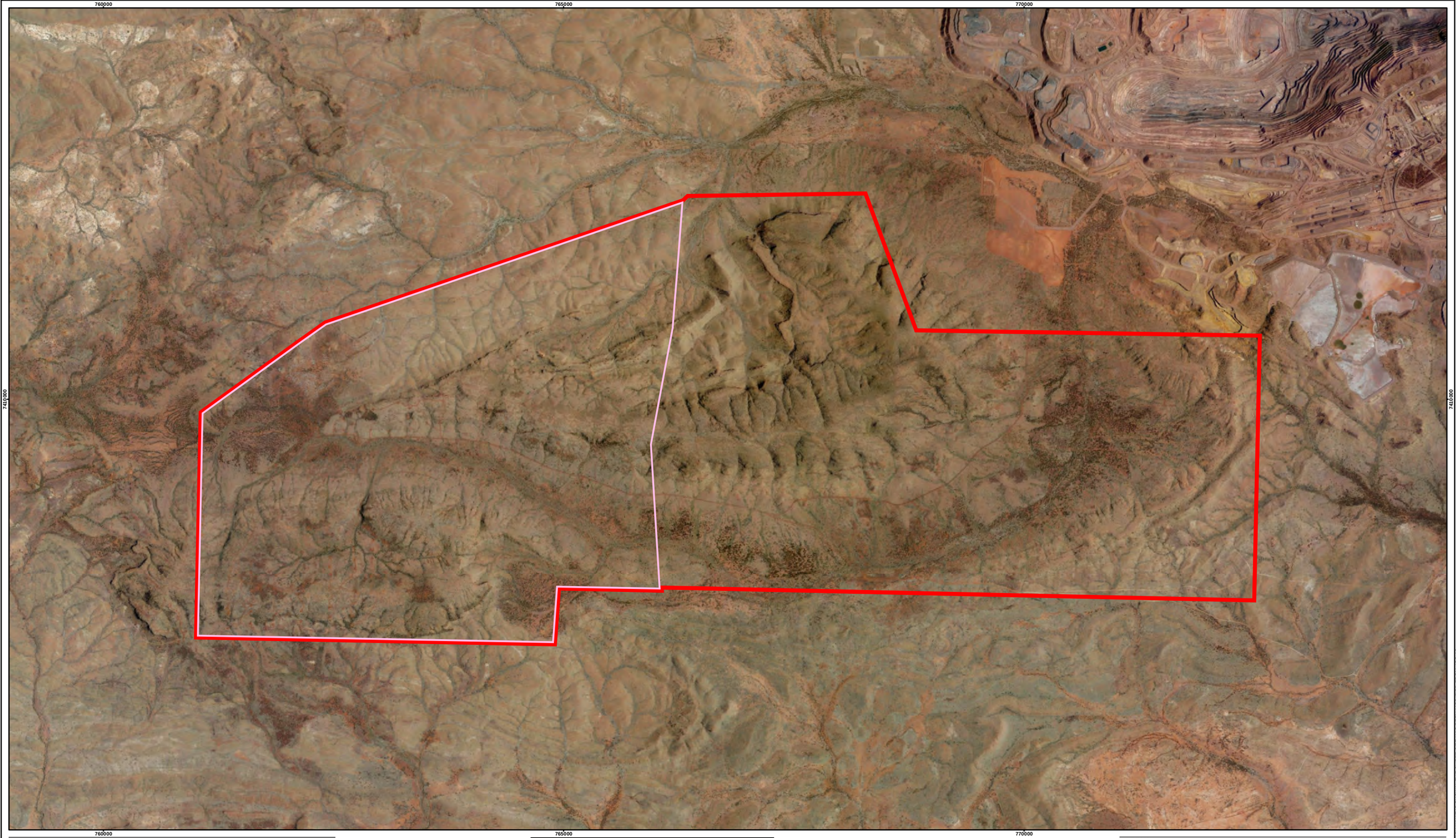
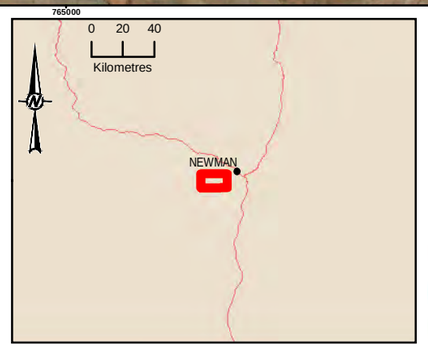


LEGEND

- WESTERN RIDGE STUDY AREA
- WESTERN RIDGE CRUSHER STUDY (WRCS)



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NOTE(S)
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2018)

CLIENT
BHP

PROJECT
PFAS BASELINE ASSESSMENT - WRCS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-03
DESIGNED	PW
PREPARED	AM
REVIEWED	CB
APPROVED	CB

TITLE
HISTORICAL IMAGERY - 2014

PROJECT NO.	CONTROL	REV.	FIGURE
21464272	005-R	0	3D

PATH: B:\BHP_BillitonPilbara\09_PROJECTS\21464272_WaterQuality\02_PRODUCTION\MXD\003-R\21464272-003-R-F003-Rev\A_WRCS.mxd PRINTED ON: 2021-05-03 AT: 4:09:00 PM
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25mm
0

APPENDIX A

Well Construction Logs

BHPIO - Hydrogeology Log

BHP

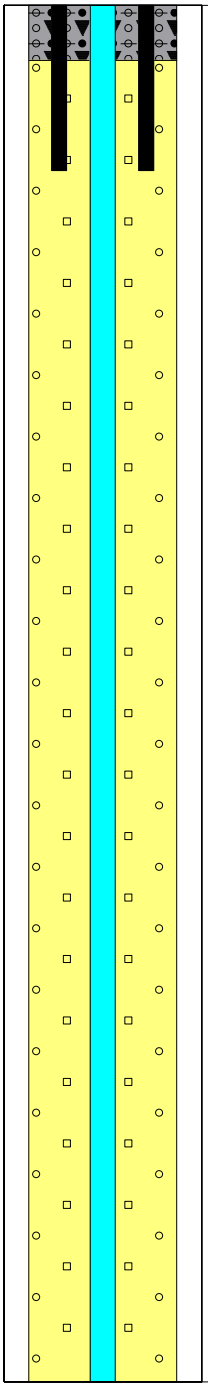
Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZWS	GY	QC			COBBLE, sandy, (SCREE), Brownish Green, Transported, Non-Cohesive soils, Well graded, Sub-angular. Mixer of sub angular detrital and Bedding material.					CEMENT (0.00-2.00) 206mm BLANK STEEL (0.00-6.00) 51mm BLANK PVC (0.00-174.00)
	D4	WG	S				MINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Strong Rock. Sub angular to angular chips.big chunks of 3cm seen; variety in size					
		W	G	S			MINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Medium Strong Rock. Decrease insize. some porous chips seen. Grade ore. Mostly small sizes: less than 2cm. no big chunk seen.					
10		JH	WCG	S			UNMINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Strong Rock. Unmineralised BIF. Angular to sub Angular chips. Seen bedding in the chips. Big Chunks seen (5cm) from 18-24m. Friable and porpous blue ore (hematite and possible martite). Decrease inseziefrom 26-30m: more porous and fraible material					
20												
30		JHC	S	Q			UNMINERALISED BIF, (D4), Blackish Brown-red, Moderately Weathered, Medium Strong Rock. Sub rounded and smooth chips. smaller chips, no big chunks seen. less than 1 cm					
		WG	LS				MINERALISED BIF, (D4), Brownish Yellow, Moderately Weathered, Medium Strong Rock. 38-40m: rich in red shale and some big chunks seen. in general small chips size and subrounded. 40-42m: rich in L.					
40		HW	G	S			MINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Medium Strong Rock. Small and sub rounded chips: less than 1cm. Lots of fines and friable material. Some big chunks seen from 48-52mm. 52-54m: increase in hardness...still rich in fines but transition to harder material					
50						0 100 200		0-5000	0-14	0-40		



BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m) (drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev: N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m) (current)	Is Live:	Y	(-)	Date: 11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	D4	HW	G	S			MINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Medium Strong Rock. Small and sub rounded chips: less than 1cm. Lots of fines and friable material. Some big chunks seen from 48-52mm. 52-54m: increase in hardness...still rich in fines but transition to harder material					51mm BLANK PVC (0.00-174.00)
		JW	HGC	S			UNMINERALISED BIF, (D4), Blackish Brown, Moderately Weathered, Strong Rock. Big chunks seen from 54-64m: and 68-72m: 3-4cm. 54-58m: transitionto BIF; still some friable material. Sub angular chips					
60												
70		J		S			UNMINERALISED BIF, (D4), Brown, Moderately Weathered, Medium Strong Rock. Unmineralised BIF. In general smaller chips, less than 1cm. From 78-84m, 96-102, 104-106m, 108-110m and 116-118m: chunks of 2-2.5 cm. Chips from sub angular to sub rounded. shale rich layer from 76-80m. Shale and chert rich at 94-96m. Rich in fine from 102-108m (dark brown/blue piles). Few quartz chips seen @ 118-120m.					
80												
90												
100						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

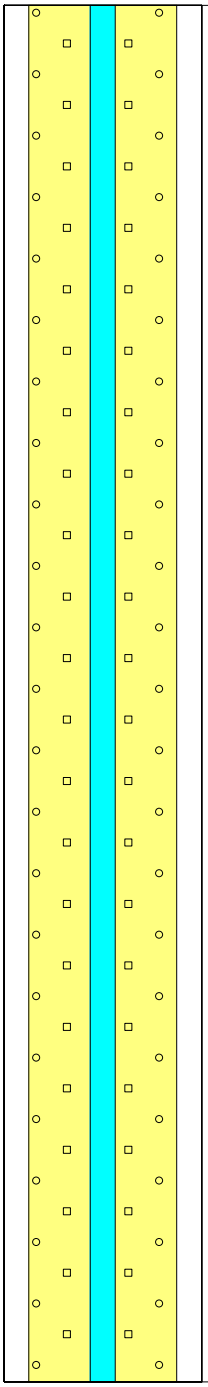
Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100–150	D4	J		S			UNMINERALISED BIF, (D4), Brown, Moderately Weathered, Medium Strong Rock. Unmineralised BIF. In general smaller chips, less than 1cm. From 78-84m, 96-102, 104-106m, 108-110m and 116-118m: chunks of 2-2.5 cm. Chips from sub angular to sub rounded. shale rich layer from 76-80m. Shale and chert rich at 94-96m. Rich in fine from 102-108m (dark brown/blue piles). Few quartz chips seen @ 118-120m.					51mm BLANK PVC (0.00-174.00)
130–150		JG		SL			UNMINERALISED BIF, (D4), Brown, Moderately Weathered, Medium Strong Rock. Unmineralised BIF. Looks Very fractured zone. chips of 3cm found at 130-132m, 146-148m, 150-152m. chips of 4-5cm from 156-162m, 164-166m, 168-170m. (driller decided to change bit). Chips from sub angular to sub rounded. Alterning of porous and smooth chips (ore) with sub angular unmineralised BIF. No chert chips seen but thin layer of cherty					

Gamma: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40



BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description	EC us/cm	pH	Yield L/s	Notes (Casing size as ID)
150–160	D4	JG		SL	UNMINERALISED BIF, (D4), Brown, Moderately Weathered, Medium Strong Rock. Unmineralised BIF. Looks Very fractured zone. chips of 3cm found at 130-132m, 146-148m, 150-152m. chips of 4-5cm from 156-162m, 164-166m, 168-170m. (driller decided to change bit). Chips from sub angular to sub rounded. Alterning of porous and smooth chips (ore) with sub angular unmineralised BIF. No chert chips seen but thin layer of cherty				51mm BLANK PVC (0.00-174.00)
160–170	D3	JG		SL	UNMINERALISED BIF, (D3), Brown, Moderately Weathered, Medium Strong Rock. Unmineralised BIF. Looks Very fractured zone. chips of 3cm found at 130-132m, 146-148m, 150-152m. chips of 4-5cm from 156-162m, 164-166m, 168-170m. (driller decided to change bit). Chips from sub angular to sub rounded. Alterning of porous and smooth chips (ore) with sub angular unmineralised BIF. No chert chips seen but thin layer of cherty				LEVELTROLL(160.00) ID: 2672
170–180		G	WJ	S					
170–180		G	SWJ	H					51mm SLOTTED PVC (174.00-186.00)
180–190		W	GSJ	L	MINERALISED BIF, (D3), Brown, Moderately Weathered, Strong Rock. Big chunks seen. 3-4cm. goethitic ore. Sub rounded friable and porous W with sub angular G. FWS @ 174m; MINERALISED BIF, (D3), Brownish Red, Moderately Weathered, Strong Rock. Partially mineraized BIF. Sub angular to smooth chips. Still big chunks seen (3-4cm) @ 174-176m, 182-186m. broken zone. Increase in dark red shale. some white shale seen. smalll quartz seen at 180-182m. Increase in more Friable and dark ore (W) from 184-186m.	421	8.0	1	END CAP (186.00)
190–200					MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. More friable and porous material. Few cherty BIF chips seen. Sub rounded and smooths chips. Still big chunks (3-4cm) seen from 186-190m and 196-198m. Big chunks of bedding chert and friable and porous ore at 192-194m.	326	7.8	1	
		WH	GL	S		401	8.0	1	

Log: 0 100 200 — EC: 0-5000 — pH: 0-14 — Yield: 0-40

Diagram (Scaled to 400mm)

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
150	D4	JG		SL								51mm BLANK PVC (0.00-174.00)
160												LEVELTROLL(160.00) ID: 2672
	D3	JG		SL								
170		G	WJ	S								
		G	SWJ	H								51mm SLOTTED PVC (174.00-186.00)
180												
		W	GSJ	L				421	8.0	1		END CAP (186.00)
190								326	7.8	1		
		WH	GL	S			MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Mineralised BIF. Increase in porous ore and decrease in shale. Smooth chips. Very broken zone: big chunks of 4cm	401	8.0	1		
200						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description	EC us/cm	pH	Yield L/s	Notes (Casing size as ID)
200	D3	WH	GL	S	MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Mineralised BIF. Increase in porous ore and decrease in shale. Smooth chips. Very broken zone: big chunks of 4cm	394	7.7	1	
		WH	SG	L	MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Mineralised BIF. Porous dark blue ore. Increase in shale (dark pink and yellow). Smooth chips. Very broken zone: big chunks of 4cm. Not many fines seen.	401	7.8	1	
210									
		WJ	SL	H	MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Strong Rock. 4cm chunk of Unmineralized BIF @216-218m. still few chunks seen but more smaller smooth chips.	424	7.7	2	
220									
		WS	JG	L	MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Porous and friable ore.Smooth chips. red and yelow shale. only few smooth chunk seen, generaly small chips.	374	7.8	2	
						369	7.7	2	
230									
						389	7.7	2	
		WS	JGL		MINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Porous and friable ore.Smooth chips. red and yelow shale. only few smooth chunk seen in it general small chips.	376	7.8	2	
240									
					UNMINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Partially mineralised BIF. porous and friable material and hard bedded BIF. Increase in chips size, more chunkier	422	7.9	2	
250		WJS	GL						

Gamma CPS API: 0 100 200
EC us/cm: 0-5000
pH: 0-14
Yield L/s: 0-40
Diagram: Scaled to 400mm

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0014	Hole Length:	252.00

Easting: 764409.32
Northing: 7409835.27
Surface RL: 666.50
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 11 Nov 20 - 13 Nov 20
Comments: Installed to 186m due to fallback and hole collapsing.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 6.0	WLDRIG5	CH	300		WELLDRILL	EC6
6.0 - 252.0	WLDRIG5	CH	200		WELLDRILL	EC6

TOC RL:	667.43	(Stickup 0.71m)	(drilled)	SWL:	150.92 MBTOC	(14 Nov 20)	Dev:	N	Final pH: -
TOC RL:	667.43	(Stickup 0.71m)	(current)	Is Live:	Y	(-)	Date:	11 Nov 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
250	D3	WJS	GL				UNMINERALISED BIF, (D3), Blackish Brown, Moderately Weathered, Medium Strong Rock. Partially mineralised BIF. porous and friable material and hard bedded BIF. Increase in chips size, more chunkier					
260												
270												
280												
290												
300												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

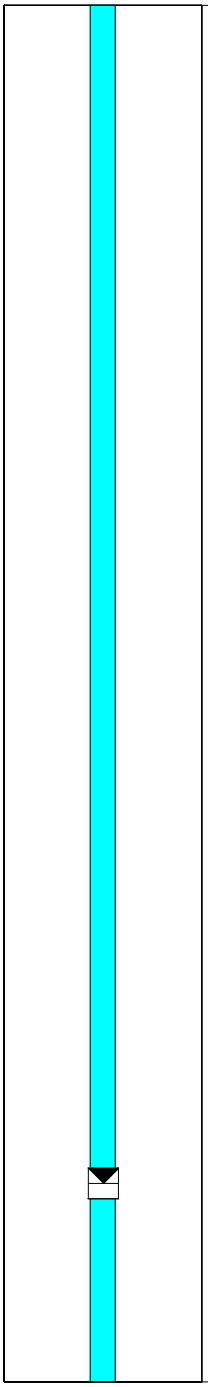
Project:	WESTERN RIDGE	Hole Name:	HWSR0019	Hole Length:	153.00

Easting: 761794.37
Northing: 7409673.55
Surface RL: 631.52
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 08 Dec 20 - 08 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC09	RHF	140		RANGER	JK3

TOC RL:	632.36	(Stickup 0.45m)	(drilled)	SWL:	42.79 MBTOC	(26 Jan 21)	Dev:	N	Final pH: -
TOC RL:	632.36	(Stickup 0.45m)	(current)	Is Live:	Y	(-)	Date:	09 Dec 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	SZ					GRAVEL, (SCREE), Reddish Brown, Transported, Non-Cohesive soils, Poorly graded, Rounded. Rounded to subrounded, chip size range 2-10mm, detrital cover.					51mm BLANK PVC (0.00-60.00)
	JN	S					Very crumbly porous chips, breaks apart easily, chip size range 2-20mm, rounded to subangular.					
10												
20												
30		S					Very crumbly porous chips, breaks apart easily, chip size range 10-30mm, rounded to subangular, very weathered.					
40												
		D					More competent harder chips, subangular to angular, chip size range 5-30mm, very fine grained.					
50						0 100 200		0-5000	0-14	0-40		



BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0019	Hole Length:	153.00

Easting: 761794.37
Northing: 7409673.55
Surface RL: 631.52
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 08 Dec 20 - 08 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC09	RHF	140		RANGER	JK3

TOC RL: 632.36 (Stickup 0.45m) (drilled) SWL: 42.79 MBTOC (26 Jan 21) Dev: N Final pH: -
TOC RL: 632.36 (Stickup 0.45m) (current) Is Live: Y (-) Date: 09 Dec 2020 Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50–100	JN	D					More competent harder chips, subangular to angular, chip size range 5-30mm, very fine grained.					51mm BLANK PVC (0.00-60.00)
		ES					Extremely weathered dolerite, fizzes with acid, chip size range 2-20mm, mostly pulverised chips.					51mm SLOTTED PVC (60.00-153.00)

Depth: 50, 60, 70, 80, 90, 100

Gamma: 0 100 200

EC: 0-5000 pH: 0-14 Yield: 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0019	Hole Length:	153.00

Easting: 761794.37
Northing: 7409673.55
Surface RL: 631.52
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 08 Dec 20 - 08 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC09	RHF	140		RANGER	JK3

TOC RL: 632.36 (Stickup 0.45m) (drilled) SWL: 42.79 MBTOC (26 Jan 21) Dev: N Final pH: -
TOC RL: 632.36 (Stickup 0.45m) (current) Is Live: Y (-) Date: 09 Dec 2020 Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	JN	ES					Extremely weathered dolerite, fizzes with acid, chip size range 2-20mm, mostly pulverised chips.					51mm SLOTTED PVC (60.00-153.00)
110		DS					Weathered dolerite, does not fizz with acid, few competent chips, rounded to subangular, chip size range 2-20mm.					
120												
130		ES					Extremely weathered dolerite, porous chips, breaks apart easily, fizzes with acid.					
140												
150						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0019	Hole Length:	153.00

Easting: 761794.37
Northing: 7409673.55
Surface RL: 631.52
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 08 Dec 20 - 08 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC09	RHF	140		RANGER	JK3

TOC RL:	632.36	(Stickup 0.45m)	(drilled)	SWL:	42.79 MBTOC	(26 Jan 21)	Dev:	N	Final pH: -
TOC RL:	632.36	(Stickup 0.45m)	(current)	Is Live:	Y	(-)	Date:	09 Dec 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
150	JN	ES					Extremely weathered dolerite, porous chips, breaks apart easily, fizzes with acid.					51mm SLOTTED PVC (60.00-153.00)
												END CAP (153.00)
160												
170												
180												
190												
200												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

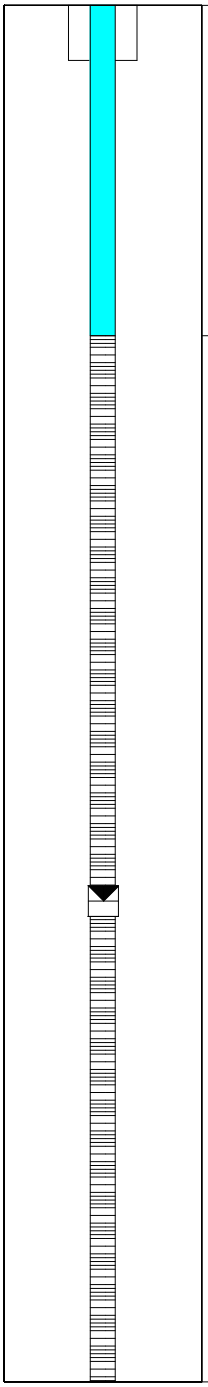
Project:	WESTERN RIDGE	Hole Name:	HWSR0020	Hole Length:	150.00

Easting: 762759.87
Northing: 7410453.29
Surface RL: 629.93
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 10 Dec 20 - 10 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	RANRC09	RHF	140		RANGER	EC6

TOC RL:	630.71	(Stickup 0.45m)	(drilled)	SWL:	32.54 MBTOC	(26 Jan 21)	Dev:	N	Final pH: -
TOC RL:	630.71	(Stickup 0.45m)	(current)	Is Live:	Y	(-)	Date:	10 Dec 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	JNE	E	S				DOLERITE, (JNE), Whiteish Grey, Highly Weathered, Medium Strong Rock. Weathered Dolerite. Some grey shale seen. Smooth chips					AB FOAM (0.00-2.00) 51mm BLANK PVC (0.00-12.00)
10		E		Q			DOLERITE, (JNE), Whiteish Grey, Moderately Weathered, Strong Rock. Fresh Grey dolerite. Very Fine graines. Some mafic minerals seen. Not the typical green dolerite but definitely vulcanics material. From 9 - 21m: 2cm chunks seen. 21-75m: small sub angiular chips (some 1.5-2cm chunks at 36-39m). From 75 to the EOH sub angulat chunks seen. Big 2.5 cm of quartz at 111-114m. Big Dolerite chunk at 141-144m.					51mm SLOTTED PVC (12.00-102.00)
20												
30												
40												
50						0 100 200		0-5000	0-14	0-40		



BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0020	Hole Length:	150.00

Easting: 762759.87
Northing: 7410453.29
Surface RL: 629.93
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 10 Dec 20 - 10 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	RANRC09	RHF	140		RANGER	EC6

TOC RL:	630.71	(Stickup 0.45m)	(drilled)	SWL:	32.54 MBTOC	(26 Jan 21)	Dev:	N	Final pH: -
TOC RL:	630.71	(Stickup 0.45m)	(current)	Is Live:	Y	(-)	Date:	10 Dec 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	JNE	E		Q			DOLERITE, (JNE), Whiteish Grey, Moderately Weathered, Strong Rock. Fresh Grey dolerite. Very Fine graines. Some mafic minerals seen. Not the typical green dolerite but definitely vulcanics material. From 9 - 21m: 2cm chunks seen. 21-75m: small sub angiular chips (some 1.5-2cm chunks at 36-39m). From 75 to the EOH sub angulat chunks seen. Big 2.5 cm of quartz at 111-114m. Big Dolerite chunk at 141-144m.					51mm SLOTTED PVC (12.00-102.00)
60												
70												
80												
90												
100						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0020	Hole Length:	150.00

Easting: 762759.87
Northing: 7410453.29
Surface RL: 629.93
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 10 Dec 20 - 10 Dec 20
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	RANRC09	RHF	140		RANGER	EC6

TOC RL:	630.71	(Stickup 0.45m)	(drilled)	SWL:	32.54 MBTOC	(26 Jan 21)	Dev:	N	Final pH: -
TOC RL:	630.71	(Stickup 0.45m)	(current)	Is Live:	Y	(-)	Date:	10 Dec 2020	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	JNE	E		Q			DOLERITE, (JNE), Whiteish Grey, Moderately Weathered, Strong Rock. Fresh Grey dolerite. Very Fine graines. Some mafic minerals seen. Not the typical green dolerite but definitely vulcanics material. From 9 - 21m: 2cm chunks seen. 21-75m: small sub angiular chips (some 1.5-2cm chunks at 36-39m). From 75 to the EOH sub angulat chunks seen. Big 2.5 cm of quartz at 111-114m. Big Dolerite chunk at 141-144m.					51mm SLOTTED PVC (12.00-102.00) END CAP (102.00)
110												
120												
130												
140												
150												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0021	Hole Length:	233.00

Easting: 764181.57
Northing: 7409365.53
Surface RL: 615.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 26 Mar 21 - 02 Apr 21
Comments: Reasonably difficult drilling conditions.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 158.0	DR3	DR	600		EASTERNWELL	VL2
158.0 - 233.0	DR3	DR	450		EASTERNWELL	JK3

License: 205541

TOC RL:	615.99	(Stickup 0.16m)	(drilled)	SWL:	107.76 MBTOC	(06 Apr 21)	Dev:	Y: 25.8 hour(s)	Final pH: 8.3
TOC RL:	615.99	(Stickup 0.16m)	(current)	Is Live:	Y	(-)	Date:	01 Apr 2021	Final EC: 840.00

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 600mm	Notes Casing size as ID
0	SZ	ZJI	K	QL			GRAVEL, (SCREE), Brownish Grey, Transported, Stiff, Uniform, Sub-rounded, Unconsolidated / unstable ground. Moderately sorted surface detritals with major BIF, pisolites+ minor shales+trace q, limonite.					CEMENT (0.00-2.00) 584mm BLANK STEEL (0.00-13.00) 305mm BLANK STEEL (0.00-143.00)
10	TD2	ZK	J				GRAVEL, clayey, (CLAY), Reddish Brown, Transported, Very Stiff, Uniform, Sub-rounded, Unconsolidated / unstable ground. Moderately sorted clay detritals + minor BIF.					
20		ZJI	S				GRAVEL, (SCREE), Brownish Grey, Transported, Hard, Uniform, Sub-rounded, Stable / competent ground conditions. Moderately sorted BIF pisolites + minor shale.					
30		ZJ	K	CL3			GRAVEL, sandy, (SCREE), Brownish Grey, Transported, Firm, Uniform, Sub-rounded, Stable / competent ground conditions. Moderately sorted BIF + minor clays + trace chert, calcrete,limonite. Hard stable ground 26-38m, unconsolidated ground 38-48m.					
40		ZS	JK	LG			GRAVEL, sandy, (SCREE), Yellowish Brown, Transported, Firm, Uniform, Sub-angular, Unconsolidated / unstable ground. Moderately sorted shales, clays + minor BIF + trace limonite, goethite.					
50						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0021	Hole Length:	233.00

Easting: 764181.57
Northing: 7409365.53
Surface RL: 615.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 26 Mar 21 - 02 Apr 21
Comments: Reasonably difficult drilling conditions.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 158.0	DR3	DR	600		EASTERNWELL	VL2
158.0 - 233.0	DR3	DR	450		EASTERNWELL	JK3

License: 205541

TOC RL:	615.99	(Stickup 0.16m)	(drilled)	SWL:	107.76 MBTOC	(06 Apr 21)	Dev:	Y: 25.8 hour(s)	Final pH: 8.3
TOC RL:	615.99	(Stickup 0.16m)	(current)	Is Live:	Y	(-)	Date:	01 Apr 2021	Final EC: 840.00

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description
50	TD2	ZS	JK	LG	GRAVEL, sandy, (SCREE), Yellowish Brown, Transported, Firm, Uniform, Sub-angular, Unconsolidated / unstable ground. Moderately sorted shales, clays + minor BIF + trace limonite, goethite.
		ZJS	K	L	GRAVEL, (SCREE), Reddish Grey, Transported, Stiff, Uniform, Sub-angular, Unconsolidated / unstable ground. Moderately sorted BIF, shales + minor clays + trace limonite.
60	OC	SK	JL		SHALE, (OC), Whiteish Yellow, Highly Weathered, Medium Strong Rock. Sub rounded shales, clays + minor sub angular BIF, limonite. Unconsolidated ground.
70		SK			SHALE, (OC), Whiteish Buff, Extremely Weathered, Weak Rock. Clays, very sticky. Very easy for rods to bog. Need to use chemicals + water to continue drilling. Unconsolidated ground.
80		SK	JL		SHALE, (OC), Greyish Yellow, Highly Weathered, Medium Strong Rock. Sub rounded shales, clays + minor sub angular BIF, limonite. Unconsolidated ground. Perched water strike at 74m @0.5 L/s.
90		S	J	K	SHALE, (OC), Greyish Yellow, Extremely Weathered, Very Weak Rock. Sub rounded very stick shales + minor grey sub angular BIF + trace clays. Unconsolidated ground. Perched water yield increased to 4 L/s, water too sticky to measure EC.
100		S	J		SHALE, (OC), Greenish Light or White, Extremely Weathered, Very Weak Rock. Sub rounded shales + minor BIF. Shales band (118-120m). Unconsolidated ground. No perched water.

Log: Gamma CPS API — 0 100 200

EC us/cm — 0-5000; pH — 0-14; Yield L/s — 0-40

pH: 8.0 (80 m), 8.1 (90 m)
Yield: 1 (80 m), 4 (90 m)

Diagram: Scaled to 600mm

Notes: Casing size as ID
305mm BLANK STEEL (0.00-143.00)

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0021	Hole Length:	233.00

Easting: 764181.57
Northing: 7409365.53
Surface RL: 615.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 26 Mar 21 - 02 Apr 21
Comments: Reasonably difficult drilling conditions.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 158.0	DR3	DR	600		EASTERNWELL	VL2
158.0 - 233.0	DR3	DR	450		EASTERNWELL	JK3

License: 205541

TOC RL:	615.99	(Stickup 0.16m)	(drilled)	SWL:	107.76 MBTOC	(06 Apr 21)	Dev:	Y: 25.8 hour(s)	Final pH: 8.3
TOC RL:	615.99	(Stickup 0.16m)	(current)	Is Live:	Y	(-)	Date:	01 Apr 2021	Final EC: 840.00

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 600mm	Notes Casing size as ID
100–150	OC	S	J				SHALE, (OC), Greenish Light or White, Extremely Weathered, Very Weak Rock. Sub rounded shales + minor BIF. Shales band (118-120m). Unconsolidated ground. No perched water.					305mm BLANK STEEL (0.00-143.00)
	OC	S					SHALE, (OC), Brown, Extremely Weathered, Extremely Weak Rock. Very sticky shales . Tend to form seal around rods if not saturated & chemical used. Unconsolidated ground.					
	OC	S	K				SHALE, (OC), Reddish Light or White, Highly Weathered, Weak Rock. Angular shales + minor clays. Broken ground. FWS at 134m @5 L/s.	1520	8.3	5		
	OC	S	KQ				SHALE, (OC), Reddish Light or White, Highly Weathered, Weak Rock. Angular shales+ minor clays, quartz + trace limonite. fault zone. Yields increased from 5 L/s to 15 L/s. Broken ground.	1015	8.4	10		
	OD	S	QJ	KL			SHALE, (OD), Whiteish Brown, Highly Weathered, Weak Rock. Angular shales + minor BIF, quartz+ trace clays, limonite. Fracture at 152m but no change in yield. Broken ground.	908	8.6	15		305mm W/W STEEL (143.00-227.00)

Depth: 100, 110, 120, 130, 140, 150
Gamma: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0021	Hole Length:	233.00

Easting: 764181.57
Northing: 7409365.53
Surface RL: 615.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 26 Mar 21 - 02 Apr 21
Comments: Reasonably difficult drilling conditions.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 158.0	DR3	DR	600		EASTERNWELL	VL2
158.0 - 233.0	DR3	DR	450		EASTERNWELL	JK3

License: 205541

TOC RL:	615.99	(Stickup 0.16m)	(drilled)	SWL:	107.76 MBTOC	(06 Apr 21)	Dev:	Y: 25.8 hour(s)	Final pH: 8.3
TOC RL:	615.99	(Stickup 0.16m)	(current)	Is Live:	Y	(-)	Date:	01 Apr 2021	Final EC: 840.00

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description	EC us/cm	pH	Yield L/s	Notes (Casing size as ID)
150	OD	S	QJ	KL	SHALE, (OD), Whiteish Brown, Highly Weathered, Weak Rock. Angular shales + minor BIF, quartz+ trace clays, limonite. Fracture at 152m but no change in yield. Broken ground.	895	8.3	20	305mm W/W STEEL (143.00-227.00)
	OC	SJ	Q		UNMINERALISED BIF, (OC), Brownish Blue, Moderately Weathered, Medium Strong Rock. Sharp increase in overall chip size, 2-20mm, rounded to subrounded, increase in quartz present, quartz 2-25mm, some porous chips. Driller reported fracture at 157m and increase in yield to 20 L/s. Mainly hard stable ground.	886	8.2	20	
160		SGH	D	Q	UNMINERALISED BIF, (OC), Brownish Blue, Moderately Weathered, Medium Strong Rock. Decrease in overall chip size, decrease in quantity of quartz, white shale present, 2-10mm, subrounded-subangular, some fizzing with acid. Hard stable ground.	865	8.4	20	
170		SJ	D	CQ	SHALE, (OC), Blueish Pink, Slightly Weathered, Medium Strong Rock. Dark grey and red, 2-20mm, some porous chips, subrounded to subangular, some fizzing with acid. Hard stable ground. Dolomitic shales.	877	8.8	20	
		SJ	D	QC	SHALE, (OC), Blueish Pink, Slightly Weathered, Medium Strong Rock. Dark grey and red, 2-10mm, subrounded to subangular, some porosity, red hematitic shale, fizzes with acid, dolomitic shale. Fractures reported between 182-188m and increase in yield to 20+ L/s. Hard stable ground.	850	8.8	20	
180						863	8.2	20	
		SJ	Q	C	SHALE, (OC), Blueish Brown, Slightly Weathered, Medium Strong Rock. Increase in quartz present, goethitic shale, subrounded to subangular. Hard stable ground.	872	8.3	20	
190	OB	DS	G	QC	DOLOMITE, (OB), Blueish Grey, Fresh, Strong Rock. Fresh dolomite with shales present, ~5-10mm, subangular to subrounded, fizzes with acid, some carbonate bands visible. Hard stable ground.	905	8.4	20	
200						877	8.4	20	

Log: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40
Diagram: Scaled to 600mm

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	HWSR0021	Hole Length:	233.00

Easting: 764181.57
Northing: 7409365.53
Surface RL: 615.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 26 Mar 21 - 02 Apr 21
Comments: Reasonably difficult drilling conditions.

