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Groundwater Monitoring Event

12-14 Zouch Road, Denham Court, NSW, 2565

Prepared for Watchtower Bible and Tract Society of Australia

26 July 2019

Version 3

reditusconsulting.com

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Executive Summary

Reditus Consulting Pty Ltd (Reditus) was engaged by Watchtower Bible & Tract Society of Australia to complete to complete a Groundwater Monitoring Event (GME) within the vehicle maintenance workshop and fuelling station located in the northern portion of 12-14 Zouch Road, Denham Court, NSW (the site).

The site is located within a rural residential precinct within Denham Court, NSW. The site is identified as Lot 2 in DP111131 and currently comprises the Jehovah's Witness Australian head office on a large rural block.

It is understood that there has been a soil and groundwater investigation to date conducted by Airsafe OHC Pty Ltd. However, further recommendations for a subsequent groundwater monitoring event and a sub-slab soil vapour assessment within a printing workshop to the south of the vehicle workshop and fuel station is required to meet anticipated Council requirements for a Development Application (DA).

The primary objectives of the GME were to:

- Establish representative concentrations of contaminants in groundwater within existing monitoring wells installed around the existing fuelling station and down gradient of the former printery area and chemical wastewater tank;
- Determine if measured concentrations of contaminant in groundwater pose an unacceptable risk to human health or the environment; and
- Establish if mitigation measures are required to render the area suitable for the proposed development.

Based on observations made during fieldwork and, results of laboratory analysis, Reditus concludes the following:

- Light Non-Aqueous Phase Liquid (LNAPL) was not reported in any of the three groundwater monitoring wells sampled during the current investigation. A sheen or hydrocarbon odour were not noted in groundwater extracted from each of the three wells; and
- Concentrations of the contaminants of potential concern in groundwater at each sample location was below adopted ANZG (2018) criteria with the exception of manganese extracted from monitoring well MW3. As manganese is not a contaminant of concern associated with petroleum storage and use, it is considered likely representative of local background conditions.

Based on the above key findings, Reditus consider that potential contaminants associated with the use of the area as a vehicle maintenance workshop, fuelling station and area down gradient of the former printery and chemical wastewater tank do not pose an unacceptable risk to human health or the environment.

Based on the above, and the conclusions made in the Airsafe (2019) PSI, Reditus considers that there is **no unacceptable risk to human health or the environment from the operation of the vehicle maintenance workshop, fuelling station, former printery chemical wastewater tank or upgradient former printery** (i.e. commercial/industrial land use).

1. Introduction

Reditus Consulting Pty Ltd (Reditus) was engaged by Watchtower Bible and Tract Society of Australia to complete a Groundwater Monitoring Event (GME) within the vehicle maintenance workshop and fuelling station located in the northern portion of 12-14 Zouch Road, Denham Court, NSW (the site). The site location is provided in **Figure 1, Appendix A.**

1.1. Background

The site is located within a rural residential precinct within Denham Court, NSW. The site is identified as Lot 2 in DP111131 and currently comprises the Jehovah's Witness Australian head office on a large rural block.

It is understood that there has been a soil and groundwater investigation to date conducted by Airsafe OHC Pty Ltd. However, further recommendations for a subsequent groundwater monitoring event and a sub-slab soil vapour assessment within a printing workshop to the south of the vehicle workshop and fuel station is required to meet anticipated Council requirements for a Development Application (DA).

Three existing groundwater monitoring wells are located within the fuel station / depot. These were installed by EIS (date unknown) and used to monitor the condition of groundwater with respect to petroleum hydrocarbon leaks for the underground storage tanks. These monitoring wells are also down gradient from the former printery. The concentration of the contaminants of concern within these monitoring wells will determine if there have been any chemical or volatile losses originating from the former printery and/or former printery chemical wastewater tank and associated pipework.

This report documents the results of the groundwater monitoring event conducted within the vehicle maintenance workshop and fuelling station (12-14 Zouch Road, Denham Court NSW).

1.2. Objectives

The primary objectives of the GME were to:

- Establish representative concentrations of contaminants in groundwater within existing monitoring wells installed around the existing fuelling station and down gradient of the former printery area and chemical wastewater tank;
- Determine if measured concentrations of contaminant in groundwater pose an unacceptable risk to human health or the environment; and
- Establish if mitigation measures are required to render the area suitable for the proposed development.

1.3. Scope of Works

The following scope of works was completed by Reditus:

- Review of previous environmental assessment reports and proposed development;
- Purging and sampling of the three (3) existing groundwater monitoring wells using a low flow micro-purge pump. Purging occurred until the parameters (pH, EC, DO, Eh and temperature) are stabilised to within 10% for 3 consecutive readings;
- Sampling of groundwater and submitting to a NATA accredited laboratory and analysed for the following contaminants of concern:
  - Total Recoverable Hydrocarbons (TRH)
  - benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN);
  - Volatile Organic Compounds (VOCs);
  - Heavy Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn);
  - Polycyclic Aromatic Hydrocarbons (PAHs) including pyrene;
- Collection of an intra-laboratory and inter-laboratory duplicate sample for Quality Analysis/Quality Control purposes; and
- Comparison of results against the NEPM (2013) and ANZG (2018) guidelines.
- Preparation of a GME report in general accordance with the UPSS: Technical Note: Site Validation Reporting DECCW, NEPM (2013) and NSW OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites.

1.4. Limitations

The findings of this report are based on the scope of work outlined in Section 1.3. Reditus performed its services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties, expressed or implied are made.

Subject to the scope of work, Reditus' assessment was limited strictly to identifying the environmental conditions associated with the subject property and does not include evaluation of any other issues. The absence of any identified hazardous or toxic materials should not be interpreted as a guarantee that such materials do not exist on the subject property.

Additionally, unless otherwise stated Reditus did not conduct soil, air, wastewater or other matrix analyses including asbestos or perform contaminated sampling of any kind. Nor did Reditus investigate any waste material from the property that may have been disposed of at the site or undertake an assessment or review of related site waste management practices.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Reditus personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the property are the professional opinions of the Reditus personnel involved with the project, subject to the qualifications made above.

While normal assessments of data reliability have been made, Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements or sources outside of Reditus, or developments resulting from situations outside the scope of this project.

Reditus is not engaged in environmental assessment and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. The client acknowledges that this report is for the exclusive use of the client.

2. Site Identification

The location of the site and site layout is shown in **Figure 1 and Figure 2, Appendix A.** A summary of the site identification details is provided in Table 2-1 below.

Table 2-1: Site Summary Details

Site Characteristics	Details
Street Address	12-14 Zouch Road, Denham Court NSW 2565
Lot & Deposited Plan	Lot 2 of DP 1111318
Local Government Area	Liverpool City Council
Zoning	RU2 – Rural Landscape' as specified in the Liverpool Local Environmental Plan 2008
Site Coordinates to the approximate centre of the site (MGA56)	Easting: 301205 Northing: 6238431
Site Area	Approximately 40.6 ha
Investigation Area (Vehicle Workshop and Refuelling Station)	Approximately 2,250m^2

2.1. Site Description

The vehicle maintenance workshop and fuelling station are located in the northern portion of the site.

Review of the preliminary site investigation (PSI) prepared by Airsafe (2019) indicates that the vehicle workshop and fuel station have operated for over 10 years. Observations made by Airsafe during the site inspection conducted as part of the PSI noted several hoists within the workshop. Site surfaces and hoists were noted t be clean. The refuelling area consisted of two petrol dispensers, one diesel dispenser and one LPG dispenser. Several underground storage tanks (USTs) are located to the north of the refilling area.

3. Site Setting and Surrounding Environment

3.1. Topography and Hydrogeology

Review of Airsafe (2019) indicates that the site is located on a medium slope facing northwest in the area occupied by the vehicle workshop and refuelling area. The southeast corner of the property is located on at an approximate elevation of 98 metre Australian Height Datum (m AHD) with a low point and dam at the centre of the property on the 66 m AHD.

3.2. Regional Geology and Soils

Review of Airsafe (2019) indicates the following:

Soil Landscapes:

Soils Landscapes Data Source: NSW Office of Environment and Heritage. Creative Commons 3.0 © Commonwealth of Australia: http://creativecommons.org/licenses/by/3.0/au/deed.en.

Luddenham Soil Landscape Group (ERlu)

- The majority of the property is located within the Luddenham Soil Landscape consists of undulating low hills on Wianamatta Group shales. Soils in this type of geology are typically shallow to moderately deep topsoils existing as a friable dark brown loam. These overlie medium reddish brown silty to heavy clay (Hazelton & Bannerman 1990: 64). Soils are generally deep and have a high clay content.
- The dominant shallow soils of this landscape consist of a dark brown sandy loam, which occurs as topsoil, and a brown apedal sandy clay loam that occurs below. This is generally underlain by a brown sandy clay with up to 20% ironstone nodules and a high chroma clay with up to 90% stones (Bannerman & Hazelton 1990: 82). Very little natural vegetation survives on this soil landscape, with most areas having been cleared and used for small farms. Topsoils have a low erodibility due to their flat grade and low organic content (Bannerman & Hazelton 1990: 82, 84).