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 158.0	DR3	DR	600		EASTERNWELL	VL2
158.0 - 233.0	DR3	DR	450		EASTERNWELL	JK3

License: 205541

TOC RL:	615.99	(Stickup 0.16m)	(drilled)	SWL:	107.76 MBTOC	(06 Apr 21)	Dev:	Y: 25.8 hour(s)	Final pH: 8.3
TOC RL:	615.99	(Stickup 0.16m)	(current)	Is Live:	Y	(-)	Date:	01 Apr 2021	Final EC: 840.00

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 600mm	Notes Casing size as ID
200	OB	DS	G	QC			DOLOMITE, (OB), Blueish Grey, Fresh, Strong Rock. Fresh dolomite with shales present, ~5-10mm, subangular to subrounded, fizzes with acid, some carbonate bands visible. Hard stable ground.	877	8.4	20		305mm W/W STEEL (143.00-227.00)
		DSG		QC								
							DOLOMITE, (OB), Blueish Grey-brown, Fresh, Medium Strong Rock. Increase in overall chip size at 202-204m and 206-208m, up to 25mm, some porosity, increase in goethitic shale, subrounded to subangular, large sized quartz at 206-208m. At 204-206m decrease in overall chip size. Hard stable ground.	870	8.1	20		
210	MM	J	Q					867	8.1	20		
							MINERALISED BIF, (MM), Brownish Blue-yellow, Moderately Weathered, Medium Strong Rock. Large porous chips from 208m decreasing in size with depth, mainly subrounded to subangular, increase in quartz at 218-224m, quartz up to 15mm. Inferred broken ground, possibly fault zone. No change in yield.	900	7.9	20		
220												
		JS		QC			UNMINERALISED BIF, (MM), Pinkish Blue, Moderately Weathered, Medium Strong Rock. Decrease in overall chip size, 2-15mm, rounded to subangular. Hard stable ground.	885	7.9	20		305mm BLANK STEEL (227.00-233.00)
230								839	8.1	20		
												END CAP (233.00)
240												
250												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WHALEBACK	Hole Name:	HXAN0002	Hole Length:	150.00

Easting: 765851.23
Northing: 7411629.78
Surface RL: 623.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 06 Feb 21 - 06 Feb 21
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	WLSRC50	RHF	146		WLS	JG6

TOC RL: 624.56 - (drilled) SWL: Dev: N Final pH: -
TOC RL: 624.56 - (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	JN	O					DOLERITE, (JN), Grey, Moderately Weathered, Medium Strong Rock. Light Grey Tuff. Talc on fingers. Becoming more weathered with depth (disintegrates in sieve). Low density. Tuff.					51mm BLANK PVC (0.00-60.00)
10												
20												
30												
40												
50												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WHALEBACK	Hole Name:	HXAN0002	Hole Length:	150.00

Easting: 765851.23
Northing: 7411629.78
Surface RL: 623.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 06 Feb 21 - 06 Feb 21
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	WLSRC50	RHF	146		WLS	JG6

TOC RL: 624.56 - (drilled) SWL: Dev: N Final pH: -
TOC RL: 624.56 - (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	JN	O					DOLERITE, (JN), Grey, Moderately Weathered, Medium Strong Rock. Light Grey Tuff. Talc on fingers. Becoming more weathered with depth (disintegrates in sieve). Low density. Tuff.					51mm BLANK PVC (0.00-60.00)
60												51mm SLOTTED PVC (60.00-150.00)
70												
80												
90												
100						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WHALEBACK	Hole Name:	HXAN0002	Hole Length:	150.00

Easting: 765851.23
Northing: 7411629.78
Surface RL: 623.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 06 Feb 21 - 06 Feb 21
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	WLSRC50	RHF	146		WLS	JG6

TOC RL: 624.56 - (drilled) SWL: Dev: N Final pH: -
TOC RL: 624.56 - (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	JN	O					DOLERITE, (JN), Grey, Moderately Weathered, Medium Strong Rock. Light Grey Tuff. Talc on fingers. Becoming more weathered with depth (disintegrates in sieve). Low density. Tuff.					51mm SLOTTED PVC (60.00-150.00)
110												
120												
130												
140												
150						0 100 200		0-5000	0-14	0-40		END CAP (150.00)

BHPIO - Hydrogeology Log

BHP

Project:	WHALEBACK	Hole Name:	HXAN0002	Hole Length:	150.00

Easting: 765851.23
Northing: 7411629.78
Surface RL: 623.63
Grid Name: MGA94_50
Incl / Azm: -90-->0
Construct: 06 Feb 21 - 06 Feb 21
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 150.0	WLSRC50	RHF	146		WLS	JG6

TOC RL:	624.56	-	(drilled)	SWL:			Dev:	N	Final pH: -
TOC RL:	624.56	-	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
150	JN											END CAP (150.00)
160												
170												
180												
190												
200												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR0663R	Hole Length:	129.00

Easting: 765826.87
Northing: 7408745.45
Surface RL: 607.86
Grid Name: MGA94_50
Incl / Azm: -89-->136
Construct: 03 Jun 16 - 03 Jun 16
Comments: Drilled to test detritals

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 129.0	RANRC11	RHF	146		RANGER	NJ

TOC RL: 608.54 (Stickup 0.68m) (drilled) SWL: 86.96 MBTOC (15 Jul 16) Dev: N Final pH: -
TOC RL: 608.54 (Stickup 0.68m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZK					Red/white sticky clays					51mm BLANK PVC (0.00-84.00)
	CY3	ZK					Red/white sticky clays					
10												
20												
30												
40												
50												

0 100 200 0-5000 0-14 0-40

Program: FY16 MH EXTENTS Planned Hole: MH_16_0141 Page: 1

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR0663R	Hole Length:	129.00

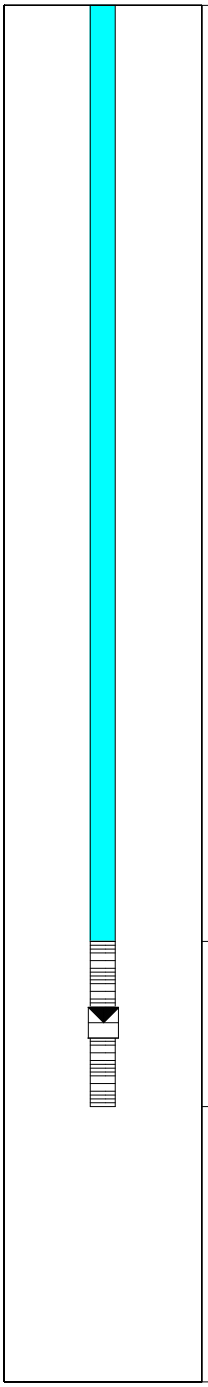
Easting: 765826.87
Northing: 7408745.45
Surface RL: 607.86
Grid Name: MGA94_50
Incl / Azm: -89-->136
Construct: 03 Jun 16 - 03 Jun 16
Comments: Drilled to test detritals

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 129.0	RANRC11	RHF	146		RANGER	NJ

TOC RL: 608.54 (Stickup 0.68m) (drilled) SWL: 86.96 MBTOC (15 Jul 16) Dev: N Final pH: -
TOC RL: 608.54 (Stickup 0.68m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	CY3	ZK				Red/white sticky clays					51mm BLANK PVC (0.00-84.00)
	ST3	ZK				Red/white sticky clays					
60		ZK		G		Yellow clays					
70	VB2	ZK		G		Yellow clays					
		ZGX	K			Some vuggy vit g chips. Good minz, should grade.					51mm SLOTTED PVC (84.00-90.00)
80		ZKG				Too much clays to grade					
90		ZK				Sloppy white clay					
		ZK		G							
100		ZKG				Brown/yell/wht clays					

Gamma scale: 0 100 200
EC: 0-5000 pH: 0-14 Yield: 0-40



BHPIO - Hydrogeology Log

BHP

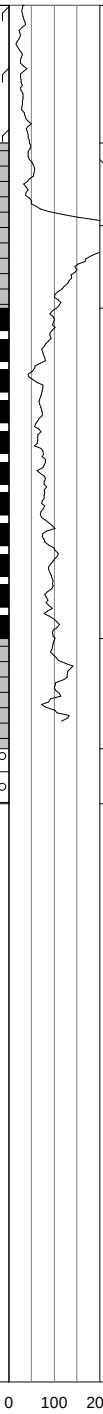
Project:	WESTERN RIDGE	Hole Name:	WSR0663R	Hole Length:	129.00

Easting: 765826.87
Northing: 7408745.45
Surface RL: 607.86
Grid Name: MGA94_50
Incl / Azm: -89-->136
Construct: 03 Jun 16 - 03 Jun 16
Comments: Drilled to test detritals

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 129.0	RANRC11	RHF	146		RANGER	NJ

TOC RL: 608.54 (Stickup 0.68m) (drilled) SWL: 86.96 MBTOC (15 Jul 16) Dev: N Final pH: -
TOC RL: 608.54 (Stickup 0.68m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	VB2	ZKG					Brown/yell/wht clays					
		S	B				Sloppy grey shale					
	OB	S	B				Sloppy grey shale					
		S					Sloppy white shale					
110		F	S	G			Mod hard f shales, light pink shale coating on last two samples					
120		S					Soft white shale					
		O					EOH grey/whie sylvia siltstone					
130												
140												
150												



0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1139R	Hole Length:	153.00

Easting: 761590.03
Northing: 7407507.47
Surface RL: 633.97
Grid Name: MGA94_50
Incl / Azm: -89-->0
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	140		RANGER	MC1

Comments: hOLE GOES THROUGH jn THEN AN ALTEREN mu ABOVE A DYKE THEN A BAKED MARGIN BELOW BEFORE NORMAL MU AND ...

TOC RL:	634.52	(Stickup 0.55m)	(drilled)	SWL:	64.90 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	634.52	(Stickup 0.55m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZK		XY			VERY HARD TO TELL BEDROCK BOUNDARY AS NOT MANY CHIPS, CHIPS THAT THERE ARE, ARE ROUNDED					51mm BLANK PVC (0.00-61.20)
	JN	ZK		XY			VERY HARD TO TELL BEDROCK BOUNDARY AS NOT MANY CHIPS, CHIPS THAT THERE ARE, ARE ROUNDED					
		SF					NO SIGN OF HC, RED SHALES, CONSISTANT					
10												
20												
30		SF	G									
		SF										
40												
		SF		G								
	MU	SF		G			RIGHT ON THE BOUNDARY WITH MU					
50		SG										

Gamma scale: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1139R	Hole Length:	153.00

Easting: 761590.03
Northing: 7407507.47
Surface RL: 633.97
Grid Name: MGA94_50
Incl / Azm: -89-->0
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	140		RANGER	MC1

Comments: hOLE GOES THROUGH jn THEN AN ALTEREN mu ABOVE A DYKE THEN A BAKED MARGIN BELOW BEFORE NORMAL MU AND ...

TOC RL:	634.52	(Stickup 0.55m)	(drilled)	SWL:	64.90 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	634.52	(Stickup 0.55m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	MU	SG					RIGHT ON THE BOUNDARY WITH MU					51mm BLANK PVC (0.00-61.20)
		HG		M			TRACE MAGNETITE					
		G	L									
		GS	L									
60		H	G	MRN			BEGINNING OF ALTERED ZONE, SOME CHIPS MAGNETIC VERY DARK COLOUR OF PILES					51mm SLOTTED PVC (61.20-103.20)
		H	M	N3			SMALL CALCITE CHIPS LOGGED AS 3					
		HG		MN			LESS ALTERED					
70		H	MG	N3			MAGNATISM MORE, LOOKS LIKE BLACK MANGANESE SHALE OUT OF THE CYCLONE AT TIMES					LEVELTROLL(72.00) ID: 2205
80		HM	3	N			LARGE CALCITE CRYSTALS SCRACHED BY SCRIBLE EASILY, MORE MAGNETIC AGAIN					
		HM		NS			CALLING A 0042 AS NO EVIDENCE YET OF Mpl-H					
90		HG	M	NR			PROBABLY THE HIGH P ZONE AT THE EDGE OF THE ALTERATION					
		ER		N			REALLY ALTERED DOLORITE					
100						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1139R	Hole Length:	153.00

Easting: 761590.03
Northing: 7407507.47
Surface RL: 633.97
Grid Name: MGA94_50
Incl / Azm: -89-->0
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	140		RANGER	MC1

Comments: hOLE GOES THROUGH jn THEN AN ALTEREN mu ABOVE A DYKE THEN A BAKED MARGIN BELOW BEFORE NORMAL MU AND ...

TOC RL: 634.52 (Stickup 0.55m) (drilled) SWL: 64.90 MBTOC (30 Aug 18) Dev: N Final pH: -
TOC RL: 634.52 (Stickup 0.55m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description	Notes (Casing size as ID)
100	MU	ER		N	REALLY ALTERED DOLORITE	51mm SLOTTED PVC (61.20-103.20)
110	K	E			SOFT AND SHALE LIKE, BUT SIMILAR IN COLOUR T0 HOMESTEAD DOLORITE, SPEARMINT TOOTHPASTE COLOUR	
120	MU	G	MEC		BAKED MARGIN? REALLY HARD TO LOG, DRILLER REPORTS MORE WATER BELOW DYKE	LEVELTROLL(72.00) ID: 2205
		G	C	S	MARGINAL AT BEST, SOME MASSIVE G CHIPS	END CAP (103.20)
130		J			TYPICAL MU BIF	
		J		N	POSSIBLE RHODOCHROSITE, PINK VEIN MATERIAL	
		J				
140		JG				
		BS	R			
150		B	R		ENDS IN ROY HOLL SHALE, LOOKS TO HAVE ALTERATION OF CARBONATE WITHIN IT	

Log: Gamma CPS API 0 100 200
EC us/cm 0-5000; pH 0-14; Yield L/s 0-40
Diagram: Scaled to 400mm

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1139R	Hole Length:	153.00

Easting: 761590.03
Northing: 7407507.47
Surface RL: 633.97
Grid Name: MGA94_50
Incl / Azm: -89-->0
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	140		RANGER	MC1

Comments: hOLE GOES THROUGH jn THEN AN ALTEREN mu ABOVE A DYKE THEN A BAKED MARGIN BELOW BEFORE NORMAL MU AND ...

TOC RL:	634.52	(Stickup 0.55m)	(drilled)	SWL:	64.90 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	634.52	(Stickup 0.55m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
150	MU	B	R				ENDS IN ROY HOLL SHALE, LOOKS TO HAVE ALTERATION OF CARBONATE WITHIN IT					
160												
170												
180												
190												
200												
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1150R	Hole Length:	132.00

Easting: 761630.82
Northing: 7408957.13
Surface RL: 648.38
Grid Name: MGA94_50
Incl / Azm: -89-->277
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 132.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH magnetic dolerite and black shale. pushed as was unsure what the strat was doing and based on ad...

TOC RL: 649.23 (Stickup 0.85m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 649.23 (Stickup 0.85m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZXG	HY				good looking detritals, some vit g.					51mm BLANK PVC (0.00-102.60)
	VB2	G		SL			almost all vit g					
		FG		L			some vit g					
10		G	FL	C			may be marginal					
		GL	F				stil some vit g.					
20	MM	GL	F				stil some vit g.					
		G	L	S								
		CL		SG			very limonitic but too much chert					
30		JC	GL	S								
40		LG		C			limonitic ore, may still be newman?? check gamma					
50												

Gamma scale: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1150R	Hole Length:	132.00

Easting: 761630.82
Northing: 7408957.13
Surface RL: 648.38
Grid Name: MGA94_50
Incl / Azm: -89-->277
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 132.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH magnetic dolerite and black shale. pushed as was unsure what the strat was doing and based on ad...

TOC RL: 649.23 (Stickup 0.85m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 649.23 (Stickup 0.85m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50		LG		C			limonitic ore, may still be newman?? check gamma					51mm BLANK PVC (0.00-102.60)
		JC	GL				white shales					
		J1		HLG								
		J1		GQ			small quartz chips					
60												
		J	1	GL								
		CJ	1	Q								
70												
	MM	CJ		QH			very cherty, possibly football cherts but doesnt have the gamma response					
80												
90		JS	C				shaley bif					
		S	J				yellow shales					
		JS	C	Q			shaley bif					
100	MU	JS	C	Q			shaley bif					
						0 100 200		0-5000	0-14	0-40		

Program: SK Extents RC FY17 Planned Hole: SK_0036 Page: 2

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1150R	Hole Length:	132.00

Easting: 761630.82
Northing: 7408957.13
Surface RL: 648.38
Grid Name: MGA94_50
Incl / Azm: -89-->277
Construct: 05 Dec 16 - 05 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 132.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH magnetic dolerite and black shale. pushed as was unsure what the strat was doing and based on ad...

TOC RL: 649.23 (Stickup 0.85m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 649.23 (Stickup 0.85m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	MU	JS	C	Q			shaley bif					51mm BLANK PVC (0.00-102.60)
												51mm SLOTTED PVC (102.60-120.60)
110		J	SC									
		E	B	PQ			dolerite dyke with black shale and sulphides. some very magnetic chips. some green chips 114-117m					
120												END CAP (120.60)
130												
140												
150												

0 100 200 0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1153R	Hole Length:	141.00

Easting: 761633.11
Northing: 7409258.79
Surface RL: 639.91
Grid Name: MGA94_50
Incl / Azm: -89-->300
Construct: 14 Dec 16 - 14 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 141.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH N1 BIF. Pushed to make sure was in N1, thought went into NS3/4 at 99m so pushed a bit more, then...

TOC RL:	641.27	(Stickup 1.36m)	(drilled)	SWL:	123.38 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	641.27	(Stickup 1.36m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Hydrogeological Description	Notes
0–10	ST3	ZXY	GH		mosstly small x-balls (2-3mm). 18-21m larger x-balls.	51mm BLANK PVC (0.00-111.00)
10–20	GS3	ZXY	GH		mosstly small x-balls (2-3mm). 18-21m larger x-balls.	
20–22	VB2	ZGY	SL		g rich, some rounded g x-balls. mixed bag of things	
22–30	VB2	ZGY	SL		g rich, some rounded g x-balls. mixed bag of things	
30–34	VB2	ZGY	LF		think this is still td2, rounded chips. messy gamma	
34–36	WA1	ZGY	LF		think this is still td2, rounded chips. messy gamma	
36–38	WA1	ZYK	G		may be coming into shales?? check assays	
38–40	WA1	G	LH		angualar chiops, so think it is gettinog out of detritals	
40–46	WA1	SGL	F	H	ns3/4. orange shales. may be marginal shaley ore.	
46–50	WA1	HG	L	Q	good ore	

Log: 0 100 200
Gamma CPS API
EC us/cm: 0-5000
pH: 0-14
Yield L/s: 0-40
Diagram: Scaled to 400mm

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1153R	Hole Length:	141.00

Easting: 761633.11
Northing: 7409258.79
Surface RL: 639.91
Grid Name: MGA94_50
Incl / Azm: -89-->300
Construct: 14 Dec 16 - 14 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 141.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH N1 BIF. Pushed to make sure was in N1, thought went into NS3/4 at 99m so pushed a bit more, then...