Blacktown Soil Landscape Group (REbt)

- The south west corner of the property lies with the Blacktown Soil Landscape.
- Landscape: gently undulating rises on Wianamatta Group shales and Hawkesbury shale. Local relief to 30m, slopes are within <5%. Broad rounded crests and ridges with gently inclined slopes. Cleared eucalypt woodland and tall open-forest.
- Soil: shallow to moderately deep (<100cm) red & brown podsolic soils on crests, upper slopes and well-drained areas, deep yellow podsolic soils on soloths (possibly saline) on lower slopes in areas of poor drainage.

Sydney – Soil Landscape Series – Sheet 9130 (4th Edition) – DECCW NSW (Soil Landscapes of the Sydney 1:100 000 sheet, Chapman, G.A and Murphy, C.L (1989). Soil Conservation Service of NSW, Sydney).

Geology:

Geological Data Source: NSW Department of Industry, Resources & Energy
The site is located within the Bringelly Shale (Rwb) of the Wianamatta Group, geological : Shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff. The Bringelly Shale of Triassic age, and sit conformably above the Hawkesbury Sandstone.

3.3. Regional Hydrogeology

The PSI (Airsafe, 2019) states that based on the regional topography, groundwater is anticipated to flow in a north westerly direction towards Cabramatta Creek (which intersects the middle of the site).

3.4. Acid Sulfate Soils

The PSI (Airsafe, 2019) states that the site is not within an acid sulfate soils (ASS) area and that potential ASS shall not be an issue affecting the site. Refer to the PSI for further details.

4. Data Quality Objectives

The Data Quality Objective (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO defines the experimental process required to test a hypothesis. The DQO process has been developed to ensure that efforts relating to data collection are cost effective, by eliminating unnecessary, duplicative or overly precise data whilst at the same time, ensuring the data collected is of sufficient quality and quantity to support defensible decision making.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before data collection begins and develop a data collection design based on these criteria. By using the DQO process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost-effective manner.

The DQO process consists of seven steps, which are designed to clarify the study objectives, define the appropriate type of data and specify tolerable levels of potential decision errors. The seven-step DQO process adopted for this GME can be summarised as:

- Step 1: State the Problem – concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem;
- Step 2: Identify the Decision – identify what questions the study will attempt to resolve, and what actions may result;
- Step 3: Identify the Inputs to the Decision – identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement;
- Step 4: Define the Study Boundaries – specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected;
- Step 5: Develop a Decision Rule – define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions;
- Step 6: Specify Tolerable Limits on Decision Errors – define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision; and
- Step 7: Optimise the Design –evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

The DQOs are provided in Table 4-1 below and were derived in accordance with Australian Standard 4482.1-2005 'Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds' (AS 4482.1-1997).

Table 4-1: Data Quality Objectives

Step	Discussion
1. State the Problem	Groundwater conditions are required to be determined prior to approval of a Development Application (DA). In addition: ▪ To assess the potential environmental and human health risks associated with the groundwater from current site use as a refuelling station and vehicle workshop. Additionally, to make recommendations for further investigation/remediation/management if required
2: Identify the decision/goal of the study	If elevated concentrations of contaminants of potential concern (COPCs) are identified at the site: ▪ What is the extent of the impact? ▪ Does any COPC at the site occur at concentrations that pose or may pose an unacceptable liability or risk to the environment and/or human health to persons who will utilise the future development? ▪ If so, what is the order of priority to minimise the risk and what additional measures are required to mitigate, remediate, or manage the risk?
Step 3: Identify the information inputs	Key data required to resolve the project problem included concentrations of COPCs in the groundwater at the site, and the structure and depth of the underlying site geology and aquifers. The selected CoPCs were based on previous investigations and current site condition observed during field works. The guidelines adopted by Reditus for groundwater are as follows: ▪ ANZECC (2000) for Fresh water quality-95% Protection for moderately disturbed ecosystems; ▪ Australian Drinking Water Guidelines (2015) ▪ NEPC (1999) amended 2013, Health Screening Level (HSL)-Commercial/Industrial for groundwater vapour intrusion; Further explanation for the selection of these criteria is provided below in Section 5 below.
Step 4: Define the boundaries of the study	Groundwater assessment was targeted existing monitoring wells with the footprint of the site. **Figure 2, Appendix A**, shows the sampling locations. The vertical extent of the study boundary was limited to a maximum depth of each monitoring well.
Step 5: Develop the analytical approach	If the concentrations of COPCs in groundwater are reported to be below the relevant adopted guidelines, then further assessment of the site will be undertaken to ensure that site is site fully acceptable. However, if the concentration of one or more COPCs are greater than the Guidelines, then further investigation will be required and/or

	recommendations made for the remediation/management of contamination.
Step 6: Specify performance or acceptance criteria	The acceptable limits for samples are as follows: ▪ % RPD for laboratory duplicates for TPH and BTEX analysis is less than 60%; and ▪ Recovery of matrix spikes and surrogate spikes is as per the laboratory's Quality Assurance targets accepted under their National Association of Testing Authorities (NATA) accreditation. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'. Replicate data for field duplicates of organics is expected to be as follows: ▪ RPD criteria of 50% or less, for concentrations > or = 10 times practical quantitation limits (PQL); ▪ RPD criteria of 75% or less, for concentrations between 5 and 10 times the EQL; and ▪ RPD criteria of 100% or less, for concentrations < 5 times PQL. Replicate data for field duplicates for inorganics, including metals is expected to be as follows: ▪ RPD criteria of 30% or less, for concentrations > or = 10 times PQL; ▪ RPD criteria of 75% or less, for concentrations between 5 and 10 times the EQL; and ▪ RPD criteria of 100% or less, for concentrations < 5 times PQL. Where acceptable limits for field duplicates were not met, a discussion on low biased error will be provided. For this investigation, a decision error of 5% will be considered acceptable This error rate is in accordance with Appendix B of Schedule B(2) of the ASC NEPM. In order to achieve this level of confidence, the investigation has been designed as described below.
Step 7: Develop the plan for obtaining data	Groundwater sample locations systematically target the horizontal extent of the contamination plume, assessing potential for both on and off-site migration. All media sampled will be conducted in accordance with Reditus standard operating procedures (SOPs) and relevant industry guidelines.

5. Groundwater Assessment Criteria

Cabramatta Creek is located within the site (approximately 250m to the west of the investigation area) and traverses the northern site boundary to Endmondson Regional Park.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) provide detailed approaches and advice on identifying appropriate guideline values for the protection of environmental receptors. These guideline values help to ensure that agreed community values and their management goals are protected.

The ANZG (2018) have been recently endorsed by the NSW EPA, which supersede the previous ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Applying the ANZECC (2000) guidelines to the range of community values relied largely on a single line of evidence (chemical assessment) to determine whether or not a guideline value was exceeded. The ANZG (2018) Water Quality Guidelines improve confidence in our assessments by:

- introducing a systematic approach to assessing a number of lines of evidence along the pressure–stressor–ecosystem receptors pathway
- promoting decisions on the basis of the integrated weight of evidence.

For the protection of aquatic ecosystems, locally derived guideline values are most appropriate. In the absence of locally derived guideline values or other jurisdictionally-legislated requirements (as in this case), the ANZG (2018) provide default guideline values (DGVs) for assessing the impacts of physio-chemical parameters and potential toxicants on aquatic ecosystems, as well as advice on tailoring DGVs to suit the local region. Where DGVs are not available within the ANZG (2018), the ANZECC (2000) guidelines trigger values (TVs) are adopted

Groundwater analytical results are tabulated in **Table 1, Appendix B** and guideline criteria are presented in Table 5-1 below.

Table 5-1: Groundwater Assessment Criteria (µg/l)

Analyte Group	Analyte	ANZG (2018) Fresh Water Quality Guidelines (µg/L)[a]	HSL D[e]
BTEX	Benzene	950	5,000
	Ethylbenzene	80	
	Toluene	180	
	Xylene (m)	75	NL
	Xylene (p)	200	
	Xylene (o)	350	
Heavy Metals	Arsenic	24	-
	Cadmium	0.2	-
	Chromium	27	-
	Copper	1.4	-
	Nickel	11	-

	Lead	3.4	-
	Zinc	8	-
	Mercury	0.6	-
	Boron	-	-
	Barium	-	-
	Beryllium	-	-
	Cobalt	-	-
	Manganese	1,900	-
	Molybdenum	-	-
	Antimony	-	-
	Selenium	5	-
	Tin	-	-
	Mercury	0.6	-
PAHs	Phenanthrene	2	-
	Anthracene	0.4	-
	Flouranthane	1.4	-
	Benzo(a)Pyrene	0.2	-
	Naphthalene	16	-
VOCs	1,1-DCA	90	-
	1,2-DCA	1,900	-
	1,1,1-TCA	270	-
	1,1,2-TCA	6,500	-
	1,1,2,2-TCA	400	-
	PCA	80	-
	DCM	4,000	-
	Chloroform	370	-
	Carbon Tetrachloride	240	-
	Vinyl Chloride	100	-
	DCE	700	-
	TCE	330	-
	PCE	70	-
	CB	55	-
	1,2-DCB	160	-
	1,3-DCB	260	-
	1,4-DCB	60	-
	1,2,3-TCB	3	-
	1,2,4-TCB	20	-
	1,3,4-TCB	8	-
	1,2,3,4-PCB	2	-

	1,2,3,5-PCB	3	-
	1,2,4,5-PCB	5	-
	PCB	1.5	-
Total Petroleum Hydrocarbons	F1 C6-C10[c]	2 (mg/L) [a]	6,000
	F2 >C10-C16[d]		NL
	TRH >C10-C40		-

a) The Australian and New Zealand Guidelines for Fresh and Marine Water Quality 95% protection for freshwater (ANZG 2018)

b) NL – Not Limiting

c) F1 = TRH C6-C10 fraction minus BTEX

d) F2 = TRH C10-C16 fraction minus naphthalene

e) Groundwater health screening level for Commercial/ Industrial: Sand - 2m - <4m and 8m+ (NEPM 2013)

- No criteria specified

6. Methodology

The methods used for the collection of data for this GME are presented in the following sections.

6.1. Groundwater Sampling Methodology

Groundwater sampling was completed by Principal Environmental Scientist, Dean Stafford on 17 July 2019.

All wells were gauged for depth to product (if present), depth to water and depth to base prior to sampling using an interface probe capable of detecting separate phase product. The interface probe was decontaminated prior to use at each well by rinsing with a phosphate free detergent (Decon-90) and potable water.

Prior to sampling the wells were purged using new clean dedicated HDPE tubing and a low-flow peristaltic pump to ensure minimal loss of volatile organic compounds. The wells were purged until water quality parameters stabilised with respect to the previous reading. Stabilisation criteria were as follows: DO +/- 10%; EC +/- 3%; pH +/- 0.05; Redox +/- 10 mV. The physico-chemical parameters of the groundwater were recorded using a calibrated YSI Pro Plus water quality meter.

Groundwater samples for dissolved metals analysis were filtered in the field using a 0.45micron filter and placed into a preserved laboratory supplied sample bottle, this was then further filtered in the laboratory to 0.1micron prior to analysis.

Groundwater samples were collected in laboratory supplied sample bottles which were labelled with the project identification code, sample name/location, sample date and who collected the sample.

All groundwater samples were stored and transported in an ice cooled Esky to the laboratory with associated chain-of-custody (CoC).

One duplicate (DUP1) and one triplicate (TRIP1) samples were collected during the sampling event and submitted to secondary NATA Accredited Laboratory Eurofins.

Groundwater sampling field sheets can be found in **Appendix C**.

6.2. Laboratory Analysis and Methods

Laboratory analytical methods and analyte PQLs are shown in the analytical certificates provided in **Appendix D**. Furthermore, the analytical suites performed during this investigation are provided in Section 1.

7. Quality Assurance and Quality Control (QA/QC)

7.1. Field Quality Assurance

7.1.1 Details of Sampling Team

Groundwater sampling was conducted by Principal Environmental Scientist, Dean Stafford on 17 July 2019, who, suitably qualified and experienced in the collection of environmental samples.

7.1.2 Decontamination Procedures Carried out Between Sampling Events

The groundwater interface probe was the only field equipment reused between sampling locations. It was appropriately decontaminated with a mix of 'Decon 90' and water, then rinsed using potable water after every sampling event to prevent cross contamination. Reditus considers this to be a suitable method of decontamination.

7.1.3 Chain of Custody Details

Groundwater samples were transported to the laboratory under a chain of custody (CoC). Information on the CoC included the sampler, sample identifier, sample matrix, collection date, analyses to be performed, sample preservation method, sample release date and sample received date. COCs are provided in **Appendix D** along with the laboratory reports.

7.1.4 Groundwater Splitting Techniques

Groundwater duplicates (DUP1) and triplicates (TRIP1) were collected by taking representative samples of the groundwater at the same depth. Due to the potential loss of volatiles, samples were not mixed or homogenised during collection or splitting.

7.1.5 Statement of Duplicate Frequency

Field duplicates and triplicates were collected at a rate of 1:20 for groundwater samples. These rates are within the Australian Standard 4482.1-2005 'Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds and Reditus' QA frequency ranges.

The following soil QA/QC samples were collected:

- DUP1 and TRIP1 were respectively groundwater intra-laboratory and inter-laboratory duplicates of sample MW2.

7.2. Laboratory QA/QC

7.2.1 Sample Technical Holding Times

All holding times were reported as being within specified ranges.

7.2.2 Laboratory Accreditation and Analytical Methods Used

The primary laboratory used for groundwater samples was Envirolab Services Pty Ltd (Envirolab), while the secondary laboratory was Eurofins.

Envirolab is accredited by NATA to ISO 17025, accreditation number 2901, while Eurofins has the accreditation number 1261.

Laboratory QA/QC is provided on the laboratory reports in **Appendix D**.

7.2.3 Laboratory Control Samples

Laboratory control samples were in acceptable ranges.

Detailed laboratory QA/QC are found in the laboratory report in **Appendix D**.

7.3. Evaluation of the QA/QC Information Compared to the DQOs

- Documentation completeness:

Chain-of-custody forms, calibration were complete and appropriate.

- Data completeness:

All samples were received by the laboratories and analytical results reported including laboratory QA/QC.

- Data comparability:

Reditus standard operating procedures, Australian Standards and industry best practice were followed during sampling;

Consistent field conditions and similarly trained staff were used during sampling;

The limits of reporting are appropriate and generally consistent from each laboratory.

- Data representativeness:

Reditus is confident that cross contamination has not occurred, and primary samples are representative of actual groundwater conditions.

The frequency of laboratory blanks was acceptable, and the results were within specified ranges.

- Precision:

Intra-laboratory and inter-laboratory duplicates were collected at the following rates:

- Groundwater Intra-laboratory and inter-laboratory duplicates frequency were collected at least 1:20.

QA/QC sample collection rate follows the guidance provided in the Australian Standard Field procedures (AS1482.1 1997);

7.3.1 Relative Percent Difference

Refer to **Table 2, Appendix B** for Relative Percent Differences (RPDs) calculations. Reditus notes that RPDs were only calculated for groups of compounds with detections above the laboratory detection limits.

RPDs for groundwater were reported within acceptable ranges indicating the analytical data is reliable.

8. Results

8.1. Field Observations

The following section presents the overview of the field observations encountered during the onsite field works.

8.1.1 Groundwater Gauging Data

Groundwater gauging data are presented in Table 8-1 below. Light Non-Aqueous Phase Liquid (LNAPL) were not identified in any of the five groundwater wells during the current GME.

Table 8-1: Groundwater Gauging Data

Well ID	Depth to Standing Water (m btoc)	Depth to Base of Well (m btoc)	Depth to LNAPL (m btoc)
MW1	2.37	8.70	-
MW2	5.10	6.53	-
MW3	4.82	7.98	-

8.1.2 Groundwater Field Observations

Groundwater gauging field observations are presented in Table 8-2 below.

Table 8-2: Groundwater Field Observations

Well ID	pH	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (ppm)	Redox Potential (mV)	Comments
MW1	6.68	21.0	2,449	0.92	62.7	Clear, colourless, very slightly cloudy.
MW2	5.51	22.0	16,520	0.61	152	Light brown, cloudy, medium to high suspended solids.
MW3	5.27	21.1	10,570	1.46	112	Cloudy, light brown.

Based on the field quality parameters collected during groundwater sampling, the following conclusions have been made:

- The pH indicates that the groundwater is generally slightly to moderately acidic;

- Conductivity ranged from 2,449 µS/cm to 16,520 µS/cm. This indicates that the localised aquifer is saline nature, likely attributed to the deep yellow podzolic soils;
- Dissolved oxygen 0.61 ppm to 1.46 ppm, indicating a relatively low oxygenated groundwater aquifer; and
- Oxygen Reduction Potential (ORP) ranges between 62.7 mV to 112 mV. The relatively even positive and indicate an oxidising (aerobic condition) environment.

8.2. Analytical Results

All groundwater analytical results can be found in **Table 1, Appendix B**. The following section outlines the key findings of the comparison between laboratory results and the site assessment criteria. Discussion of analytical results is provided in Section 8.3 below.

8.2.1 Heavy Metals

Concentrations of heavy metals in groundwater samples submitted for analysis were reported below the adopted guidelines, with the exception of the following:

- manganese reported in groundwater extracted from MW3 (2,900 µg/L) which exceeded the ANZG (2018) criteria of 1,900 µg/L.