TOC RL:	641.27	(Stickup 1.36m)	(drilled)	SWL:	123.38 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	641.27	(Stickup 1.36m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	A1	HG	L	Q			good ore					51mm BLANK PVC (0.00-111.00)
		HG	L	Q			good ore					
		J	HL	Q			51-54m may be marginal, almost major H.but a bit of chert					
60	N3	JC	H				chert chips are pitted /altered. possibly altered Quartz?					
70		J1	C	Q			dark MN bif. quite clean					
	N2	J1	C	Q			dark MN bif. quite clean					
80												
90												
		JC	SL	H			bif gets more yellow and shaley here but not seen on gamma, thought it was MM or NS3/4 but nothing conclusive on gamma					
100												

0 100 200 | 0-5000 | 0-14 | 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1153R	Hole Length:	141.00

Easting: 761633.11
Northing: 7409258.79
Surface RL: 639.91
Grid Name: MGA94_50
Incl / Azm: -89-->300
Construct: 14 Dec 16 - 14 Dec 16

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 141.0	RANRC12	RHF	146		RANGER	JT4

Comments: EOH N1 BIF. Pushed to make sure was in N1, thought went into NS3/4 at 99m so pushed a bit more, then...

TOC RL:	641.27	(Stickup 1.36m)	(drilled)	SWL:	123.38 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	641.27	(Stickup 1.36m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	N2	JC	SL	H			bif gets more yellow and shaley here but not seen on gamma, thought it was MM or NS3/4 but nothing conclusive on gamma					51mm BLANK PVC (0.00-111.00)
110		J1	CG	S			eoh					51mm SLOTTED PVC (111.00-135.00)
120												
130												LEVELTROLL(130.00) ID: 2199
												END CAP (135.00)
140												
150												

0 100 200 | 0-5000 | 0-14 | 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1193R	Hole Length:	87.00

Easting: 762750.88
Northing: 7407563.88
Surface RL: 635.69
Grid Name: MGA94_50
Incl / Azm: -89-->18
Construct: 14 Dec 16 - 14 Dec 16
Comments: Testing mineralisation close to "fault".

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 87.0	MCYRC15	RHF	140		MCKAY	GAD

TOC RL: 636.44 (Stickup 0.75m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 636.44 (Stickup 0.75m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	MU	GC		SJ			#marginal, brown cherts					51mm BLANK PVC (0.00-63.00)
		CJ	GL	S								
10												
20												
30												
40		LG	C	J			marginal, still very silicious					
		C	GJL									
50		J	C									
						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1193R	Hole Length:	87.00

Easting: 762750.88
Northing: 7407563.88
Surface RL: 635.69
Grid Name: MGA94_50
Incl / Azm: -89-->18
Construct: 14 Dec 16 - 14 Dec 16
Comments: Testing mineralisation close to "fault".

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 87.0	MCYRC15	RHF	140		MCKAY	GAD

TOC RL: 636.44 (Stickup 0.75m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 636.44 (Stickup 0.75m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	MU	J	C									51mm BLANK PVC (0.00-63.00)
60												51mm SLOTTED PVC (63.00-87.00)
70												
80		JC		ST			eoh, testing min close to fault as per Ali's instruction					
												END CAP (87.00)
90												
100						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1241R	Hole Length:	153.00

Easting: 764088.18
Northing: 7409191.26
Surface RL: 617.35
Grid Name: MGA94_50
Incl / Azm: -89-->87
Construct: 13 Dec 16 - 13 Dec 16
Comments: closed out newman, depth for pizo hole

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	146		RANGER	SDD

TOC RL: 618.37 (Stickup 1.02m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 618.37 (Stickup 1.02m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZXY	GS				mixed bag					51mm BLANK PVC (0.00-84.00)
	ST3	ZXS	KG				white dentaured shale?? with some x balls					
10		ZYK					red soily balls					
20												
30												
40												
50												

Gamma: 0 100 200
EC: 0-5000
pH: 0-14
Yield: 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1241R	Hole Length:	153.00

Easting: 764088.18
Northing: 7409191.26
Surface RL: 617.35
Grid Name: MGA94_50
Incl / Azm: -89-->87
Construct: 13 Dec 16 - 13 Dec 16
Comments: closed out newman, depth for pizo hole

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	146		RANGER	SDD

TOC RL: 618.37 (Stickup 1.02m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 618.37 (Stickup 1.02m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	ST3	ZYK					red soily balls					51mm BLANK PVC (0.00-84.00)
		ZK					yellow brown clays					
	CA2	ZK					yellow brown clays					
60												
	VB2	ZK					yellow brown clays					
70		ZK	G				aa, some geothite					
		ZKG					transition zone					
	WA2	ZKG					transition zone					
80		FS					should be in WA now					51mm SLOTTED PVC (84.00-102.00)
		S	G									
90		SL	G									
		G	SL				becoming marginally better					
100						0 100 200		0-5000	0-14	0-40		

Program: SK Extents RC FY17 Planned Hole: SK_0124 Page: 2

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1241R	Hole Length:	153.00

Easting: 764088.18
Northing: 7409191.26
Surface RL: 617.35
Grid Name: MGA94_50
Incl / Azm: -89-->87
Construct: 13 Dec 16 - 13 Dec 16
Comments: closed out newman, depth for pizo hole

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	146		RANGER	SDD

TOC RL: 618.37 (Stickup 1.02m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 618.37 (Stickup 1.02m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	WA2	G	SL				becoming marginally better					51mm SLOTTED PVC (84.00-102.00)
		GS										
110		S	G									
	WA1	G	S									
120		GH					best sammple, high grade?					
		SG										
130		SC										
		GJ	C									
140		S	JC									
150		JC					eoh					

0 100 200 0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1241R	Hole Length:	153.00

Easting: 764088.18
Northing: 7409191.26
Surface RL: 617.35
Grid Name: MGA94_50
Incl / Azm: -89-->87
Construct: 13 Dec 16 - 13 Dec 16
Comments: closed out newman, depth for pizo hole

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 153.0	RANRC12	RHF	146		RANGER	SDD

TOC RL: 618.37 (Stickup 1.02m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 618.37 (Stickup 1.02m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
150	WA1	JC					eoh					
160												
170												
180												
190												
200												

0 100 200 0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

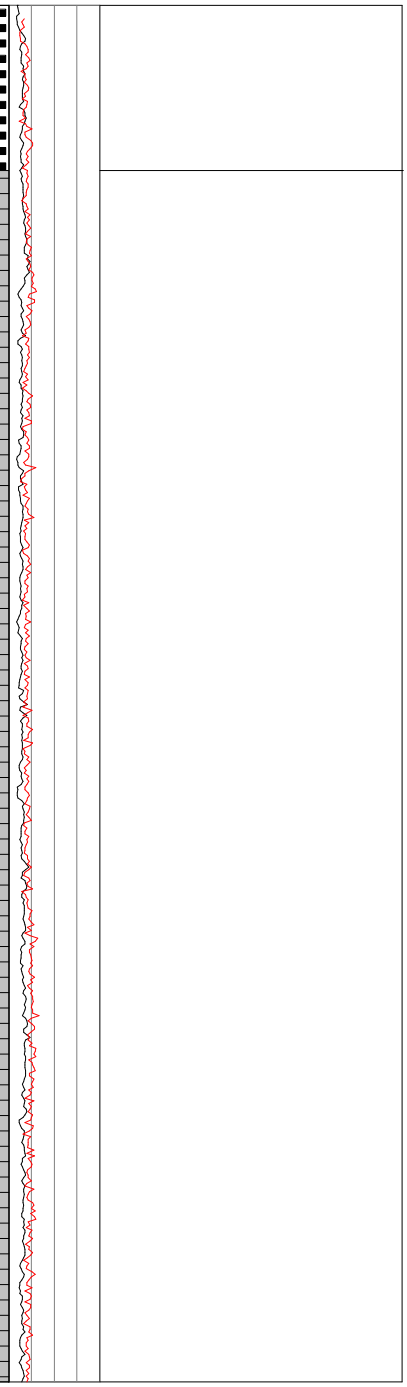
Project:	WESTERN RIDGE	Hole Name:	WSR1248R	Hole Length:	123.00

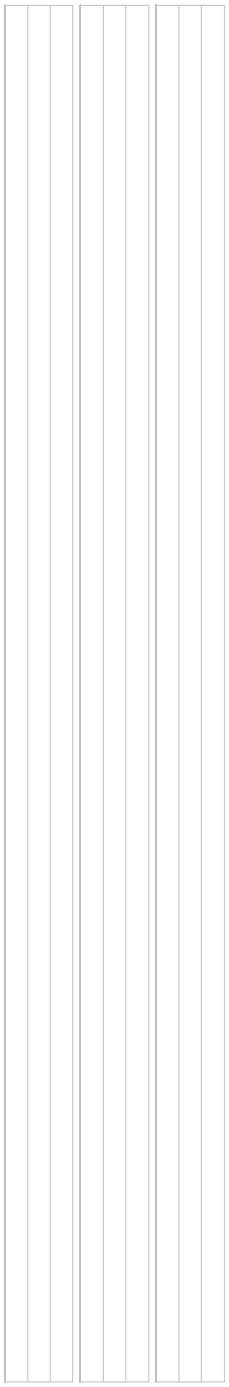
Easting: 764342.42
Northing: 7409137.70
Surface RL: 614.16
Grid Name: MGA94_50
Incl / Azm: -71-->190
Construct: 13 Dec 16 - 13 Dec 16
Comments: Testing structure and strat

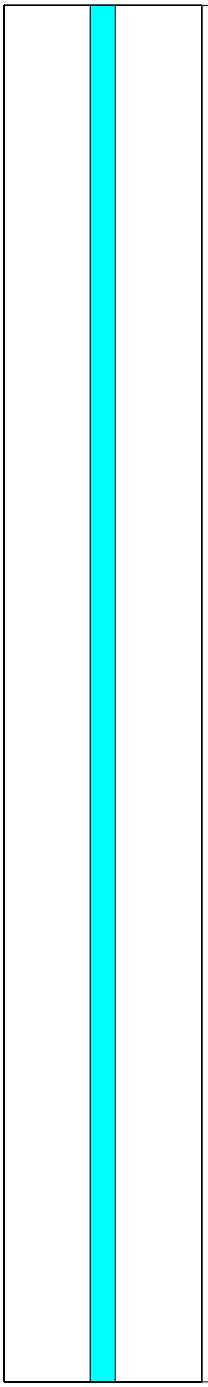
Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 123.0	RANRC09	RHF	140		RANGER	GAD

TOC RL: 615.05 (Stickup 0.89m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 615.05 (Stickup 0.89m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZXG	S	C								51mm BLANK PVC (0.00-72.00)
	ST3	ZS	K									
10												
20												
30												
40												
50												







Program: SK Extents RC FY17 Planned Hole: SK_0131 Page: 1

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1248R	Hole Length:	123.00

Easting: 764342.42
Northing: 7409137.70
Surface RL: 614.16
Grid Name: MGA94_50
Incl / Azm: -71-->190
Construct: 13 Dec 16 - 13 Dec 16
Comments: Testing structure and strat

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 123.0	RANRC09	RHF	140		RANGER	GAD

TOC RL: 615.05 (Stickup 0.89m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 615.05 (Stickup 0.89m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	ST3	ZS	K									51mm BLANK PVC (0.00-72.00)
	VB2	ZSG		K								
60		ZSG		K								
		ZG	S	T								
	WA2	ZG	S	T								
70		ZG	CS									
		ZG	SN									51mm SLOTTED PVC (72.00-90.00)
		S	G				Td2 still???					
80												
		S		G								
90												END CAP (90.00)
100		S	JG									

0 100 200 0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1248R	Hole Length:	123.00

Easting: 764342.42
Northing: 7409137.70
Surface RL: 614.16
Grid Name: MGA94_50
Incl / Azm: -71-->190
Construct: 13 Dec 16 - 13 Dec 16
Comments: Testing structure and strat

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 123.0	RANRC09	RHF	140		RANGER	GAD

TOC RL: 615.05 (Stickup 0.89m) (drilled) SWL: Dev: N Final pH: -
TOC RL: 615.05 (Stickup 0.89m) (current) Is Live: Y (-) Date: - Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	WA2	S	JG									
		S					YELLOW AND LIGHT PINK SHALES					
110												
120		SC					EOH, THOUGHT WAS IN MM,					
130												
140												
150												

0-5000 0-14 0-40

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1270R	Hole Length:	135.00

Easting: 765523.29
Northing: 7408555.02
Surface RL: 605.88
Grid Name: MGA94_50
Incl / Azm: -70-->173
Construct: 13 Dec 16 - 13 Dec 16
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 135.0	RANRC11	RHF	146		RANGER	SDD

TOC RL:	606.68	(Stickup 0.80m)	(drilled)	SWL:	87.56 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	606.68	(Stickup 0.80m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
0	SZ	ZXY	G	SK			x balls and silt					51mm BLANK PVC (0.00-84.00)
	ST3	ZXY	G	SK			x balls and silt					
10												
20												
30												
40												
	VB2	ZXY	G	SK			x balls and silt					
		SJ					white shales/clay					
		SG	J									
50						0 100 200		0-5000	0-14	0-40		

BHPIO - Hydrogeology Log

BHP

Project:	WESTERN RIDGE	Hole Name:	WSR1270R	Hole Length:	135.00

Easting: 765523.29
Northing: 7408555.02
Surface RL: 605.88
Grid Name: MGA94_50
Incl / Azm: -70-->173
Construct: 13 Dec 16 - 13 Dec 16
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 135.0	RANRC11	RHF	146		RANGER	SDD

TOC RL:	606.68	(Stickup 0.80m)	(drilled)	SWL:	87.56 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	606.68	(Stickup 0.80m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
50	VB2	SG	J									51mm BLANK PVC (0.00-84.00)
60												
		SG	J				pale white shales					
		S		GJ								
70	WA2	G	S				marginal					
80												51mm SLOTTED PVC (84.00-102.00)
		GS										
90		SG										
		GS										
100		G	S									LEVELTROLL(100.00) ID: 2200

0 100 200 | 0-5000 | 0-14 | 0-40

BHPIO - Hydrogeology Log

BHP

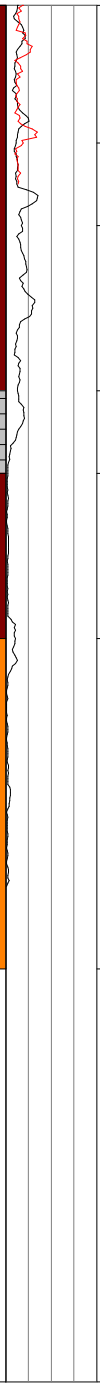
Project:	WESTERN RIDGE	Hole Name:	WSR1270R	Hole Length:	135.00

Easting: 765523.29
Northing: 7408555.02
Surface RL: 605.88
Grid Name: MGA94_50
Incl / Azm: -70-->173
Construct: 13 Dec 16 - 13 Dec 16
Comments:

Depth	Drill Rig	Type	Size	Fluid	Drilled By	Logged By
0.0 - 135.0	RANRC11	RHF	146		RANGER	SDD

TOC RL:	606.68	(Stickup 0.80m)	(drilled)	SWL:	87.56 MBTOC	(30 Aug 18)	Dev:	N	Final pH: -
TOC RL:	606.68	(Stickup 0.80m)	(current)	Is Live:	Y	(-)	Date:	-	Final EC: -

Depth mgbl	Strat	Major	Minor	Trace	Log	Gamma CPS API	Hydrogeological Description	EC us/cm	pH	Yield L/s	Diagram Scaled to 400mm	Notes Casing size as ID
100	WA2	G	S									51mm SLOTTED PVC (84.00-102.00)
		GSC										
110		GS										
	WA1	S	G									
120		GC					becoming cherty					
130		CG					aa					
140												
150												



0-5000 0-14 0-40

APPENDIX B

Field Sheets

Well Gauging - WRCS CONTAMINATED SITES.

GOLDER

Weather: Dry. Overcast. Warm. Light breeze

Project No: CX214 64272
Golder Staff: S. Pringle
Dipper/ IP: 1550T2 BHP 200m WL meter.

Well ID	Date	Time (hrs)	DTP (mbtoc)	DTW (mbtoc)	DTB (mbtoc)	Comment (colour/ odour)
WSR1270RM	13/04/21	08:18	—	DRY	102.0m	Dry. Bore drilled on an approx 15° angle.
WSR1241RM	13/04/21	08:50	—	DRY	107.5m	Dry. Bore drilled vertically. Mud at base
WSR1153RM	13/04/21	09:16	—	DRY	71.35.0m	Dry. ~~Did not dip deep as below~~ ~~assumed dirt if~~
WSR1193RM	13/04/21	09:50	—	~~Dry~~ 67.5	—	Hydrosleeve deployed.
HWSR0019M	13/04/21	11:08	—	49.35	—	Hydrosleeve deployed.
HWSR0020M	13/04/21	12:06	—	27.93	—	Hydrosleeve deployed.
WSR0296RM	13/04/21	12:35	—	117.40	—	Hydrosleeve deployed.
WSR0663R	14/04/21	09:50	—	DRY	90.80	Close to 1270R as other was dry. DRY.
WSR1248R	14/04/21	10:11	—	DRY	88.92	Close to 1241RM as others dry. DRY.
HWSR0021	14/04/21	10:47	—	107.91	~227.0m	close to 1241RM. Hydrosleeve deployed.
WSR0299RM	14/04/21	11:10	—	112.11	—	Hydrosleeve deployed.
HWSR0014M	14/04/21	11:55	—	151.77	—	Hydrosleeve deployed.
WSR0597RM	14/04/21	16:35	—	135.37	—	Hydrosleeve deployed
HXAN0002M	15/04/21	09:50	—	76.70	—	Hydrosleeve deployed
WSR1150R	15/04/21	14:00	—	~~[illegible]~~	97.16	close to WSR1153RM DRY

Notes to table:
DTP = depth to product
mbtoc = metres below top of casing
DTW = depth to water
DTB = depth to base
IP = interface probe
NM = not measured

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	HXAN0002M

PROJECT INFORMATION

Project Number:	CX21464272	Date:	15/04/21
Client:	BHP	Sampled By:	Pwhanen / SPRINGLE
Site Location:	WESTERN RIDGE	Time:	09:50

Weather Conditions (Temperature, Precipitation, Wind): Dry. Windy. Mild.

Well Maintenance Required? YES / NO (NO) Detail

WELL INFORMATION

Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

CALIBRATION

Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES / NO (NO)	Depth of pump intake (mbRP)	79m
Initial depth to water (mbRP)	15/04/21 76.70 16/04/21	Length of hose (m)	
Depth to product (mbRP)	—	Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	Hydrosleeve

CONTROLLER SETTINGS

CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102 3399

GROUNDWATER CONTINUOUS FIELD PARAMETER RECORD

	Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
16/04/21	09:30			76.10	7.79	892	-205.0	0.66	26.7	Clear, rotten egg odour

SAMPLING RECORD

Time Sampled:	09:30
Colour:	Clear
Odour:	Rotten egg
Turbidity:	Low / Medium / High
Hydrocarbon Sheen ?	Yes / No
DI Water Lab Certificate No.	