8.2.2 PAHs

Concentrations of PAHs in groundwater samples submitted for analysis were reported below the adopted guidelines in each of the three groundwater samples submitted for analysis.

8.2.3 TRH & BTEXN

Concentrations of TRH & BTEXN in all groundwater samples submitted for analysis were reported below the below laboratory limit of reporting (LOR) and the adopted guidelines.

8.2.4 VOCs

Concentrations of VOCs in all groundwater samples submitted for analysis were reported below the laboratory limit of reporting (LOR) and the adopted guidelines.

9. Discussion of Groundwater Results

9.1.1 Groundwater Investigation Levels

The results of the laboratory analysis indicate that the concentrations of the contaminants of potential concern in groundwater at each sample location was below adopted ANZG (2018) criteria with the exception of manganese extracted from monitoring well MW3.

As manganese is not a contaminant of concern associated with petroleum storage and use, it is likely representative of local background conditions and not considered likely to impact the environment.

9.1.2 Health Screening Levels (HSLs) for Vapour Intrusion

The results of the laboratory analysis indicate that the concentrations of the contaminants of potential concern in groundwater collected from each of the three groundwater monitoring wells was below adopted NEPC (2013) HSL-D assessment criteria for vapour intrusion indicating human heath will not be affected.

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10. Conclusions

The following conclusions and recommendations are made based on the key findings of the GME.

10.1. Conclusions

Based on observations made during fieldwork and, results of laboratory analysis, Reditus concludes the following:

- LNAPL was not reported in any of the three groundwater monitoring wells sampled during the current investigation. A sheen or hydrocarbon odour were not noted in groundwater extracted from each of the three wells; and
- Concentrations of the contaminants of potential concern in groundwater at each sample location was below adopted ANZG (2018) criteria with the exception of manganese extracted from monitoring well MW3. As manganese is not a contaminant of concern associated with petroleum storage and use, it is considered likely representative of local background conditions.

Based on the above key findings, Reditus consider that potential contaminants associated with the use of the area as a vehicle maintenance workshop, fuelling station and area down gradient of the former printery and chemical wastewater tank do not pose an unacceptable risk to human health or the environment.

Based on the above, and the conclusions made in the Airsafe (2019) PSI, Reditus considers that **there is no unacceptable risk to human health or the environment from the operation of the vehicle maintenance workshop, fuelling station, former printery chemical wastewater tank or upgradient former printery** (i.e. commercial/industrial land use).

10.2. Extent of Uncertainties in the Results

The sampling methodologies used by Reditus during this investigation have been designed to limit uncertainty in the results. Reditus is confident that the results of this investigation give an accurate representation of the current status of the site but note that in all subsurface investigations the potential remains for variability between sampling points and for conditions to be different on site from the conditions reported herein.

Appendix A - Figures

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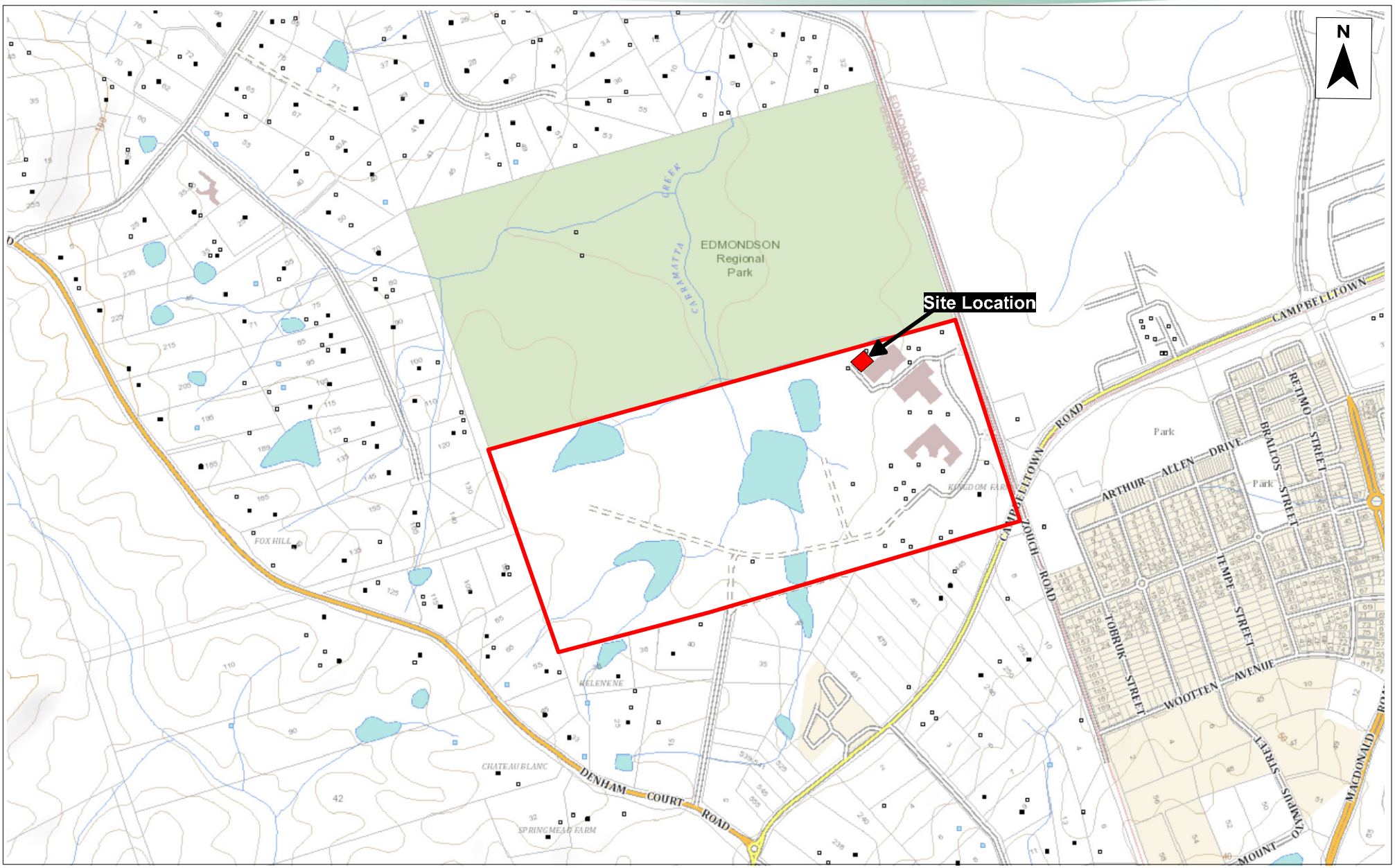
FIGURE 1

Site Location
12-14 Zouch Road, Denham Court NSW
Groundwater Monitoring Event

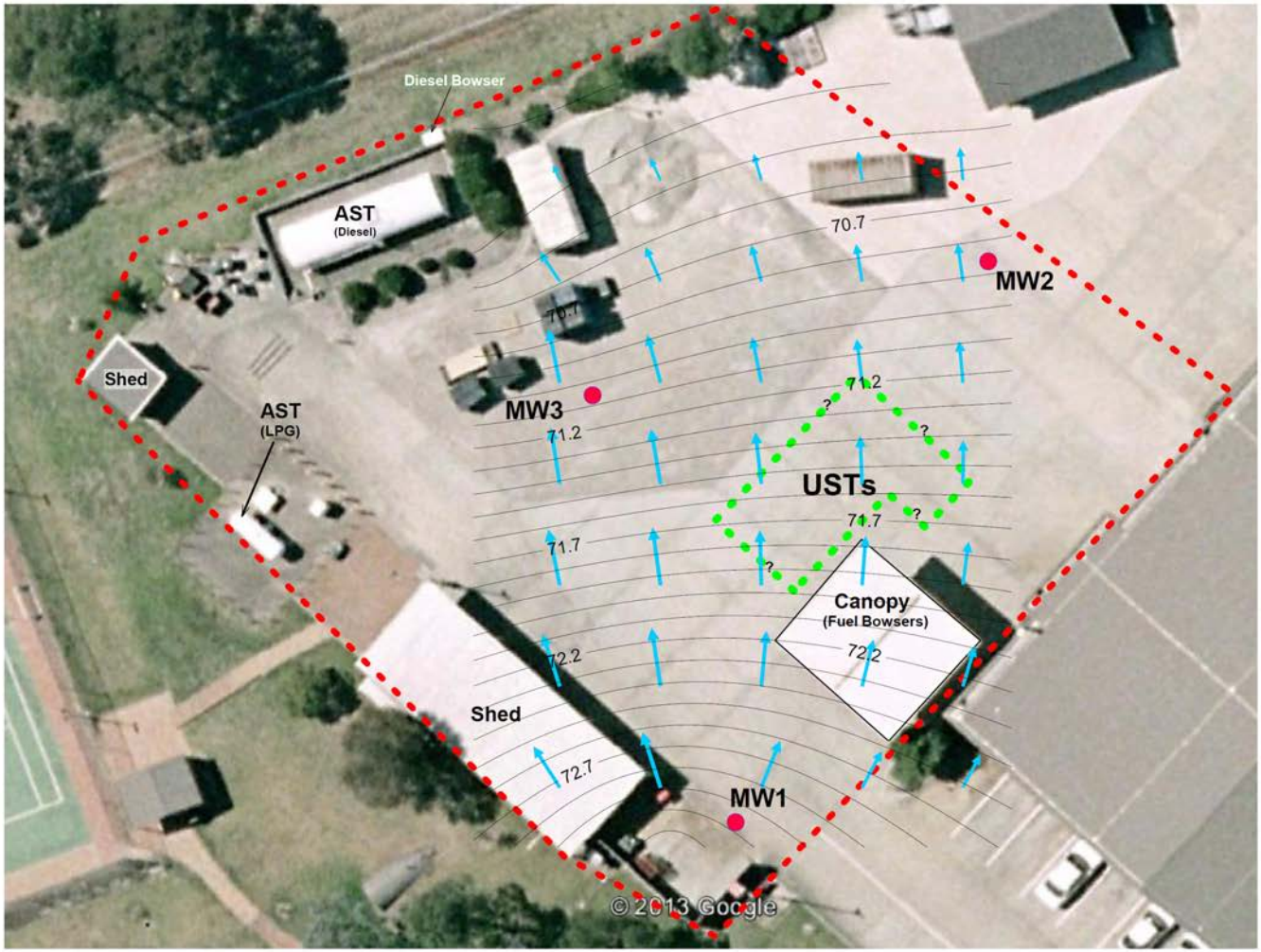


REDITUS

FIGURE 2

Sample Locations
12-14 Zouch Road, Denham Court NSW
Groundwater Monitoring Event

Figure Extracted from Airsafe (2019) PSI



N

LEGEND:

- Approximate Service Station boundary
- Well Location (MW1)
- Approximate location of suspected UST
- Inferred Groundwater Flow Direction

NOTES:
Figure 2 has been recreated from UBD Maps

The borehole locations presented on this plan have been established from site measurements only and should not be construed as survey points.

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (m): 0 3 6 9 12 15

EIS ENVIRONMENTAL INVESTIGATION SERVICES

Project Number:	Title:
E27003KG	Well Location Plan
Figure: 2	Address: 12-14 Zouch Road Denham Court, NSW 2565

Appendix B – Summary Result Tables

Table 1: Groundwater Summary Results
12-14 Zouch Road, Denham Court NSW
Groundwater Monitoring Event

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			TRH										BTEXN							VOCs																									
			TRH C6 - C9	TRH C6 - C10	vTPH C6 - C10 lessBTEX (F1)	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	TRH >C10-C16	TRH >C10 - C16less Naphthalene (F2)	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Xylenes - Total	naphthalene	Dichlorodifluoromethane	Chloromethane	Vinyl Chloride	Bromomethane	Chloroethane	Trichlorofluoromethane	1,1-Dichloroethene	Trans-1,2-dichloroethene	1,1-dichloroethane	Cis-1,2-dichloroethene	Bromochloromethane	Chloroform	2,2-dichloropropane	1,2-dichloroethane	1,1,1-trichloroethane	1,1-dichloropropene	Cyclohexane	Carbon tetrachloride	Dibromomethane	1,2-dichloropropane
			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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			10	10	10	50	100	100	50	50	100	100	1	1	1	2	1	1	1	10	10	10	10	10	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Guidelines																																												
NEPC (2013) NEPM HSL D Commercial/Industrial - 2m to <4m - Sand Profile					6000					NL			5000	NL	NL	NL	NL																											
ANZG (2018) Fresh Water Quality Guidelines (µg/L)a					2000					2000			950	180	80		350		16			100										370											
Sample ID	Sample Date	Sample Type																																									
MW1	17/07/2019	Water	<10	<10	<10	<50	<100	<100	<50	<50	<100	<100	<1	<1	<1	<2	<1	<3	<1	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW2	17/07/2019	Water	<10	<10	<10	<50	<100	<100	<50	<50	<100	<100	<1	<1	<1	<2	<1	<3	<1	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW3	17/07/2019	Water	<10	<10	<10	<50	<100	<100	<50	<50	<100	<100	<1	<1	<1	<2	<1	<3	<1	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DUP1	17/07/2019	Water	<10	<10	<10	<50	<100	<100	<50	<50	<100	<100	<1	<1	<1	<2	<1	<3	<1	<10	<10	<10	<10	<10	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

			VOCs Cont.																																										
			Trichloroethene	Bromodichloromethane	trans-1,3-dichloropropene	cis-1,3-dichloropropene	1,1,2-trichloroethane	1,3-dichloropropane	Dibromochloromethane	1,2-dibromoethane	Tetrachloroethene	1,1,1,2-tetrachloroethane	Chlorobenzene	Bromoform	Styrene	1,1,2,2-tetrachloroethane	1,2,3-trichloropropane	Isopropylbenzene	Bromobenzene	n-propyl benzene	2-chlorotoluene	4-chlorotoluene	1,3,5-trimethyl benzene	Tert-butyl benzene	1,2,4-trimethyl benzene	1,3-dichlorobenzene	Sec-butyl benzene	1,4-dichlorobenzene	4-isopropyl toluene	1,2-dichlorobenzene	n-butyl benzene	1,2-dibromo-3-chloropropane	1,2,4-trichlorobenzene	Hexachlorobutadiene	1,2,3-trichlorobenzene	1.1.1.2-Tetrachloroethane	1.2-Dibromoethane	1.3-Dichlorobenzene
			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	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Guidelines																																												
NEPC (2013) NEPM HSL D Commercial/Industrial - 2m to <4m - Sand Profile																																												
ANZG (2018) Fresh Water Quality Guidelines (µg/L)a																																												
Sample ID	Sample Date	Material Type																																										
MW1	01/07/2019	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW2	01/07/2019	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW3	01/07/2019	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DUP1	01/07/2019	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

			Metals																	PAH																									
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Boron	Barium	Beryllium	Cobalt	Manganese	Molybdenum	Antinmony	Selenium	Tin	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Total +vePAH's	Benzo(a)pyrene TEQ
			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	µg/L
			1	0.1	1	1	1	0.05	1	1	20	1	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	5
Guidelines																																											
NEPC (2013) NEPM HSL D Commercial/Industrial - 2m to <4m - Sand Profile																																											
ANZG (2018) Fresh Water Quality Guidelines (µg/L)a			24	0.2	27	1.4	3.4	0.6	11	8	-	-	-	-	1,900	-	-	5	-	16				2	0.4	1.4																	
Sample ID	Sample Date	Material Type																																										
MW1	01/07/2019	Water	<1	<0.1	<1	1	<1	<0.05	<1	2	20	34	<0.5	<1	50	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	0	<5
MW2	01/07/2019	Water	1	0.6	<1	<1	<1	<0.05	54	120	<20	80	0.9	54	930	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	0	<5
MW3	01/07/2019	Water	1	<0.1	<1	<1	2	<0.05	35	91	<20	35	1	90	**2900**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	0	<5
DUP1	01/07/2019	Water	1	0.6	<1	8	2	<0.05	52	120	<20	79	1	55	900	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	0	<5

Table 2: Summary Groundwater %RPDs
12-14 Zouch Road, Denham Court NSW
Groundwater Monitoring Event