Sample IDs: HXAN0002M / 50160421

Primary Duplicate:	
Secondary Duplicate:	
Trip Blank:	
Rinsate:	
Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
1	250mL Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2x PFAS	Other

Notes: Hydrosleeve deployed 15/04/21 at 09:55am at >3m b WL.

GAP FORM 60-1 / RL 1

FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	HWSR0021M

Project Number:	CX1464272	Date:	14/04/21
Client:	BHP	Sampled By:	Dwayne. Spinnoli
Site Location:	WESTERN RIDGE	Time:	10:47

WELL INFORMATION	
Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

Weather Conditions (Temperature, Precipitation, Wind): Dry. Mild. Warm

Well Maintenance Required? YES / NO (NO circled) Detail:

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES / NO (NO circled)	Depth of pump intake (mbRP)	150m
Initial depth to water (mbRP)	14/04/21 107.41 / 15/04/21	Length of hose (m)	
Depth to product (mbRP)	—	Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	HYDRASLEEVE

Control Settings	
CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102399

	Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
15/04/21	16:10	—	—	107.89	7.27	961	17.6	5.14	30.5	cloudy brown. very turbid. no odour

SAMPLING RECORD

Time Sampled:	16:10	Sample IDs	HWSR0021/50150421
Colour:	No	Primary Duplicate:	
Odour:	Brown	Secondary Duplicate:	
Turbidity:	Low Medium High (High circled)	Trip Blank:	
Hydrocarbon Sheen ?	Yes No (No circled)	Rinsate:	
DI Water Lab Certificate No.		Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
2	1L Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2xPFAS.	Other

Notes:

- Screen interval 143-227m. Newly drilled (1 week ago)
- Hydrasleave installed at 150m on 14/04/21 10:50

GAP FORM 60-1 / RL 1
FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	MWSR0014M

Project Number:	21464272	Date:	14/04/21
Client:	BHP	Sampled By:	Pharro / JP, Ingle.
Site Location:	WESTERN RIDGE	Time:	11:55

Weather Conditions (Temperature, Precipitation, Wind): Dry. Windy. Mild.

Well Maintenance Required? YES / NO Detail

WELL DIAGRAM	
Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GAUGING INFORMATION

Pre-Sampling Information	YES / NO	Purging and Sampling Information	
Interface probe used?	YES / NO	Depth of pump intake (mbRP)	175
Initial depth to water (mbRP)	14/04/21: 151.77 / 16/04/21: 151.78	Length of hose (m)	
Depth to product (mbRP)	—	Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	HYDRASLEEVE

CONTROLLER SETTINGS	
CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102399

	Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
16/04/21	07:40	—	—	151.78	7.15	545	164.3	3.76	24.9	Clear, ~~no odour~~, Minimal turbidity no odour

SAMPLING RECORD

Time Sampled: 07:40
Colour: clear
Odour: no ~~[illegible]~~
Turbidity: (Low) Medium High
Hydrocarbon Sheen ? Yes (No)
DI Water Lab Certificate No.

Sample IDs MWSR0014M / SR16042 1

Primary Duplicate:	
Secondary Duplicate:	
Trip Blank:	
Rinsate:	
Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2x	Vials (P/UP)		Metals (F/UF;P/UP)
1x	1L Amber 250mL		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2x PFAS	Other

Notes: Groundwater came up warm ~~[illegible]~~. A strong solvent / glue odour was emitting from the bore but the groundwater did not have an odour.

Hydrasleeve deployed at 12:00 14/04/21 at 175m bgl.

GAP FORM 60-1 / RL 1
FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	HWSR0019M

PROJECT INFORMATION			
Project Number:	CA21464242	Date:	13/04/21
Client:	TSMP	Sampled By:	RJ/MND / PRICE
Site Location:	WESTERN RIDGE	Time:	11:03

WELL INFORMATION	
Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

Weather Conditions (Temperature, Precipitation, Wind): Dry. Overcast. mild.

Well Maintenance Required? YES / NO (NO circled) Detail

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GROUNDWATER INFORMATION			
Pre-Sampling Information		**Purging and Sampling Information**	
Interface probe used?	YES / NO (NO circled)	Depth of pump intake (mbRP)	~55m
Initial depth to water (mbRP)	13/04/21: 49.35; 15/04/21: 14.15	Length of hose (m)	—
Depth to product (mbRP)	—	Volume in hose (L)	—
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	—
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	—
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	—
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	Hydrosleeve

CONTROLLER SETTINGS	
CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102399

WATER QUALITY MONITORING RECORD

	Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
15/04/21	12:00	—	—	49.15	7.47	3022	-70.0	1.20	29.20	GROUND SAMPLE

SAMPLING RECORD

Time Sampled:	12:00	Sample IDs	HWSR0019M/50150421
Colour:	clear	Primary Duplicate:	
Odour:	no	Secondary Duplicate:	HWSR0019M/59150421
Turbidity:	Low (circled) / Medium / High	Trip Blank:	
Hydrocarbon Sheen ?	Yes / No (No circled)	Rinsate:	
DI Water Lab Certificate No.		Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

4x	Vials (P/UP)		Metals (F/UF;P/UP)
2x	1L Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	3x PFAS	Other

Notes: Hydrosleeve deployed at 11:10 on 13/04/21 at ~55m b WL.

GAP FORM 60-1 / RL 1
FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	HWSR0020m

GENERAL INFORMATION			
Project Number:	CX2146427 2	Date:	13/04/21
Client:	TSMP	Sampled By:	Armand Strauss
Site Location:	Western Road	Time:	12:00

Weather Conditions (Temperature, Precipitation, Wind): Dry. mild. Overcast.

Well Maintenance Required? YES / NO Detail

WELL DEVELOPMENT	
Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	/
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GROUNDWATER PURGING			
Pre-Sampling Information		**Purging and Sampling Information**	
Interface probe used?	YES / NO	Depth of pump intake (mbRP)	30m bgOC
Initial depth to water (mbRP)	13/04/21: 27.45	Length of hose (m)	–
Depth to product (mbRP)	15/04/21: 28.0m	Volume in hose (L)	–
Thickness of product (m)	–	Depth to water after placement of pump (mbRP)	–
Bailed product thickness (m)	–	Depth to water at end of purging (mbRP)	–
Total depth of well (mbRP)	–	Depth to water after collection of samples (mbRP)	–
Thickness of sediment on base of well (m)	–	Purging and Sampling Method	Hydrosleeve

CONTROLLER	
CPM	
Refill	/
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 191102399

GROUNDWATER PARAMETER MONITORING RECORD									
Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm) SPC	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
15/04/21 10:40	–	–	28.0	8.11	1540	-332.6	0.28	27.6	Grab sample. Rotten Eggy odour.

SAMPLING RECORD			
Time Sampled:	10:40	Sample IDs	HWSR0020M / 501504 21
Colour:	clear	Primary Duplicate:	HWSR0020M / 581584 21
Odour:	rotten eggy	Secondary Duplicate:	
Turbidity:	Low / Medium / High	Trip Blank:	
Hydrocarbon Sheen ?	Yes / No	Rinsate:	
DI Water Lab Certificate No.		Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2x2	Vials (P/UP)		Metals (F/UF;P/UP)
1x250ml	Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2x 2x PFAS	Other

Notes: Hydrosleeve deployed at 12:10 on 13/04/21 at <5m bWL.

GAP FORM 60-1 / RL 1

FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	WSR0296RM

WORKSHEET INFORMATION

Project Number:	CA21464242	Date:	13/04/21
Client:	TSMP	Sampled By:	
Site Location:	western edge	Time:	12:35

Weather Conditions (Temperature, Precipitation, Wind): Dry. Windy. Mot.

Well Maintenance Required? YES / NO Detail

WELL INFORMATION

Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GAUGING RECORD

Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES / NO	Depth of pump intake (mbRP)	120m
Initial depth to water (mbRP)	13/04/21 117.40 / 15/04/21 117.08	Length of hose (m)	
Depth to product (mbRP)		Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	Hydrosleeve

CONTROLLER

CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102 399

OBSERVATIONS DURING LOW FLOW PURGING RECORD

Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity spc (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
15/04/21 13:20	—	—	117.08	7.56	983	-16.7	2.22	29.5	clear. no odour. slight sediment.

SAMPLING RECORD

Time Sampled:	13:20
Colour:	clear
Odour:	no
Turbidity:	Low / Medium / High
Hydrocarbon Sheen ?	Yes / No
DI Water Lab Certificate No.	

Sample IDs

Primary Duplicate:	WSR0296RM/50150421 ~~WSR0296RM/50150421-PFAS~~
Secondary Duplicate:	
Trip Blank:	
Rinsate:	
Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
1	~~1L~~ Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	4x PFAS	Other

Notes: 2x Extra PFAS for lab QAQC.

Hydrosleeve deployed at < 5m bWL on 13/04/21 at 12:40

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

PROJECT INFORMATION			
WELL ID: WSR0299RM	Project Number: CA21446427 2	Date: 14/04/21	
	Client: DMP	Sampled By: PW/RMD/SP single	
	Site Location: WESTERN RIDGE	Time: 11:10	

Weather Conditions (Temperature, Precipitation, Wind): Dry Wind. HA

Well Maintenance Required? YES / NO (NO circled) Detail

WELL INFORMATION	
Diameter of standpipe (mm)	50 mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GAUGING INFORMATION			
Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES / NO (NO circled)	Depth of pump intake (mbRP)	187
Initial depth to water (mbRP)	14/04/21 112.11 / 01/04/21 112.16	Length of hose (m)	—
Depth to product (mbRP)	—	Volume in hose (L)	—
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	—
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	—
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	—
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	Hydrosleeve.

Controller settings	
CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102399

PURGING RECORD

	Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
14/04/21	15:20	—	—	112.10	7.50	513	-1.6	1.85	31.2	clear. no odour. no sediment.

SAMPLING RECORD

Time Sampled:	15:20	Sample IDs	WSR0299RM/50150421
Colour:	clear	Primary Duplicate:	
Odour:	no	Secondary Duplicate:	
Turbidity:	Low (circled) Medium High	Trip Blank:	
Hydrocarbon Sheen ?	Yes No (No circled)	Rinsate:	
DI Water Lab Certificate No.		Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
2	1L Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2 pfas	Other

Notes: 1x Extra TRH for lab Dup

Hydrosleeve deployed on 14/04/21 at 11:20 at 187m bgl.

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	WSR0597RM

Project Number:	CX21464272	Date:	14/04/21
Client:	BHP	Sampled By:	PURMED / JS STRINGER
Site Location:	NEWTON RIDGE	Time:	16:35

Weather Conditions (Temperature, Precipitation, Wind): Dry. Mild. Windy.

Well Maintenance Required? YES / NO (NO) Detail

WELL INFORMATION	
Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	/
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GAUGING INFORMATION			
Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES / NO (NO)	Depth of pump intake (mbRP)	140m
Initial depth to water (mbRP)	14/04/21 135.37	Length of hose (m)	/
Depth to product (mbRP)	—	Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	HYDRASLEEVE

PUMP INFORMATION	
CPM	
Refill	/
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L1023399

GROUNDWATER MONITORING/PARAMETERS									
Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
16/04/21 08:40	—	—	135.10	7.18	1194	105.9	3.83	25.8	Cloudy, grey, no odour

SAMPLING RECORD			
Time Sampled:	08:40	Sample IDs	WSR0597/16160421
Colour:	Grey	Primary Duplicate:	
Odour:	No	Secondary Duplicate:	
Turbidity:	Low Medium (Medium) High	Trip Blank:	
Hydrocarbon Sheen ?	Yes No (No)	Rinsate:	
DI Water Lab Certificate No.		Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
1 x 2L	1L Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	2x PFAS	Other

Notes:

Hydrasleeve installed at approx 5m bWL on 14/04/21 at 16:40

GAP FORM 60-1 / RL 1
FEBRUARY 2018

GROUNDWATER SAMPLING RECORD FORM
LOW FLOW PURGING and SAMPLING (incl. low yielding wells)

GOLDER

WELL ID:	WRS1193RM

PROJECT INFORMATION

Project Number:	CA21464242	Date:	13/04/2021
Client:	BHP	Sampled By:	Pumza Spiro NALE
Site Location:	WESTERN RIDGE	Time:	09:40

Weather Conditions (Temperature, Precipitation, Wind): Dry. Windy. Hot.

Well Maintenance Required? YES / NO Detail

WELL INFORMATION

Diameter of standpipe (mm)	50mm
Standpipe stick up (m)	
Surveyed reference point	
Depth to top of filter pack (from log)	
Depth to bottom of filter pack (from log)	
Depth of well (from log)	

mbRP - metres below top of reference point
Hose volume - 0.12 L/m of 1/2 inch diameter hose
Hose volume - 0.07 L/m of 3/8 inch diameter hose
Hose volume - 0.03 L/m of 1/4 inch diameter hose

GROUNDWATER INFORMATION

Pre-Sampling Information		Purging and Sampling Information	
Interface probe used?	YES NO	Depth of pump intake (mbRP)	70m
Initial depth to water (mbRP)	13/03/21 67.55 / 15/04/21 67.05	Length of hose (m)	
Depth to product (mbRP)	—	Volume in hose (L)	
Thickness of product (m)	—	Depth to water after placement of pump (mbRP)	
Bailed product thickness (m)	—	Depth to water at end of purging (mbRP)	
Total depth of well (mbRP)	—	Depth to water after collection of samples (mbRP)	
Thickness of sediment on base of well (m)	—	Purging and Sampling Method	HYDRASLEEVE

Controller settings

CPM	
Refill	
Discharge	
Throttle	

WQM Model: YSI

WQM Calibration Certificate: 19L102399

GROUNDWATER MONITORING FIELD RECORD

Time	Cumulative Volume Purged (L)	Flow Rate (L/min)	Depth to Water (mbRP)	±0.1 pH	±5% Conductivity (µS/cm)	±10 Redox (mV)	±10% Dissolved Oxygen (ppm)	±0.5°C Temperature (°C)	Appearance (Colour, Turbidity, Odour, etc)
14:20	—	—	67.05	7.42	1422	-155.1	1.22	28.1	cloudy brown no odour. slight sediment

SAMPLING RECORD

Time Sampled:	14:20
Colour:	cloudy brown
Odour:	no
Turbidity:	Low Medium High
Hydrocarbon Sheen ?	Yes No
DI Water Lab Certificate No.	

Sample IDs WSR1193RM/50150421

Primary Duplicate:	
Secondary Duplicate:	
Trip Blank:	
Rinsate:	
Field Blank:	

Sample Containers/Preservation (F=Filtered; UF=Unfiltered; P=Preserved; UP=Unpreserved)

2	Vials (P/UP)		Metals (F/UF;P/UP)
1	1L Amber		Cyanide
	1L Plastic		Sulphide
	Phenols/COD/NH3 (F/UF; P/UP)		Arsenic
	Ferrous/Ferric Iron (F/UF; P/UP)	4x PFAS	Other

Notes: 2x Extra PFAS for lab QAQC

- Hydrasleeve installed approx 25m below top of WL. on 13/04/21

APPENDIX C

Calibration Certificates

GK Environmental EQUIPMENT

Calibration Report

Multi-Parameter Water Quality Instrument

Customer: Golder
Contact: Phil/Syke

Manufacturer: YSI
Instrument: Professional Plus with Quatro cable
Serial #: 19L102399
Cable length: 1m

Item	Test	Pass	Comments
Battery	2 x Alkaline C-cells	✓	Voltage reading above 2.9V
	Battery Saver	✓	Automatically turns off after 30 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	4.0.0
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	Good, clean
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	173.90 mV
pH slope		✓	55 to 60 mV/pH, ideal 59mV 58.14
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	Good, clean
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	variance range ± 20mV -2 mV
Conductivity			
Condition		✓	Good, clean
Temperature		✓	°C
Conductivity cell constant 5.0 ± 1.0 in GLP file		✓	
Clean sensor reads less than 3 uS/cm in dry air		✓	
Calibrated and conforms to manufacturer's specifications		✓	µs/cm
Dissolved Oxygen			
Condition		✓	Good, clean
DO sensor in use		✓	Galvanic
1.25 mil PE membrane (yellow membrane):		✓	
DO Sensor Value		✓	(min 4.31 uA - max 8.00 uA) Avg 6.15 uA
Calibrated and conforms to manufacturer's specifications		✓	ppm

This is to certify that the above instrument has been calibrated to the following specifications:

Parameter	Standards	Reference	Calibration Point	Span	Units	Instrument Readings Before	After	Units
Temperature		Room Temp	23.5	0	°C	NA	23.5	°C
pH	pH 7.00	356684	7.01	-28.50	mV	7.02	7.01	pH
pH	pH 4.00	355385	4.00	145.40	mV	4.03	4.00	pH
Conductivity	2764 µs/cm at 25°C	20/1007	2764	GLP	5.21	2719	2764	µs/cm
ORP (Reference check only)	Zobell A & B	20/0506	232	232	mV	234.6	233.9	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	10175	0.0	NA	NA	-0.2	0.0	%
100% Dissolved Oxygen	100% Air Saturation	Air	100.0	5.94	uA	100.9	100.0	%

Calibrated by: Gaurav Kanwar

Calibration Date: 08-Apr-21
Next Due: 05-Oct-21

Water Quality Meter Calibration Sheet

GOLDER

Job: Western Ridge

Date and time: 15/04/2021

Name: Skye Pringle

Signature:

Phase/Task Number:

WQ meter make/model:

WQ meter serial number: 19L102399

Start of day Certificate Number*:

* use unique identifier (e.g YYYYMMDD_"technician's initials")

Parameter	Standard Solution	~~Pre-calibration reading~~	Acceptable range	Calibration Required (Y/N)	Post Calibration Reading
Temperature	— °C	20.3	± 0.5 °C	N	15.8
pH	4	4.10	3.9 - 4.1	N	4.10
	7	7.10	6.9 - 7.1	N	7.10
	10	—	9.9 – 10.1	—	—
Conductivity	0	—	0.0 - 0.1 mS/cm	—	—
	2760 µS/cm @ 25 °C	2.85 mS	± 5%	N	2.75
	— mS/cm @ — °C	—	~~± 5%~~	—	—
Dissolved Oxygen	0% Saturation Solution	0.15	± 0.1 ppm	[illegible]	0.03
	Ambient Air	8.22	± 0.5 ppm of value on Table A overleaf	Y	9.50
Redox	229 mV @ 25 °C	231.1	± 10 MV	N	235.8