			Sample ID	MW2	DUP1	RPD	MW2	TRIP1	RPD
			Sample Date	17/07/2019	17/07/2019		17/07/2019	17/07/2019	
	Analyte	Units	EQL						
TRH	TRH C6 - C9	µg/L	10	<10	<10	0	<10	<10	0
	TRH C6 - C10	µg/L	10	<10	<10	0	<10	<10	0
	vTPH C6 - C10 lessBTEX (F1)	µg/L	10	<10	<10	0	<10	<10	0
	TRH C10 - C14	µg/L	50	<50	<50	0	<50	<50	0
	TRH C15 - C28	µg/L	100	<100	<100	0	<100	<100	0
	TRH C29 - C36	µg/L	100	<100	<100	0	<100	<100	0
	TRH >C10-C16	µg/L	50	<50	<50	0	<50	<50	0
	TRH >C10 - C16less Naphthalene (F2)	µg/L	50	<50	<50	0	<50	<50	0
	TRH >C16-C34	µg/L	100	<100	<100	0	<100	<100	0
	TRH >C34-C40	µg/L	100	<100	<100	0	<100	<100	0
BTEXN	Benzene	µg/L	1	<1	<1	0	<1	<1	0
	Toluene	µg/L	1	<1	<1	0	<1	<1	0
	Ethylbenzene	µg/L	1	<1	<1	0	<1	<1	0
	m+p-xylene	µg/L	2	<2	<2	0	<2	<2	0
	o-Xylene	µg/L	1	<1	<1	0	<1	<1	0
	Xylenes - Total	µg/L	1	<3	<3	0	<3	<3	0
	naphthalene	µg/L	1	<1	<1	0	<1	<10	0
VOCs	Dichlorodifluoromethane	µg/L	10	<10	<10	0	<10	<10	0
	Chloromethane	µg/L	10	<10	<10	0	<10	<10	0
	Vinyl Chloride	µg/L	10	<10	<10	0	<10	<1	0
	Bromomethane	µg/L	10	<10	<10	0	<10	<1	0
	Chloroethane	µg/L	10	<10	<10	0	<10	<1	0
	Trichlorofluoromethane	µg/L	10	<10	<10	0	<10	<1	0
	1,1-Dichloroethene	µg/L	1	<1	<1	0	<1	<1	0
	Trans-1,2-dichloroethene	µg/L	1	<1	<1	0	<1	<1	0
	1,1-dichloroethane	µg/L	1	<1	<1	0	<1	<1	0
	Cis-1,2-dichloroethene	µg/L	1	<1	<1	0	<1	<1	0
	Bromochloromethane	µg/L	1	<1	<1	0	<1	<1	0
	Chloroform	µg/L	1	<1	<1	0	<1	<5	0
	2,2-dichloropropane	µg/L	1	<1	<1	0	<1	-	0
	1,2-dichloroethane	µg/L	1	<1	<1	0	<1	<1	0
	1,1,1-trichloroethane	µg/L	1	<1	<1	0	<1	<1	0
	1,1-dichloropropene	µg/L	1	<1	<1	0	<1	-	0
	Cyclohexane	µg/L	1	<1	<1	0	<1	-	0
	Carbon tetrachloride	µg/L	1	<1	<1	0	<1	<1	0
	Dibromomethane	µg/L	1	<1	<1	0	<1	<1	0
	1,2-dichloropropane	µg/L	1	<1	<1	0	<1	<1	0
	Trichloroethene	µg/L	1	<1	<1	0	<1	<1	0
	Bromodichloromethane	µg/L	1	<1	<1	0	<1	<1	0
	trans-1,3-dichloropropene	µg/L	1	<1	<1	0	<1	<1	0
	cis-1,3-dichloropropene	µg/L	1	<1	<1	0	<1	<1	0
	1,1,2-trichloroethane	µg/L	1	<1	<1	0	<1	<1	0
	1,3-dichloropropane	µg/L	1	<1	<1	0	<1	<1	0
	Dibromochloromethane	µg/L	1	<1	<1	0	<1	<1	0
	1,2-dibromoethane	µg/L	1	<1	<1	0	<1	<1	0
	Tetrachloroethene	µg/L	1	<1	<1	0	<1	<1	0
	1,1,1,2-tetrachloroethane	µg/L	1	<1	<1	0	<1	<1	0
	Chlorobenzene	µg/L	1	<1	<1	0	<1	<1	0
	Bromoform	µg/L	1	<1	<1	0	<1	<1	0
	Styrene	µg/L	1	<1	<1	0	<1	<1	0
	1,1,2,2-tetrachloroethane	µg/L	1	<1	<1	0	<1	<1	0
	1,2,3-trichloropropane	µg/L	1	<1	<1	0	<1	<1	0
	Isopropylbenzene	µg/L	1	<1	<1	0	<1	<1	0
	Bromobenzene	µg/L	1	<1	<1	0	<1	<1	0
	n-propyl benzene	µg/L	1	<1	<1	0	<1	-	0
	2-chlorotoluene	µg/L	1	<1	<1	0	<1	-	0
	4-chlorotoluene	µg/L	1	<1	<1	0	<1	<1	0
	1,3,5-trimethyl benzene	µg/L	1	<1	<1	0	<1	<1	0
	Tert-butyl benzene	µg/L	1	<1	<1	0	<1	-	0
	1,2,4-trimethyl benzene	µg/L	1	<1	<1	0	<1	<1	0
	1,3-dichlorobenzene	µg/L	1	<1	<1	0	<1	<1	0
	Sec-butyl benzene	µg/L	1	<1	<1	0	<1	-	0
	1,4-dichlorobenzene	µg/L	1	<1	<1	0	<1	<1	0
	4-isopropyl toluene	µg/L	1	<1	<1	0	<1	-	0
	1,2-dichlorobenzene	µg/L	1	<1	<1	0	<1	<1	0
	n-butyl benzene	µg/L	1	<1	<1	0	<1	-	0
	1,2-dibromo-3-chloropropane	µg/L	1	<1	<1	0	<1	-	0
	1,2,4-trichlorobenzene	µg/L	1	<1	<1	0	<1	-	0

Table 2: Summary Groundwater %RPDs
12-14 Zouch Road, Denham Court NSW
Groundwater Monitoring Event

	Hexachlorobutadiene	µg/L	1	<1	<1	0	<1	-	0
	1,2,3-trichlorobenzene	µg/L	1	<1	<1	0	<1	-	0
	1.1.1.2-Tetrachloroethane	µg/L	1	<1	<1	0	<1	<1	0
	1.2-Dibromoethane	µg/L	1	<1	<1	0	<1	<1	0
	1.3-Dichlorobenzene	µg/L	1	<1	<1	0	<1	<1	0
Metals	Arsenic	µg/L	1	1	1	0	1	2	67
	Cadmium	µg/L	0.1	0.6	0.6	0	0.6	0.6	0
	Chromium	µg/L	1	<1	<1	0	<1	<1	0
	Copper	µg/L	1	<1	8	0	<1	<1	0
	Lead	µg/L	1	<1	2	0	<1	<1	0
	Mercury	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.1	0
	Nickel	µg/L	1	54	52	4	54	60	11
	Zinc	µg/L	1	120	120	0	120	120	0
	Boron	µg/L	20	<20	<20	0	<20	<50	0
	Barium	µg/L	1	80	79	1	80	90	12
	Beryllium	µg/L	0.5	0.9	1	11	0.9	1	11
	Cobalt	µg/L	1	54	55	2	54	55	2
	Manganese	µg/L	1	930	900	3	930	990	6
	Molybdenum	µg/L	1	<1	<1	0	<1	<5	0
	Antinmony	µg/L	1	<1	<1	0	<1	-	0
	Selenium	µg/L	1	<1	<1	0	<1	<1	0
	Tin	µg/L	1	<1	<1	0	<1	<5	0
PAH	Naphthalene	µg/L	1	<1	<1	0	<1	<1	0
	Acenaphthylene	µg/L	1	<1	<1	0	<1	<1	0
	Acenaphthene	µg/L	1	<1	<1	0	<1	<1	0
	Fluorene	µg/L	1	<1	<1	0	<1	<1	0
	Phenanthrene	µg/L	1	<1	<1	0	<1	<1	0
	Anthracene	µg/L	1	<1	<1	0	<1	<1	0
	Fluoranthene	µg/L	1	<1	<1	0	<1	<1	0
	Pyrene	µg/L	1	<1	<1	0	<1	<1	0
	Benzo(a)anthracene	µg/L	1	<1	<1	0	<1	<1	0
	Chrysene	µg/L	1	<1	<1	0	<1	<1	0
	Benzo(b,j+k)fluoranthene	µg/L	2	<2	<2	0	<2	<2	0
	Benzo(a)pyrene	µg/L	1	<1	<1	0	<1	<1	0
	Indeno(1,2,3-c,d)pyrene	µg/L	1	<1	<1	0	<1	<1	0
	Dibenzo(a,h)anthracene	µg/L	1	<1	<1	0	<1	<1	0
	Benzo(g,h,i)perylene	µg/L	1	<1	<1	0	<1	<1	0
	Total +vePAH's	µg/L	1	0	0	0	0	0	0
	Benzo(a)pyrene TEQ	µg/L	5	<5	<5	0	<5	<5	0

Appendix C – Field Data Sheets

REDITUS Groundwater Monitoring Field Sheet

Job Information

Date:	17/7/19	Time: arrive	depart
Project Name:	WATCH TOWER.	Project Number:	19113
Site Location:	DENMAN COURT	Operator:	D STAFFORD
Well ID:	MW1	Weather:	FINE

Equipment

Water quality equipment description: ~~TECH~~ YSI

Interface probe number: GEOTECH

Purging equipment (please circle): Bailer type: Plastic / Teflon

Pump type: Peristaltic / Submersible / Micro-purge / Amazon / Other:

Well Gauging and Purge Volume Calculations

Casing Diameter	25mm	50mm	100mm	125mm	150mm	200mm	250mm	300mm
Conversion Factor (volume in factor L/m)	0.98	1.96	7.85	31.4	49.1	70.7	125.7	196.3

Volume of water in well / V = Pr x r x h
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column

8.70 m (-) 2.37 m (=) _____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume

_____ m (x) _____ (=) _____ L

Water Quality Parameters

Beginning purge time: Ending purge time:

Litres	Time	pH	Temp C	Cond mS/cm	DO ppm	Redox mV	Comments
2		6.74	21.0	2.64	0.17	65.8	clear colourless v.slight ~~cloudy~~
5		6.74	20.9	2.64	0.25	62.8	
10		6.67	21.0	~~2444~~	0.31	62.1	
15		6.68	21.0	2449	0.29	62.7	

Stabilisation Criteria	+/- 0.05	+/- 10%	+/- 3%	+/- 10%	+/- 10%	Example Comments: clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour

15 **Total Well Volume** — Actual amount of water prior to sampling

*pH, temp, cond readings not necessary if well is purged dry

Did field parameters stabilise? (Y) N NA Was the well dry purged? Y (N)

Field QC Checks

Was pre-cleaning sampling equipment used for these samples?	(Y)	N	
Was pre-cleaning sampling equipment properly protected from contamination?	(Y)	N	
Was documentation of equipment conducted?	(Y)	N	NA
Were air bubbles present in vials at time of collection?	Y	(N)	NA
Was sample for metals field filtered prior to preservations?	(Y)	N	NA
Duplicate sample collected?	Y	(N)	Duplicate sample ID

REDITUS Groundwater Monitoring Field Sheet

Job Information

Date: 17/7/19	Time: arrive depart
Project Name: WATCHTOWER	Project Number: 19113
Site Location: DENHAM COURT	Operator: D. STAFFORD
Well ID: MW 2	Weather: FINE

Equipment

Water quality equipment description: YSI

Interface probe number: GEOTECH

Purging equipment (please cirlce): Bailer type: Plastic Teflon

Pump type: Peristaltic Submersible Micro-purge Amazon Other:

Well Gauging and Purge Volume Calculations

Casing Diameter	25mm	50mm	100mm	125mm	150mm	200mm	250mm	300mm
Conversion Factor (volume in factor L/m)	0.98	1.96	7.85	31.4	49.1	70.7	125.7	196.3

Volume of water in well / V = Pr x r x h
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column

6.53 m (-) 5.10 m (=) _____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume

_____ m (x) _____ (=) _____ L

Water Quality Parameters

Beginning purge time: Ending purge time:

Litres	Time	pH	Temp C	Cond mS/cm	DO ppm	Redox mV	Comments
5		5.47	22.0	16333	1.12	149	light brown cloudy Med-High SS
10		5.49	22.0	16493	0.65	153	
15		5.51	22.0	16520	0.61	152	
Stabilisation Criteria		+/- 0.05	+/- 10%	+/- 3%	+/- 10%	+/- 10%	**Example Comments:** clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour

15 **Total Well Volume** Actual amount of water prior to sampling

*pH, temp, cond readings not necessary if well is purged dry

Did field parameters stabilise? (Y) N NA

Was the well dry purged? Y (N)

Field QC Checks

Was pre-cleaning sampling equipment used for these samples?	(Y)	N	
Was pre-cleaning sampling equipment properly protected from contamination?	(Y)	N	
Was documentation of equipment conducted?	(Y)	N	NA
Were air bubbles present in vials at time of collection?	Y	(N)	NA
Was sample for metals field filtered prior to preservations?	(Y)	N	NA
Duplicate sample collected?	(Y)	N	

Duplicate sample ID DUP1/TRIP1

REDITUS Groundwater Monitoring Field Sheet

Job Information

Date: 17/7/19	Time: arrive depart
Project Name: WATCH TOWER	Project Number: 19113
Site Location: DENHAM COURT.	Operator: D. STAFFORD
Well ID: MW3	Weather: FINE.

Equipment

Water quality equipment description: 451

Interface probe number: GEOTECH

Purging equipment: (please cirlce)
Bailer type: **Plastic** **Teflon**
Pump type: **Peristaltic** **Submersible** **Micro-purge** **Amazon** **Other:**

Well Gauging and Purge Volume Calculations

Casing Diameter	25mm	50mm	100mm	125mm	150mm	200mm	250mm	300mm
Conversion Factor (volume in factor L/m)	0.98	1.96	7.85	31.4	49.1	70.7	125.7	196.3

Volume of water in well / V = Pr x r x h
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column
7.98 m (-) 4.82 m (=) _____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume
_____ m (x) _____ (=) _____ L

Water Quality Parameters

Beginning purge time: Ending purge time:

Litres	Time	pH	Temp C	Cond mS/cm	DO ppm	Redox mV	Comments
2		4.25	21.2	8.59	1.97	145	cloudy light brown
5		5.29	21.3	10.02	0.88	116	
10		5.27	21.3	10.51	1.44	116	
15		5.27	21.2	10.57	1.46	112	
Stabilisation Criteria		**+/- 0.05**	**+/- 10%**	**+/- 3%**	**+/- 10%**	**+/- 10%**	**Example Comments:** clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour

15 **Total Well Volume**
Actual amount of water prior to sampling

*pH, temp, cond readings not necessary if well is purged dry

Did field parameters stabilise? (Y) N NA Was the well dry purged? Y (N)

Field QC Checks

Was pre-cleaning sampling equipment used for these samples?	(Y)	N	
Was pre-cleaning sampling equipment properly protected from contamination?	(Y)	N	
Was documentation of equipment conducted?	(Y)	N	NA
Were air bubbles present in vials at time of collection?	Y	(N)	NA
Was sample for metals field filtered prior to preservations?	(Y)	N	NA
Duplicate sample collected?	Y	(N)	Duplicate sample ID

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument	**YSI Quatro Pro Plus**
Serial No.	**09K100887**

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		324189	pH 9.56
1. pH 7.00		pH 7.00		330737	pH 6.95
2. pH 4.00		pH 4.00		324985	pH 4.06
3. mV		234mV		325420/325421	239.6mV
4. EC		2.76mS		322349	2.78mS
5. D.O		0.00ppm		10175	0.00ppm
6. Temp		18°C		MultiTherm	17.9°C

Calibrated by: K.Bo **Kylie Boardman**

Calibration date: **15/07/2019**

Next calibration due: **14/08/2019**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3910

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Calibrated by: Olivia Viant

Calibration date: **15/07/2019**

Next calibration due: **13/09/2019**

Appendix D – Laboratory Reports

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

CERTIFICATE OF ANALYSIS 221839

Client Details

Client	Reditus Consulting
Attention	Dean Stafford
Address	102 Railway Cres, JANNALI, NSW, 2226

Sample Details

Your Reference	**19113, Watchtower**
Number of Samples	4 Water
Date samples received	17/07/2019
Date completed instructions received	17/07/2019

Analysis Details

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

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

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

Report Details

Date results requested by	23/07/2019
Date of Issue	23/07/2019

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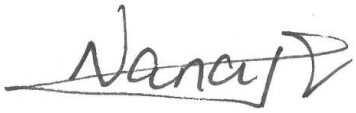
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

VOCs in water					
Our Reference		221839-1	221839-2	221839-3	221839-4
Your Reference	UNITS	MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Date analysed	-	19/07/2019	19/07/2019	19/07/2019	19/07/2019
Dichlorodifluoromethane	µg/L	<10	<10	<10	<10
Chloromethane	µg/L	<10	<10	<10	<10
Vinyl Chloride	µg/L	<10	<10	<10	<10
Bromomethane	µg/L	<10	<10	<10	<10
Chloroethane	µg/L	<10	<10	<10	<10
Trichlorofluoromethane	µg/L	<10	<10	<10	<10
1,1-Dichloroethene	µg/L	<1	<1	<1	<1
Trans-1,2-dichloroethene	µg/L	<1	<1	<1	<1
1,1-dichloroethane	µg/L	<1	<1	<1	<1
Cis-1,2-dichloroethene	µg/L	<1	<1	<1	<1
Bromochloromethane	µg/L	<1	<1	<1	<1
Chloroform	µg/L	<1	<1	<1	<1
2,2-dichloropropane	µg/L	<1	<1	<1	<1
1,2-dichloroethane	µg/L	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L	<1	<1	<1	<1
1,1-dichloropropene	µg/L	<1	<1	<1	<1
Cyclohexane	µg/L	<1	<1	<1	<1
Carbon tetrachloride	µg/L	<1	<1	<1	<1
Benzene	µg/L	<1	<1	<1	<1
Dibromomethane	µg/L	<1	<1	<1	<1
1,2-dichloropropane	µg/L	<1	<1	<1	<1
Trichloroethene	µg/L	<1	<1	<1	<1
Bromodichloromethane	µg/L	<1	<1	<1	<1
trans-1,3-dichloropropene	µg/L	<1	<1	<1	<1
cis-1,3-dichloropropene	µg/L	<1	<1	<1	<1
1,1,2-trichloroethane	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
1,3-dichloropropane	µg/L	<1	<1	<1	<1
Dibromochloromethane	µg/L	<1	<1	<1	<1
1,2-dibromoethane	µg/L	<1	<1	<1	<1
Tetrachloroethene	µg/L	<1	<1	<1	<1
1,1,1,2-tetrachloroethane	µg/L	<1	<1	<1	<1
Chlorobenzene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1