Comments (including any additional repairs or services performed)

Water Quality Meter Calibration Sheet

GOLDER

Job: Western Ridge

Date and time: 16/04/2021 07:40

Name: Skye Pringle

Signature:

Phase/Task Number:

WQ meter make/model: Pro Plus YSI

WQ meter serial number: 19L102399

Certificate Number*:

* use unique identifier (e.g YYYYMMDD_"technician's initials")

Parameter	Standard Solution	~~Pre-calibration reading~~ Start of day	Acceptable range	Calibration Required (Y/N)	~~Post Calibration Reading~~ End of day
Temperature	°C	15.8	± 0.5 °C	N	18.2
pH	4	4.10	3.9 - 4.1	N	4.10
	7	7.10	6.9 - 7.1	N	7.10
	~~10~~		~~9.9 – 10.1~~		
Conductivity	~~0~~		~~0.0 - 0.1 mS/cm~~		
	2760 µS/cm @ 25 °C	2754	± 5%	N	2833
	~~mS/cm @ °C~~		~~± 5%~~		
Dissolved Oxygen	0% Saturation Solution	0.03	± 0.1 ppm	N	0.04
	Ambient Air	9.50	± 0.5 ppm of value on Table A overleaf	N	9.23
Redox	229 mV @ 25.0 °C	235.6	± 10 MV	N	229.9

Comments (including any additional repairs or services performed)

Water Quality Meter Calibration Sheet

GOLDER

Job: Western Ridge - BHP

Date and time: 17/04/2021

Name: Stage Pringle

Signature:

Phase/Task Number:

WQ meter make/model:

WQ meter serial number: 19L102399

Certificate Number*:

* use unique identifier (e.g YYYYMMDD_"technician's initials")

Parameter	Standard Solution	Pre-calibration reading	Acceptable range	Calibration Required (Y/N)	Post Calibration Reading
Temperature	°C	18.2	± 0.5 °C	N	22.5
pH	4	4.10	3.9 - 4.1	N	4.10
	7	7.10	6.9 - 7.1	N	7.09
	10	—	9.9 – 10.1	—	—
Conductivity	0	—	0.0 - 0.1 mS/cm	—	—
	2760 mS/cm @ 25 °C	2833	± 5%	N	2844
	mS/cm @ °C	—	± 5%	—	—
Dissolved Oxygen	0% Saturation Solution	0.04	± 0.1 ppm	N	0.05
	Ambient Air	9.23	± 0.5 ppm of value on Table A overleaf	N	9.68
Redox	229 mV @ 25 °C	229.9	± 10 MV	N	222.5

Comments (including any additional repairs or services performed)

GAP Form No. 61 / RL1
February 2018

Water Quality Meter Calibration Sheet

GOLDER

Job: Western Ridge - BMP

Date and time: 18/04/2021 08:30

Name: Skye Pringle

Signature:

Phase/Task Number:

WQ meter make/model:

WQ meter serial number: 19L102399

Certificate Number*:

* use unique identifier (e.g YYYYMMDD_"technician's initials")

Parameter	Standard Solution	Pre-calibration reading	Acceptable range	Calibration Required (Y/N)	Post Calibration Reading
Temperature	_____ °C	15.6	± 0.5 °C	N	20.0
pH	4	4.10	3.9 - 4.1		4.1
	7	7.00	6.9 - 7.1		7.00
	10	—	9.9 – 10.1	—	—
Conductivity	0	—	0.0 - 0.1 mS/cm	—	—
	2760 mS/cm @ 25 °C	2866	± 5%	N	2866
	_____ mS/cm @ _____ °C	—	± 5%	—	—
Dissolved Oxygen	0% Saturation Solution	0.05	± 0.1 ppm	N	0.05
	Ambient Air	10.63	± 0.5 ppm of value on Table A overleaf	N	10.63
Redox	229 mV @ 25 °C	225.6	± 10 MV	N	225.6

Comments (including any additional repairs or services performed)

APPENDIX D

Laboratory Certificates

CERTIFICATE OF ANALYSIS

Work Order	: **EP2104244**	Page	: 1 of 12
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: CHRISTIAN BUDIMULJONO	Contact	: Lauren Biagioni
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: 08 9406 1307
Project	: 21464272 - Western Ridge - WRCS	Date Samples Received	: 19-Apr-2021 14:40
Order number	: 21464272	Date Analysis Commenced	: 21-Apr-2021
C-O-C number	: ----	Issue Date	: 29-Apr-2021 16:22
Sampler	: Philip Ward, SKYE PRINGLE		
Site	: MWB		
Quote number	: EN/002/20		
No. of samples received	: 12		
No. of samples analysed	: 12		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Vanessa Nguyen	Organic Chemist	Perth Organics, Wangara, WA

General Comments

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

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

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

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

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

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

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

- PFAS conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080: Sample EP2104244-001 and 002 are positive for TRH C6-C9/10 fractions due to the presence of compounds other than BTEX.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	HWSR0014M	HWSR0019M	HWSR0020M	WSR0296RM	WSR0299RM
			Sampling date / time	16-Apr-2021 07:40	15-Apr-2021 12:00	15-Apr-2021 10:40	15-Apr-2021 13:20	15-Apr-2021 15:20
Compound	CAS Number	LOR	Unit	EP2104244-001	EP2104244-002	EP2104244-003	EP2104244-004	EP2104244-005
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**180**	**170**	**600**	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	**110**	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	**120**	**120**	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	**120**	**230**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	**170**	**150**	**540**	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	**170**	**150**	**530**	<20	<20
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	**130**	**110**	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	**130**	**110**	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	**7**	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	**7**	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
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	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	HWSR0014M	HWSR0019M	HWSR0020M	WSR0296RM	WSR0299RM
			Sampling date / time	16-Apr-2021 07:40	15-Apr-2021 12:00	15-Apr-2021 10:40	15-Apr-2021 13:20	15-Apr-2021 15:20
Compound	CAS Number	LOR	Unit	EP2104244-001	EP2104244-002	EP2104244-003	EP2104244-004	EP2104244-005
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
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
Perfluoroheptanoic acid (PFHpA)	375-85-9	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
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 (PFTrDA)	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
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								

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	HWSR0014M	HWSR0019M	HWSR0020M	WSR0296RM	WSR0299RM
			Sampling date / time	16-Apr-2021 07:40	15-Apr-2021 12:00	15-Apr-2021 10:40	15-Apr-2021 13:20	15-Apr-2021 15:20
Compound	CAS Number	LOR	Unit	EP2104244-001	EP2104244-002	EP2104244-003	EP2104244-004	EP2104244-005
				Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued								
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	<0.0002
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
^ Sum of PFAS	----	0.0002	µg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	104	103	109	100	99.6
Toluene-D8	2037-26-5	2	%	99.8	101	100	98.5	98.3
4-Bromofluorobenzene	460-00-4	2	%	102	104	104	100	99.8
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	119	106	99.1	114	106
13C8-PFOA	----	0.0005	%	101	90.5	91.1	106	100

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	WSR0597RM	WSR1193RM	HXAN0002M	FD01	HWSR0021M
			Sampling date / time	16-Apr-2021 08:40	15-Apr-2021 14:20	16-Apr-2021 09:30	15-Apr-2021 10:40	15-Apr-2021 16:10
Compound	CAS Number	LOR	Unit	EP2104244-006	EP2104244-007	EP2104244-008	EP2104244-009	EP2104244-010
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	**440**	**780**	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	**90**	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	**90**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	**400**	**710**	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	**390**	**700**	<20
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	**7**	**8**	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	**7**	**8**	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
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	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	WSR0597RM	WSR1193RM	HXAN0002M	FD01	HWSR0021M
			Sampling date / time	16-Apr-2021 08:40	15-Apr-2021 14:20	16-Apr-2021 09:30	15-Apr-2021 10:40	15-Apr-2021 16:10
Compound	CAS Number	LOR	Unit	EP2104244-006	EP2104244-007	EP2104244-008	EP2104244-009	EP2104244-010
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
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
Perfluoroheptanoic acid (PFHpA)	375-85-9	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
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 (PFTrDA)	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
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								

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	WSR0597RM	WSR1193RM	HXAN0002M	FD01	HWSR0021M
			Sampling date / time	16-Apr-2021 08:40	15-Apr-2021 14:20	16-Apr-2021 09:30	15-Apr-2021 10:40	15-Apr-2021 16:10
Compound	CAS Number	LOR	Unit	EP2104244-006	EP2104244-007	EP2104244-008	EP2104244-009	EP2104244-010
				Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued								
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	**0.002**	<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	<0.0002
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	<0.0002	**0.0020**	<0.0002	<0.0002
^ Sum of PFAS	----	0.0002	µg/L	<0.0002	<0.0002	**0.0020**	<0.0002	<0.0002
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**101**	**100**	**109**	**107**	**117**
Toluene-D8	2037-26-5	2	%	**98.5**	**98.4**	**99.0**	**101**	**104**
4-Bromofluorobenzene	460-00-4	2	%	**100**	**99.1**	**103**	**102**	**94.6**
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	**109**	**105**	**93.8**	**108**	**105**
13C8-PFOA	----	0.0005	%	**106**	**101**	**99.9**	**91.1**	**104**

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	TB319	TBW325	----	----	----
			Sampling date / time	16-Apr-2021 00:00	16-Apr-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2104244-011	EP2104244-012	--------	--------	--------
				Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	----	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
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	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	----	<0.0005	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	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	----	----	----

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	TB319	TBW325	----	----	----
			Sampling date / time	16-Apr-2021 00:00	16-Apr-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2104244-011	EP2104244-012	--------	--------	--------
				Result	Result	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
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	----	----	----
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								

Analytical Results

Sub-Matrix: PFAS (Matrix: WATER)			Sample ID	TB319	TBW325	----	----	----
			Sampling date / time	16-Apr-2021 00:00	16-Apr-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP2104244-011	EP2104244-012	--------	--------	--------
				Result	Result	----	----	----
EP231P: PFAS Sums - Continued								
^ 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	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	101	----	----	----	----
Toluene-D8	2037-26-5	2	%	99.5	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	99.9	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0005	%	----	103	----	----	----
13C8-PFOA	----	0.0005	%	----	103	----	----	----

Surrogate Control Limits

Sub-Matrix: **PFAS**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	61	141
Toluene-D8	2037-26-5	73	126
4-Bromofluorobenzene	460-00-4	60	125
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Inter-Laboratory Testing

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

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

(WATER) EP231C: Perfluoroalkyl Sulfonamides

(WATER) EP231A: Perfluoroalkyl Sulfonic Acids

(WATER) EP231B: Perfluoroalkyl Carboxylic Acids

(WATER) EP231P: PFAS Sums

(WATER) EP231S: PFAS Surrogate

QUALITY CONTROL REPORT

Work Order	: **EP2104244**	Page	: 1 of 7
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: CHRISTIAN BUDIMULJONO	Contact	: Lauren Biagioni
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: 08 9406 1307
Project	: 21464272 - Western Ridge - WRCS	Date Samples Received	: 19-Apr-2021
Order number	: 21464272	Date Analysis Commenced	: 21-Apr-2021
C-O-C number	: ----	Issue Date	: 29-Apr-2021
Sampler	: Philip Ward, SKYE PRINGLE		
Site	: MWB		
Quote number	: EN/002/20		
No. of samples received	: 12		
No. of samples analysed	: 12		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Vanessa Nguyen	Organic Chemist	Perth Organics, Wangara, WA

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3633186)									
EP2104244-005	WSR0299RM	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.00	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.00	No Limit
EP2104244-010	HWSR0021M	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.00	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3638782)									
EP2104244-001	HWSR0014M	EP080: C6 - C9 Fraction	----	20	µg/L	180	180	0.00	No Limit
EP2104244-011	TB319	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3633186)									
EP2104244-005	WSR0299RM	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
EP2104244-010	HWSR0021M	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3638782)									
EP2104244-001	HWSR0014M	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	170	160	0.00	No Limit
EP2104244-011	TB319	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
EP080: BTEXN (QC Lot: 3638782)									
EP2104244-001	HWSR0014M	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
				Laboratory Duplicate (DUP) Report					
EP080: BTEXN (QC Lot: 3638782) - continued									
EP2104244-001	HWSR0014M	EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
EP2104244-011	TB319	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 3644577)									
EP2104244-007	WSR1193RM	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: 3644577)									
EP2104244-007	WSR1193RM	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
		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: 3644577)									

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 3644577) - continued									
EP2104244-007	WSR1193RM	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: 3644577)									
EP2104244-007	WSR1193RM	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: 3644577)									
EP2104244-007	WSR1193RM	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

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3633186)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	378 µg/L	61.8	39.3	103
EP071: C15 - C28 Fraction	----	100	µg/L	<100	359 µg/L	61.7	47.2	122
EP071: C29 - C36 Fraction	----	50	µg/L	<50	269 µg/L	57.3	42.5	119
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3638782)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	320 µg/L	106	73.6	113
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3633186)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	372 µg/L	62.9	42.0	104
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	446 µg/L	55.6	46.2	116
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	271 µg/L	29.9	24.7	137
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3638782)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	370 µg/L	105	73.9	115
EP080: BTEXN (QCLot: 3638782)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	105	84.1	114
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	108	81.0	115
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	109	84.4	113
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	108	84.3	114
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	110	86.5	111
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	101	77.0	118
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 3644577)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.004 µg/L	80.8	72.0	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.004 µg/L	88.4	71.0	127
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.004 µg/L	89.6	68.0	131
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.004 µg/L	95.2	69.0	134
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.004 µg/L	84.8	65.0	140
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.004 µg/L	82.0	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3644577)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.02 µg/L	92.9	73.0	129
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.004 µg/L	98.0	72.0	129
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.004 µg/L	95.2	72.0	129
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.004 µg/L	91.2	72.0	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.004 µg/L	94.4	71.0	133
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.004 µg/L	90.0	69.0	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.004 µg/L	90.4	71.0	129

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 3644577) - continued								
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	86.8	69.0	133
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.004 µg/L	104	72.0	134
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	94.4	65.0	144
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.01 µg/L	94.7	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 3644577)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.004 µg/L	97.6	67.0	137
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.01 µg/L	106	68.0	141
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.01 µg/L	93.9	56.6	136
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.01 µg/L	94.9	61.9	129
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.01 µg/L	100	52.8	135
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.004 µg/L	84.0	65.0	136
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.004 µg/L	74.8	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 3644577)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.004 µg/L	82.0	63.0	143
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.004 µg/L	80.0	64.0	140
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.004 µg/L	93.2	67.0	138
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.004 µg/L	88.0	60.9	136
EP231P: PFAS Sums (QCLot: 3644577)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3638782)							
EP2104244-002	HWSR0019M	EP080: C6 - C9 Fraction	----	240 µg/L	108	77.0	137

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3638782)							
EP2104244-002	HWSR0019M	EP080: C6 - C10 Fraction	C6_C10	290 µg/L	92.8	77.0	137
EP080: BTEXN (QCLot: 3638782)							
EP2104244-002	HWSR0019M	EP080: Benzene	71-43-2	20 µg/L	117	77.0	122
		EP080: Toluene	108-88-3	20 µg/L	121	73.5	126

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2104244**	Page	: 1 of 7
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: CHRISTIAN BUDIMULJONO	Telephone	: 08 9406 1307
Project	: 21464272 - Western Ridge - WRCS	Date Samples Received	: 19-Apr-2021
Site	: MWB	Issue Date	: 29-Apr-2021
Sampler	: Philip Ward, SKYE PRINGLE	No. of samples received	: 12
Order number	: 21464272	No. of samples analysed	: 12

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 / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	1	14	7.14	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	14	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	12	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 / *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation* Date extracted	Due for extraction	Evaluation	*Analysis* Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**21-Apr-2021**	22-Apr-2021	✓	**22-Apr-2021**	31-May-2021	✓
Amber Glass Bottle - Unpreserved (EP071) HWSR0014M, WSR0597RM, HXAN0002M	**16-Apr-2021**	**21-Apr-2021**	23-Apr-2021	✓	**22-Apr-2021**	31-May-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**23-Apr-2021**	29-Apr-2021	✓	**23-Apr-2021**	29-Apr-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0014M, WSR0597RM, HXAN0002M, TB319	**16-Apr-2021**	**23-Apr-2021**	30-Apr-2021	✓	**23-Apr-2021**	30-Apr-2021	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**21-Apr-2021**	22-Apr-2021	✓	**22-Apr-2021**	31-May-2021	✓
Amber Glass Bottle - Unpreserved (EP071) HWSR0014M, WSR0597RM, HXAN0002M	**16-Apr-2021**	**21-Apr-2021**	23-Apr-2021	✓	**22-Apr-2021**	31-May-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**23-Apr-2021**	29-Apr-2021	✓	**23-Apr-2021**	29-Apr-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0014M, WSR0597RM, HXAN0002M, TB319	**16-Apr-2021**	**23-Apr-2021**	30-Apr-2021	✓	**23-Apr-2021**	30-Apr-2021	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**23-Apr-2021**	29-Apr-2021	✓	**23-Apr-2021**	29-Apr-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWSR0014M, WSR0597RM, HXAN0002M, TB319	**16-Apr-2021**	**23-Apr-2021**	30-Apr-2021	✓	**23-Apr-2021**	30-Apr-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-SUT) HWSR0019M, HWSR0020M, WSR0296RM, WSR0299RM, WSR1193RM, FD01, HWSR0021M	**15-Apr-2021**	**28-Apr-2021**	12-Oct-2021	✓	**28-Apr-2021**	12-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) HWSR0014M, WSR0597RM, HXAN0002M	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**28-Apr-2021**	13-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) TBW325	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**29-Apr-2021**	13-Oct-2021	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X-SUT) HWSR0019M, WSR0296RM, WSR1193RM, HWSR0021M	HWSR0020M, WSR0299RM, FD01,	**15-Apr-2021**	**28-Apr-2021**	12-Oct-2021	✓	**28-Apr-2021**	12-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) HWSR0014M, HXAN0002M	WSR0597RM,	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**28-Apr-2021**	13-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) TBW325		**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**29-Apr-2021**	13-Oct-2021	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X-SUT) HWSR0019M, WSR0296RM, WSR1193RM, HWSR0021M	HWSR0020M, WSR0299RM, FD01,	**15-Apr-2021**	**28-Apr-2021**	12-Oct-2021	✓	**28-Apr-2021**	12-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) HWSR0014M, HXAN0002M	WSR0597RM,	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**28-Apr-2021**	13-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) TBW325		**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**29-Apr-2021**	13-Oct-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X-SUT) HWSR0019M, WSR0296RM, WSR1193RM, HWSR0021M	HWSR0020M, WSR0299RM, FD01,	**15-Apr-2021**	**28-Apr-2021**	12-Oct-2021	✓	**28-Apr-2021**	12-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) HWSR0014M, HXAN0002M	WSR0597RM,	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**28-Apr-2021**	13-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT) TBW325		**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**29-Apr-2021**	13-Oct-2021	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X-SUT)								
HWSR0019M, WSR0296RM, WSR1193RM, HWSR0021M	HWSR0020M, WSR0299RM, FD01,	**15-Apr-2021**	**28-Apr-2021**	12-Oct-2021	✓	**28-Apr-2021**	12-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT)								
HWSR0014M, HXAN0002M	WSR0597RM,	**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**28-Apr-2021**	13-Oct-2021	✓
HDPE (no PTFE) (EP231X-SUT)								
TBW325		**16-Apr-2021**	**28-Apr-2021**	13-Oct-2021	✓	**29-Apr-2021**	13-Oct-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	14	**7.14**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	0	14	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	12	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2104244**

Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: CHRISTIAN BUDIMULJONO	Contact	: Lauren Biagioni
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: cbudimuljono@golder.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 9213 7600	Telephone	: 08 9406 1307
Facsimile	: +61 08 9427 7611	Facsimile	: +61-8-9406 1399
Project	: 21464272 - Western Ridge - WRCS	Page	: 1 of 2
Order number	: 21464272	Quote number	: EP2020GOLASSWA0058 (EN/002/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Philip Ward, SKYE PRINGLE		

Dates

Date Samples Received	: 19-Apr-2021 14:40	Issue Date	: 20-Apr-2021
Client Requested Due Date	: 29-Apr-2021	Scheduled Reporting Date	: **29-Apr-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 21.9 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 12 / 12

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
- PFAS conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Sampling date / time	Sample ID	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (29	WATER - W-04 TRH/BTEXN	WATER - W-18 TRH(C6 - C9)/BTEXN
EP2104244-001	16-Apr-2021 07:40	HWSR0014M/50160421	✓	✓	
EP2104244-002	15-Apr-2021 12:00	HWSR0019M/50150421	✓	✓	
EP2104244-003	15-Apr-2021 10:40	HWSR0020M/50150421	✓	✓	
EP2104244-004	15-Apr-2021 13:20	WSR0296RM/50150421	✓	✓	
EP2104244-005	15-Apr-2021 15:20	WSR0299RM/50150421	✓	✓	
EP2104244-006	16-Apr-2021 08:40	WSR0597RM/50160421	✓	✓	
EP2104244-007	15-Apr-2021 14:20	WSR1193RM/50150421	✓	✓	
EP2104244-008	16-Apr-2021 09:30	HXAN0002M/50160421	✓	✓	
EP2104244-009	15-Apr-2021 10:40	HWSR0020M/58150421	✓	✓	
EP2104244-010	15-Apr-2021 16:10	HWSR0021M/50150421	✓	✓	
EP2104244-011	16-Apr-2021 00:00	TB319			✓
EP2104244-012	16-Apr-2021 00:00	TBW325	✓		

Proactive Holding Time Report

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

Requested Deliverables

ALL INVOICES

- A4 - AU Tax Invoice (INV)	Email	auaccountspayable@golder.com.au

AUS ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	auaccounts@golder.com.au

CHRISTIAN BUDIMULJONO

- *AU Certificate of Analysis - NATA (COA)	Email	cbudimuljono@golder.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	cbudimuljono@golder.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	cbudimuljono@golder.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	cbudimuljono@golder.com.au
- Chain of Custody (CoC) (COC)	Email	cbudimuljono@golder.com.au
- EDI Format - ESDAT (ESDAT)	Email	cbudimuljono@golder.com.au
- EDI Format - XTab (XTAB)	Email	cbudimuljono@golder.com.au

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP2104244**

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Telephone	: +61 08 9213 7600	Telephone	: 08 9406 1307
Facsimile	: +61 08 9427 7611	Facsimile	: +61-8-9406 1399
Project	: 21464272 - Western Ridge - WRCS	Page	: 1 of 2
Order number	: 21464272	Quote number	: EP2020GOLASSWA0058 (EN/002/20)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: MWB		
Sampler	: Philip Ward, SKYE PRINGLE		

Dates

Date Samples Received	: 19-Apr-2021 14:40	Issue Date	: 22-Apr-2021
Client Requested Due Date	: 29-Apr-2021	Scheduled Reporting Date	: **29-Apr-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 21.9 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 12 / 12

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
- PFAS conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Sampling date / time	Sample ID	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (29	WATER - W-04 TRH/BTEXN	WATER - W-18 TRH(C6 - C9)/BTEXN
EP2104244-001	16-Apr-2021 07:40	HWSR0014M	✓	✓	
EP2104244-002	15-Apr-2021 12:00	HWSR0019M	✓	✓	
EP2104244-003	15-Apr-2021 10:40	HWSR0020M	✓	✓	
EP2104244-004	15-Apr-2021 13:20	WSR0296RM	✓	✓	
EP2104244-005	15-Apr-2021 15:20	WSR0299RM	✓	✓	
EP2104244-006	16-Apr-2021 08:40	WSR0597RM	✓	✓	
EP2104244-007	15-Apr-2021 14:20	WSR1193RM	✓	✓	
EP2104244-008	16-Apr-2021 09:30	HXAN0002M	✓	✓	
EP2104244-009	15-Apr-2021 10:40	FD01	✓	✓	
EP2104244-010	15-Apr-2021 16:10	HWSR0021M	✓	✓	
EP2104244-011	16-Apr-2021 00:00	TB319			✓
EP2104244-012	16-Apr-2021 00:00	TBW325	✓		

Proactive Holding Time Report

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

Requested Deliverables

ALL INVOICES

- A4 - AU Tax Invoice (INV)	Email	auaccountspayable@golder.com.au

AUS ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	auaccounts@golder.com.au

CHRISTIAN BUDIMULJONO

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- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	cbudimuljono@golder.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	cbudimuljono@golder.com.au
- Chain of Custody (CoC) (COC)	Email	cbudimuljono@golder.com.au
- EDI Format - ESDAT (ESDAT)	Email	cbudimuljono@golder.com.au
- EDI Format - XTab (XTAB)	Email	cbudimuljono@golder.com.au

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4958 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
☐PERTH 23 Rigali Way, Wangara WA 6065 Ph: 08 9408 1301 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Golder Associates
OFFICE: West Perth
PROJECT: 21464272 - Western Ridge - WRCS
COC ID:
PROJECT MANAGER: Christian Budimuljono
CONTACT PH: 08 9213 7414
SAMPLER: PWARD, SPRINGLE
SAMPLER MOBILE: 0401201999
COC Emailed to ALS? (YES / NO)
EDD FORMAT (or default): BHP Envirosys
cbudimuljono@golder.com
Email Invoice to: auaccounts@golder.com.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.:
COUNTRY OF ORIGIN: AUSTRALIA

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5
OF: 1 2 3 4 5

FOR 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 comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
R.	SP		
DATE/TIME: 11:00 17/04/21	DATE/TIME: 1440 19.4.21	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY — **SAMPLE DETAILS** MATRIX: Solid(S) Water(W) — **CONTAINER INFORMATION** — **ANALYSIS REQUIRED including SUITES** (NB. Suite Codes must be listed to attract suite price) — **Additional Information**

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	PFAS (99% protection level)	TRH (C6-C40)	TRH (C6-C9) and BTEX	Additional Information
1	HWSR0014M/50 16 0421	16 /04/2021 07:40	Water		5	X	X		
2	HWSR0019M/50 15 0421	15 /04/2021 12:00	Water		5	X	X		
3	HWSR0020M/50 15 0421	15 /04/2021 10:40	Water		5	X	X		
4	WSR0296RM/50 15 0421	15 /04/2021 13:20	Water		7	X	X		Extra for PFAS Lab QAQC
5	WSR0299RM/50 15 0421	15 /04/2021 15:20	Water		6	X	X		Extra for TRH lab QAQC
6	WSR0597RM/50 16 0421	16 /04/2021 8:40	Water		5	X	X		
	~~WSR1193RM/50 0421~~	~~/04/2021~~	~~Water~~		~~[illegible]~~	~~X~~	~~X~~		
	~~WSR1193aRM/50 0421~~	~~/04/2021~~	~~Water~~		~~[illegible]~~	~~X~~	~~X~~		
7	WSR1193RM/50 15 0421	15 /04/2021 14:20	Water		7	X	X		Extra for PFAS lab QAQC.
8	HXAN0002M/50 16 0421	16 /04/2021 09:30	Water		5	X	X		
	~~WSR1241RM/50 0421~~	~~/04/2021~~	~~Water~~			~~X~~	~~X~~		
	~~WSR1250RM/50 0424~~	~~/04/2021~~	~~Water~~			~~X~~	~~X~~		
9	HWSR0020M/58 15 0421	15 /04/2021 10:40	Water		5	X	X		
10	HWSR0021M/58 15 0421	15 /04/2021 16:10	Water		6	X	X		Extra for TRH lab QAQC
11	TB 319	16 /04/2021	Water		1			X	
-	TBW 325				2	X			
				TOTAL	1	0	0	0	

Environmental Division Perth
Work Order Reference
EP2104244
Telephone : -- 61-8-9406 1301

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

CHAIN OF CUSTODY

GOLDER

COC ID:

Tel: (08) 9213 7600
Fax: (08) 9213 7611

Page ____ of ____

Golder Job Number: 21464272

Job Location: WESTERN RIDGE - WRCS

Laboratory Issued To: Eurofins Analytical

Quote No.:

Sampled By: Philip Ward, Skye Pringle

Golder Job Contact: Christian Budimuljono

Golder Contact Email: Cbudimuljono@golder.com

SAMPLE NUMBER	DATE	TIME	SAMPLE MATRIX	NUMBER OF BOTTLES	PFAS (99% protection level)	TRH (C6-C40)	TRH (C6-C9) and BTEX
21WSR001GW/59 15 0421	15 /04/21	12:00	Water	4	X	X	

Special Instructions:

TURN AROUND TIME REQUIRED

☐ 1 Working Day ☐ 2 Working Days ☐ 3 Working Days ☐ 4 Working Days ☐ 5-7 Working Days (standard) ☐ Other _____

SAMPLE RECEIPT

Relinquished by: [signature] Date: 17/04/21
Organisation: Golder Time: 11:00

Recieved by: Carlyn Gibson Date: 19/4/21
Organisation: Eurofins Time: 10:40

DELIVERED BY:
COURIER/LAB ☐
GOLDER ☐

SAMPLE STATUS
☐ Chilled
☐ Frozen
☐ Ambient

789525

Date/Time: 19/4/21 10:40

	Yes / No
Chilled:	
Temp:	20.8
	21.0
Correction:	21.6
Final Temp:	+0.1
	21.2

Forms F012-b RL8 Aug08

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

Brisbane
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NATA # 1261 Site # 20794

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Phone : +64 9 526 45 51
IANZ # 1327

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43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	Golder Associates Pty Ltd (WA)
Contact name:	Christian Budimuljono
Project name:	WESTERN RIDGE-WRCS
Project ID:	21464272
Turnaround time:	5 Day
Date/Time received	Apr 19, 2021 10:40 AM
Eurofins reference	789525

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- **N/A** Custody Seals intact (if used).

Notes

Contact

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

Rhys Thomas on phone : (+61) 8 9251 9602 or by email: RhysThomas@eurofins.com

Results will be delivered electronically via email to Christian Budimuljono - cbudimuljono@golder.com.au.

Note: A copy of these results will also be delivered to the general Golder Associates Pty Ltd (WA) email address.

eurofins | Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

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Phone : 0800 856 450
IANZ # 1290

Company Name: Golder Associates Pty Ltd (WA)
Address: Level 3, 1 Havelock Street
West Perth
WA 6005

Project Name: WESTERN RIDGE-WRCS
Project ID: 21464272

Order No.:
Report #: 789525
Phone: 08 9213 7600
Fax: 03 8862 3501

Received: Apr 19, 2021 10:40 AM
Due: Apr 26, 2021
Priority: 5 Day
Contact Name: Christian Budimuljono

Eurofins Analytical Services Manager : Rhys Thomas

Sample Detail						Total Recoverable Hydrocarbons	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory - NATA Site # 25079							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	HWSR0019/59 150421	Apr 15, 2021	12:00PM	Water	M21-Ap39302	X	X
Test Counts						1	1

Golder Associates Pty Ltd (WA)
Level 3, 1 Havelock Street
West Perth
WA 6005

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **Christian Budimuljono**

Report **789525-W**
Project name WESTERN RIDGE-WRCS
Project ID 21464272
Received Date Apr 19, 2021

Client Sample ID			**HWSR0019/59150421**
Sample Matrix			**Water**
Eurofins Sample No.			**M21-Ap39302**
Date Sampled			**Apr 15, 2021**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.01	mg/L	< 0.01
TRH C6-C10	0.02	mg/L	0.33
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	0.33
TRH >C10-C16	0.05	mg/L	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1
Total Recoverable Hydrocarbons			
TRH C6-C9	0.02	mg/L	0.31
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C10-C14	0.05	mg/L	0.26
TRH C15-C28	0.1	mg/L	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	0.26
PFASs Summations			
Sum (PFHxS + PFOS)*	0.001	ug/L	< 0.001
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	< 0.001
Sum of PFASs (n=30)*	0.005	ug/L	< 0.005
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	< 0.001
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.005
Perfluoroalkyl sulfonamido substances- Trace			
Perfluorooctane sulfonamide (FOSA)[N11]	0.005	ug/L	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.005	ug/L	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.005	ug/L	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	0.005	ug/L	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	0.005	ug/L	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.005	ug/L	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.005	ug/L	< 0.005
13C8-FOSA (surr.)	1	%	77
D3-N-MeFOSA (surr.)	1	%	139

Client Sample ID			HWSR0019/59150421
Sample Matrix			Water
Eurofins Sample No.			M21-Ap39302
Date Sampled			Apr 15, 2021
Test/Reference	LOR	Unit	
Perfluoroalkyl sulfonamido substances- Trace			
D5-N-EtFOSA (surr.)	1	%	144
D7-N-MeFOSE (surr.)	1	%	83
D9-N-EtFOSE (surr.)	1	%	81
D5-N-EtFOSAA (surr.)	1	%	117
D3-N-MeFOSAA (surr.)	1	%	131
Perfluoroalkyl carboxylic acids (PFCAs) - Trace			
Perfluorobutanoic acid (PFBA)[N11]	0.005	ug/L	< 0.005
Perfluoropentanoic acid (PFPeA)[N11]	0.001	ug/L	< 0.001
Perfluorohexanoic acid (PFHxA)[N11]	0.001	ug/L	< 0.001
Perfluoroheptanoic acid (PFHpA)[N11]	0.001	ug/L	< 0.001
Perfluorooctanoic acid (PFOA)[N11]	0.001	ug/L	< 0.001
Perfluorononanoic acid (PFNA)[N11]	0.001	ug/L	< 0.001
Perfluorodecanoic acid (PFDA)[N11]	0.001	ug/L	< 0.001
Perfluorotridecanoic acid (PFTrDA)[N15]	0.001	ug/L	< 0.001
Perfluoroundecanoic acid (PFUnDA)[N11]	0.001	ug/L	< 0.001
Perfluorododecanoic acid (PFDoDA)[N11]	0.001	ug/L	< 0.001
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.001	ug/L	< 0.001
13C4-PFBA (surr.)	1	%	64
13C5-PFPeA (surr.)	1	%	66
13C5-PFHxA (surr.)	1	%	71
13C4-PFHpA (surr.)	1	%	78
13C8-PFOA (surr.)	1	%	58
13C5-PFNA (surr.)	1	%	84
13C6-PFDA (surr.)	1	%	75
13C2-PFUnDA (surr.)	1	%	57
13C2-PFDoDA (surr.)	1	%	100
13C2-PFTeDA (surr.)	1	%	65
Perfluoroalkyl sulfonic acids (PFSAs)- Trace			
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.001
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.001
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.001	ug/L	< 0.001
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001
13C3-PFBS (surr.)	1	%	74
18O2-PFHxS (surr.)	1	%	57
13C8-PFOS (surr.)	1	%	54
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	0.005	ug/L	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001
13C2-4:2 FTS (surr.)	1	%	123
13C2-6:2 FTSA (surr.)	1	%	104

Client Sample ID			HWSR0019/59150421
Sample Matrix			**Water**
Eurofins Sample No.			**M21-Ap39302**
Date Sampled			**Apr 15, 2021**
Test/Reference	LOR	Unit	
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace			
13C2-8:2 FTSA (surr.)	1	%	112
13C2-10:2 FTSA (surr.)	1	%	147

Sample History

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

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Apr 23, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Apr 23, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons	Melbourne	Apr 23, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Apr 23, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
PFASs Summations	Melbourne	Apr 27, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances- Trace	Melbourne	Apr 27, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Melbourne	Apr 27, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Melbourne	Apr 27, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Melbourne	Apr 27, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			

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Company Name: Golder Associates Pty Ltd (WA)
Address: Level 3, 1 Havelock Street
West Perth
WA 6005

Project Name: WESTERN RIDGE-WRCS
Project ID: 21464272

Order No.:
Report #: 789525
Phone: 08 9213 7600
Fax: 03 8862 3501

Received: Apr 19, 2021 10:40 AM
Due: Apr 26, 2021
Priority: 5 Day
Contact Name: Christian Budimuljono