VOCs in water					
Our Reference		221839-1	221839-2	221839-3	221839-4
Your Reference	UNITS	MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Bromoform	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
Styrene	µg/L	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	<1	<1	<1	<1
o-xylene	µg/L	<1	<1	<1	<1
1,2,3-trichloropropane	µg/L	<1	<1	<1	<1
Isopropylbenzene	µg/L	<1	<1	<1	<1
Bromobenzene	µg/L	<1	<1	<1	<1
n-propyl benzene	µg/L	<1	<1	<1	<1
2-chlorotoluene	µg/L	<1	<1	<1	<1
4-chlorotoluene	µg/L	<1	<1	<1	<1
1,3,5-trimethyl benzene	µg/L	<1	<1	<1	<1
Tert-butyl benzene	µg/L	<1	<1	<1	<1
1,2,4-trimethyl benzene	µg/L	<1	<1	<1	<1
1,3-dichlorobenzene	µg/L	<1	<1	<1	<1
Sec-butyl benzene	µg/L	<1	<1	<1	<1
1,4-dichlorobenzene	µg/L	<1	<1	<1	<1
4-isopropyl toluene	µg/L	<1	<1	<1	<1
1,2-dichlorobenzene	µg/L	<1	<1	<1	<1
n-butyl benzene	µg/L	<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	<1	<1	<1	<1
Hexachlorobutadiene	µg/L	<1	<1	<1	<1
1,2,3-trichlorobenzene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	96	111	98	103
Surrogate toluene-d8	%	107	98	98	99
Surrogate 4-BFB	%	107	96	93	104

vTRH(C6-C10)/BTEXN in Water					
Our Reference	UNITS	221839-1	221839-2	221839-3	221839-4
Your Reference		MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Date analysed	-	19/07/2019	19/07/2019	19/07/2019	19/07/2019
TRH C_6 - C_9	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	96	111	98	103
Surrogate toluene-d8	%	107	98	98	99
Surrogate 4-BFB	%	107	96	93	104

svTRH (C10-C40) in Water					
Our Reference		221839-1	221839-2	221839-3	221839-4
Your Reference	UNITS	MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Date analysed	-	19/07/2019	19/07/2019	19/07/2019	19/07/2019
TRH C_{10} - C_{14}	µg/L	<50	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	106	103	87	94

PAHs in Water					
Our Reference		221839-1	221839-2	221839-3	221839-4
Your Reference	UNITS	MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Date analysed	-	19/07/2019	19/07/2019	19/07/2019	19/07/2019
Naphthalene	µg/L	<1	<1	<1	<1
Acenaphthylene	µg/L	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	91	85	76	73

HM in water - dissolved					
Our Reference		221839-1	221839-2	221839-3	221839-4
Your Reference	UNITS	MW1	MW2	MW3	DUP
Date Sampled		17/07/2019	17/07/2019	17/07/2019	17/07/2019
Type of sample		Water	Water	Water	Water
Date prepared	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Date analysed	-	18/07/2019	18/07/2019	18/07/2019	18/07/2019
Arsenic-Dissolved	µg/L	<1	1	1	1
Cadmium-Dissolved	µg/L	<0.1	0.6	<0.1	0.6
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	54	35	52
Zinc-Dissolved	µg/L	2	120	91	120
Boron-Dissolved	µg/L	20	<20	<20	<20
Barium-Dissolved	µg/L	34	80	35	79
Beryllium-Dissolved	µg/L	<0.5	0.9	1	1
Cobalt-Dissolved	µg/L	<1	54	90	55
Manganese-Dissolved	µg/L	50	930	2,900	900
Molybdenum-Dissolved	µg/L	<1	<1	<1	<1
Antimony-Dissolved	µg/L	<1	<1	<1	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1	<1

Method ID	Methodology Summary
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			18/07/2019	1	18/07/2019	22/07/2019		18/07/2019	[NT]
Date analysed	-			19/07/2019	1	19/07/2019	23/07/2019		19/07/2019	[NT]
Dichlorodifluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	100	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-013	<1	1	<1	<1	0	101	[NT]
2,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	102	[NT]
1,1,1-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	101	[NT]
1,1-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromomethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	88	[NT]
Bromodichloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	101	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	95	[NT]
1,2-dibromoethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	95	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromoform	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-013	<2	1	<2	<2	0	[NT]	[NT]
Styrene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
o-xylene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-013	103	1	96	104	8	98	[NT]
Surrogate toluene-d8	%		Org-013	98	1	107	96	11	99	[NT]
Surrogate 4-BFB	%		Org-013	103	1	107	91	16	93	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			18/07/2019	1	18/07/2019	22/07/2019		18/07/2019	[NT]
Date analysed	-			19/07/2019	1	19/07/2019	23/07/2019		19/07/2019	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	1	<10	<10	0	97	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	1	<10	<10	0	97	[NT]
Benzene	µg/L	1	Org-016	<1	1	<1	<1	0	98	[NT]
Toluene	µg/L	1	Org-016	<1	1	<1	<1	0	100	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	1	<1	<1	0	95	[NT]
m+p-xylene	µg/L	2	Org-016	<2	1	<2	<2	0	96	[NT]
o-xylene	µg/L	1	Org-016	<1	1	<1	<1	0	94	[NT]
Naphthalene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	103	1	96	104	8	98	[NT]
Surrogate toluene-d8	%		Org-016	98	1	107	96	11	99	[NT]
Surrogate 4-BFB	%		Org-016	103	1	107	91	16	93	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	221839-2
Date extracted	-			18/07/2019	1	18/07/2019	18/07/2019		18/07/2019	18/07/2019
Date analysed	-			19/07/2019	1	19/07/2019	19/07/2019		18/07/2019	19/07/2019
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	1	<50	<50	0	101	74
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	1	<100	<100	0	87	76
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	1	<100	<100	0	116	89
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	1	<50	<50	0	101	74
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	1	<100	<100	0	87	76
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	1	<100	<100	0	116	89
Surrogate o-Terphenyl	%		Org-003	76	1	106	85	22	125	94

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	221839-2
Date extracted	-			18/07/2019	1	18/07/2019	18/07/2019		18/07/2019	18/07/2019
Date analysed	-			19/07/2019	1	19/07/2019	19/07/2019		19/07/2019	19/07/2019
Naphthalene	µg/L	1	Org-012	<1	1	<1	<1	0	92	78
Acenaphthylene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Acenaphthene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Fluorene	µg/L	1	Org-012	<1	1	<1	<1	0	80	78
Phenanthrene	µg/L	1	Org-012	<1	1	<1	<1	0	77	72
Anthracene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Fluoranthene	µg/L	1	Org-012	<1	1	<1	<1	0	75	76
Pyrene	µg/L	1	Org-012	<1	1	<1	<1	0	81	82
Benzo(a)anthracene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Chrysene	µg/L	1	Org-012	<1	1	<1	<1	0	72	72
Benzo(b,j+k)fluoranthene	µg/L	2	Org-012	<2	1	<2	<2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-012	<1	1	<1	<1	0	74	76
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-012	<1	1	<1	<1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	77	1	91	80	13	89	90

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-			18/07/2019	[NT]	[NT]	[NT]	[NT]	18/07/2019	[NT]
Date analysed	-			18/07/2019	[NT]	[NT]	[NT]	[NT]	18/07/2019	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	113	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	114	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Tin-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

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

Quality Control Definitions

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

CHAIN OF CUSTODY - Client

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Client: REDITUS	Client Project Name / Number / Site etc (ie report title): 19113 WATCHTOWER
Contact Person: DEAN STAFFORD	
Project Mgr: 〃	PO No.: 19113
Sampler: 〃	Envirolab Quote No. :
Address: 102 RAILWAY CRES JANNALI NSW	Date results required: 24/7/19
	Or choose: standard / same day / 1 day / 2 day / 3 day
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Phone: Mob: 0434 657 155	Additional report format: esdat / equis /
Email: deanstafford@reditusconsulting.com accounts@reditusconsulting.com	Lab Comments:

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	TRH	BTEXN	VOCs	17 Metals	PAH											Comments
1	MW1		17/7/19	WATER	X	X	X	X	X											
2	MW2		↓	↓	X	X	X	X	X											
3	MW3				X	X	X	X	X											
4	DUP1				X	X	X	X	X											
	TRIP1				X	X	X	X	X											FWD TO EUROFINS

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company): REDITUS	Received by (Company): ELS	*Lab Use Only*
Print Name: DEAN STAFFORD	Print Name: Trinidad Canales	Job number: 221839 — Cooling: (Ice) / Ice pack / None
Date & Time: 17/7/19 3.45	Date & Time: 17.07.19 15:42	Temperature: 6.1 °C. — Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req: (SAME day) / 1 / (2) / 3 / 4 / STD