Eurofins Analytical Services Manager : Rhys Thomas

Sample Detail						Total Recoverable Hydrocarbons	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
Mayfield Laboratory - NATA Site # 25079							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	HWSR0019/59 150421	Apr 15, 2021	12:00PM	Water	M21-Ap39302	X	X
Test Counts						1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ug/L: micrograms per litre
ppm: Parts per million
ppb: Parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	108			70-130	Pass	
TRH C6-C10	%	121			70-130	Pass	
TRH >C10-C16	%	70			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	123			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	%	71			70-130	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	111			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	148			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	147			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	123			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	126			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	123			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	136			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	106			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	142			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	118			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	89			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	111			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	106			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	121			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	133			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	127			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	115			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	108			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	%	112			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	128			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	121			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	110			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	109			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	109			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	139			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	101			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	117			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	121			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	149			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	73			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M21-Ap30738	NCP	%	117			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M21-Ap30738	NCP	%	120			70-130	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances- Trace				Result 1					
Perfluorooctane sulfonamide (FOSA)	M21-Ap42492	NCP	%	107			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M21-Ap42492	NCP	%	122			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M21-Ap42492	NCP	%	116			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	M21-Ap42492	NCP	%	110			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	M21-Ap42492	NCP	%	142			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	M21-Ap42492	NCP	%	97			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	M21-Ap42492	NCP	%	92			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1					
Perfluorobutanoic acid (PFBA)	M21-Ap42492	NCP	%	125			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	M21-Ap42492	NCP	%	138			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	M21-Ap42492	NCP	%	124			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	M21-Ap42492	NCP	%	90			50-150	Pass	
Perfluorooctanoic acid (PFOA)	M21-Ap42492	NCP	%	103			50-150	Pass	
Perfluorononanoic acid (PFNA)	M21-Ap42492	NCP	%	114			50-150	Pass	
Perfluorodecanoic acid (PFDA)	M21-Ap42492	NCP	%	114			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	M21-Ap42492	NCP	%	134			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	M21-Ap42492	NCP	%	126			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	M21-Ap42492	NCP	%	129			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M21-Ap42492	NCP	%	77			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)	M21-Ap42492	NCP	%	118			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	M21-Ap42492	NCP	%	88			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	M21-Ap42492	NCP	%	106			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	M21-Ap42492	NCP	%	107			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M21-Ap42492	NCP	%	107			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	M21-Ap42492	NCP	%	105			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	M21-Ap42492	NCP	%	122			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	M21-Ap42492	NCP	%	50			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1					

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M21-Ap42492	NCP	%	110			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	M21-Ap42492	NCP	%	117			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M21-Ap42492	NCP	%	136			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M21-Ap42492	NCP	%	115			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M21-Ap42824	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	M21-Ap42824	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	S21-Ap33235	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	S21-Ap33235	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	S21-Ap33235	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	M21-Ap42824	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	S21-Ap33235	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S21-Ap33235	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S21-Ap33235	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD			
Perfluorododecanoic acid (PFDoDA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	M21-Ap42491	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M21-Ap42491	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

Authorised by:

Rhys Thomas	Analytical Services Manager
Joseph Edouard	Senior Analyst-Organic (VIC)
Joseph Edouard	Senior Analyst-PFAS (VIC)
Vivian Wang	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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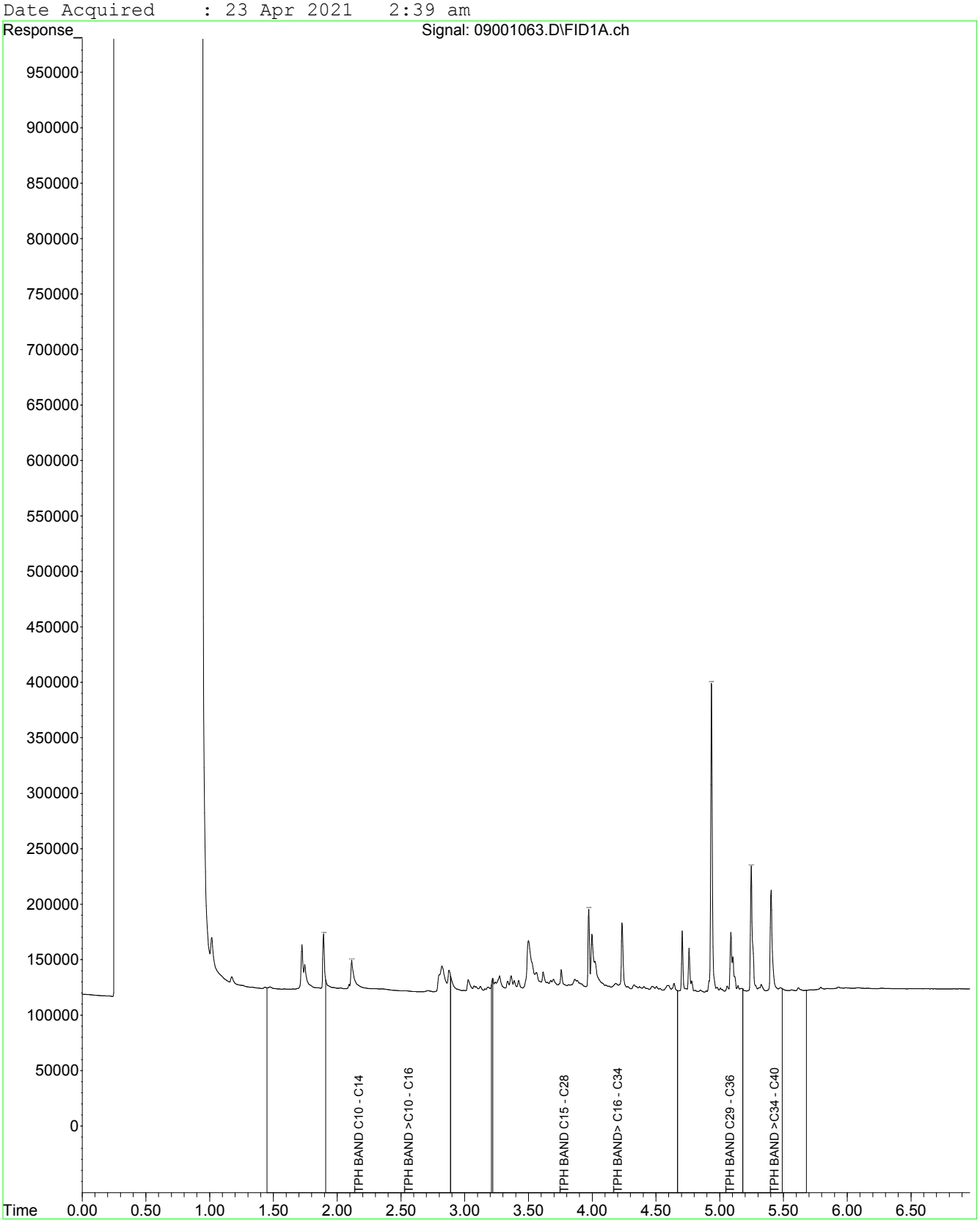
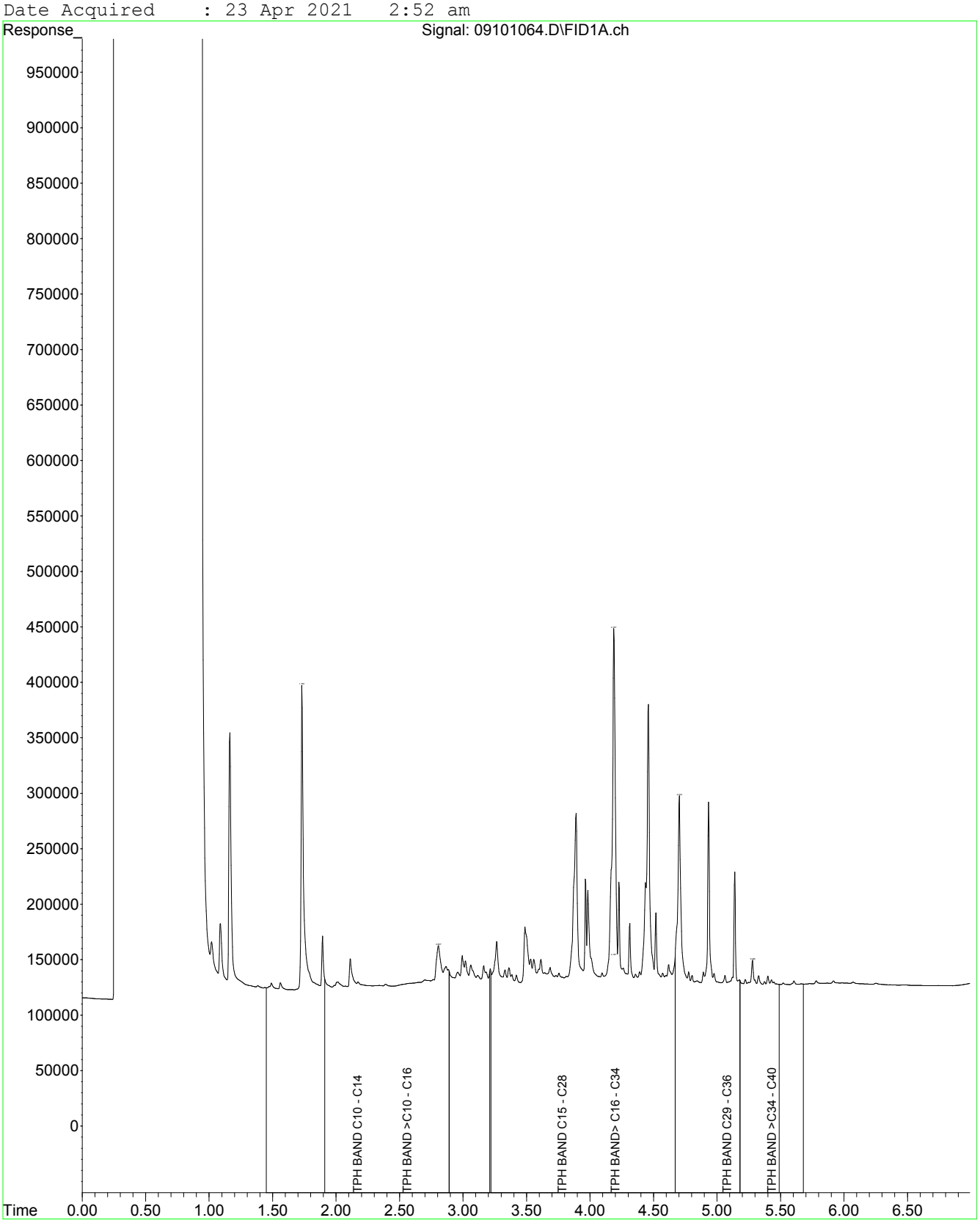
APPENDIX E

Chromatographs

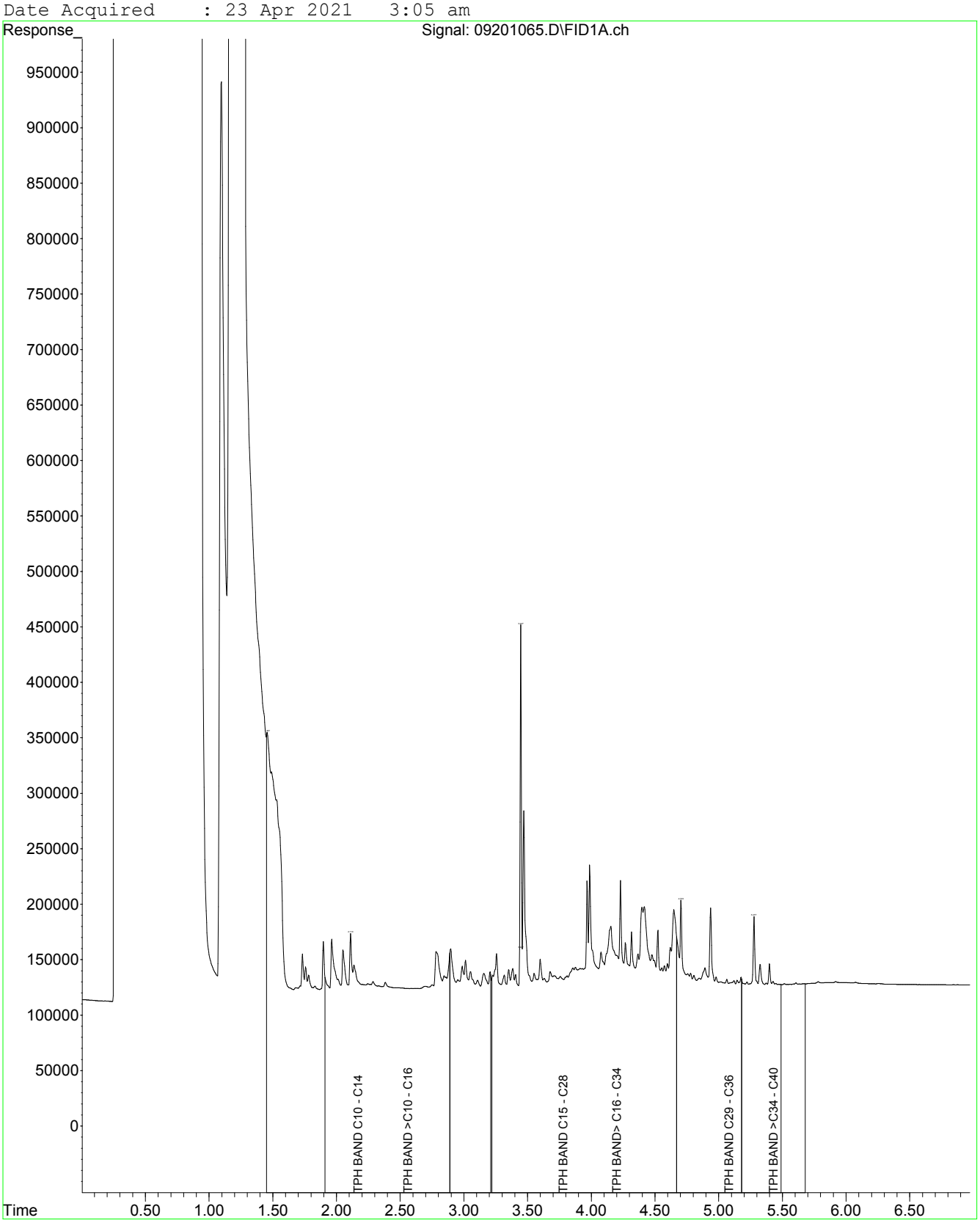
Fraction Scheme :
Data File : 09001063.D
Laboratory Number: EP2104244-001
Sample ID : HWSR0014M/50160421
Date Acquired : 23 Apr 2021 2:39 am



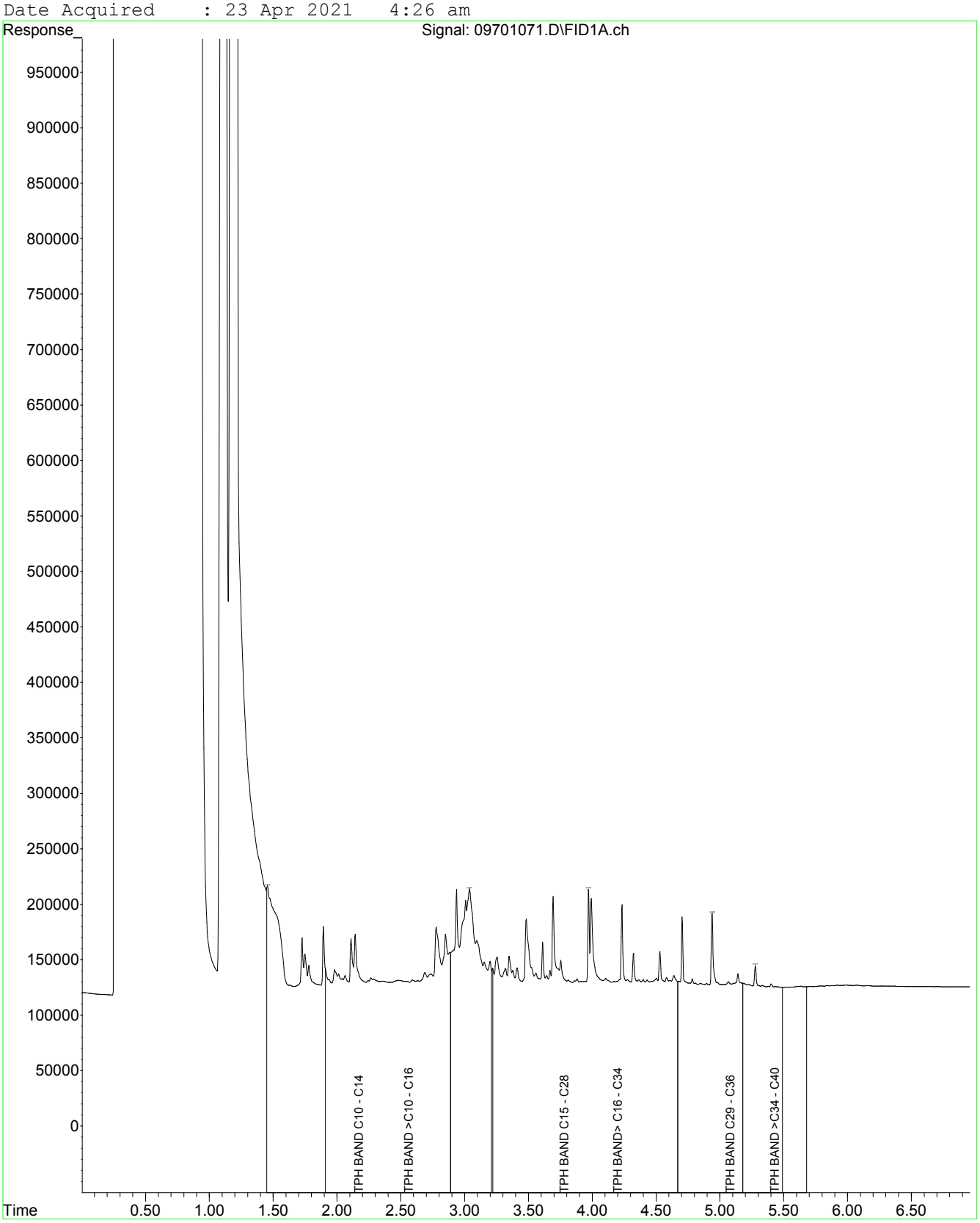
Fraction Scheme :
Data File : 09101064.D
Laboratory Number: EP2104244-002
Sample ID : HWSR0019M/50150421
Date Acquired : 23 Apr 2021 2:52 am



Fraction Scheme :
Data File : 09201065.D
Laboratory Number: EP2104244-003
Sample ID : HWSR0020M/50150421
Date Acquired : 23 Apr 2021 3:05 am



Fraction Scheme :
Data File : 09701071.D
Laboratory Number: EP2104244-008
Sample ID : HXAN0002M/50160421
Date Acquired : 23 Apr 2021 4:26 am



APPENDIX F

Important Information

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At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

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