Response to DPE Query for Dewatering Management Plan

University of Newcastle Gosford Campus, 305 Mann Street, Gosford

NCA24L164410
23 February 2024

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23 February 2024
NCA24L164410

Hansen Yuncken Pty Ltd

Suite 12/125 Bull Street

Newcastle West NSW 2302

Attention: Zac Birleson

Subject: Response to DPE Query for Dewatering Management Plan
University of Newcastle Gosford Campus, 305 Mann Street, Gosford

1 INTRODUCTION

Kleinfelder prepared a Dewatering Management Plan for the site titled “Dewatering Management Plan University of Newcastle Gosford Campus, 305 Mann Street, Gosford”, Project: 20232408.005 dated 24 May 2023.

A query was made by Department of “NSW Department of Planning & Environment” requiring:

A cover letter, which:

1. Includes a table, identifying where (citing section and page numbers), and how, the Dewatering Management Plan (the plan) addresses the requirements of Condition B41 of the development consent, particularly, "arrangements to pump and treat groundwater extracted during any dewatering activities during works prior to discharge".
2. Explains why the plan pre-dates the consent.
3. Identifies the relevant stage of work to which the plan relates; and the forecast, commencement date of that stage.
4. Confirm that the instruments and guidelines listed at Section 1.4 of the plan, are contemporary.
5. Provide details in the plan, that its author is a suitably qualified expert.
6. Provide indicative timing of consultation with Central Coast Council Liquid (re. Section 6).

The response to each item is presented in the following section.

2 RESPONSE TO QUERIES

Response to Question 1. B.41 Indicates “Prior to the commencement of the relevant stage of works, the Applicant must, either:

a) Obtain approval from the local water authority to discharge groundwater extracted during any dewatering activities during works to the sewer network; or

b) Submit details, including a supporting report prepared by a suitably qualified expert, of arrangements to pump and treat groundwater extracted during any dewatering activities during works prior to discharge, to the Planning Secretary for Approval.”

The response to above is presented in a Revision 1 of the Kleinfelder’s report “Dewatering Management Plan University of Newcastle Gosford Campus, 305 Mann Street, Gosford”, Kleinfelder Project: 20232408.005”.

As per discussion with Hansen Yuncken (The Contractor), a treatment facility will be present onsite during the excavation. This is the requirement of Consent B41.b that also satisfies the requirement of B41.a as per guidelines presented by the Council (Civil Works Specification and Liquid Trade Waste). Section 5.4 of the report includes the details of the proposed treatment facility.

Response to Question 2. "Explains why the plan pre-dates the consent."

The dewatering activities can have significant environmental implications. By establishing a dewatering plan early in the project timeline, the developer can assess the potential impacts on nearby water resources, ecosystems, and communities. This proactive approach enables them to design mitigation measures and ensure compliance with environmental regulations from the outset. Additionally, integrating the dewatering plan into the initial project planning phase allows for better coordination with relevant authorities and stakeholders, facilitating a smoother approval process. Ultimately, by addressing dewatering considerations early on, developers can minimise environmental risks, enhance project efficiency, and demonstrate a commitment to sustainable development practices in accordance with NSW regulatory requirements.

Response to Question to "3. Identifies the relevant stage of work to which the plan relates; and the forecast, commencement date of that stage."

The stages of excavation, dewatering and treatment is presented in the table below and in the Revision 1 of the report.

Table 1-1-1: Work Stages for Excavation and Dewatering Activities

Activity	Start Date	Finish Date
Construction of Piling and Shoring System	Early March 2024	Early April 2024
Excavation of Basement Site	Mid March 2024	Mid April 2024
Construction Activities at Basement Level	Mid June 2024	Mid August 2024
Total Excavation Volume	3,420m^3	
Total Treated Groundwater	122,430 Lit	
End of dewatering	Late August 2024	

Response to "4. Confirm that the instruments and guidelines listed at Section 1.4 of the plan, are contemporary."

The list is updated to the latest specifically "Minimum requirements for building site groundwater investigations and reporting Information for developers and consultants", October 2022. We confirm that the list is now Contemporary.

Response to "5. Provide details in the plan, that its author is a suitably qualified expert."

Phil Band, Principal Geotechnical Engineer - Phil has over 30 years' geotechnical and civil engineering consulting experience with major clients such as NSW Government RMS and DPI, Newcastle City Council, Park Fuels, ARTC, Roy Hill, WA Water Corporation, and Signal Energy. Projects have been successfully completed in WA, Queensland, NT, SA, NSW and Victoria. His experience covers design and analysis of foundations and piles, slope stability, excavation dewatering and ground improvement. Phil has completed multiple dewatering projects across NSW and particularly Newcastle and Central Coast. Phil has completed multiple studies and investigations into sites in the Newcastle region of New South Wales that are undermined by abandoned coal mine workings. Phil also has significant experience in scoping, managing and interpreting geotechnical investigation projects. Phil holds a bachelor degree in Civil Engineering from Salford University and a master's degree in Geotechnical Engineering from Bolton University and is a Registered Professional Engineer in NSW, Queensland and Victoria. .

Amir Farazmand, Principal Geotechnical Engineer - Amir has 22 years' experience in geotechnical engineering aspects of buildings, roads and dams, mines, and tunnels. He has extensive experience in geotechnical engineering and associated dewatering and seepage analysis. He has carried out design and construction dewatering projects across Australia spanning all major cities with numerous dewatering projects in NSW and septically Newcastle. He holds a bachelor degree in Civil Engineering and a master's degree in Geotechnical Engineering. He is also a Licensed driller in NSW (Class 3) where he has demonstrated his understanding of aquifers, dewatering and protecting aquifer's contamination through interaquifer leakage.

Response to "6. Provide indicative timing of consultation with Central Coast Council Liquid (re. Section 6)."

Consultation with Central Coast Council about discharging treated water to Sewer have been initiated by Hansen Yuncken and are ongoing.

If you require additional information or clarification, please contact the undersigned.

Sincerely,

Kleinfelder Australia Pty Ltd

Amir Farazmand

Principal Geotechnical Engineer
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Attachments

Attachment 1 Updated Dewatering Management Plan

DEWATERING MANAGEMENT PLAN

University of Newcastle Gosford Campus, 305 Mann Street, Gosford

20232408.005 Rev 1

24 May 2023

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Dewatering Management Plan

University of Newcastle Gosford Campus, 305 Mann Street, Gosford

Kleinfelder Project: 20232408.005 Rev 1

Kleinfelder Document: NCA24R164411

Prepared for:
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1.0	Draft	24 May 2023
2.0	Amended for Regulator Comments	22 February 2024
Prepared	Reviewed	Endorsed
		
Amir Farazmand	Phil Band	Phil Band

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APPENDICES

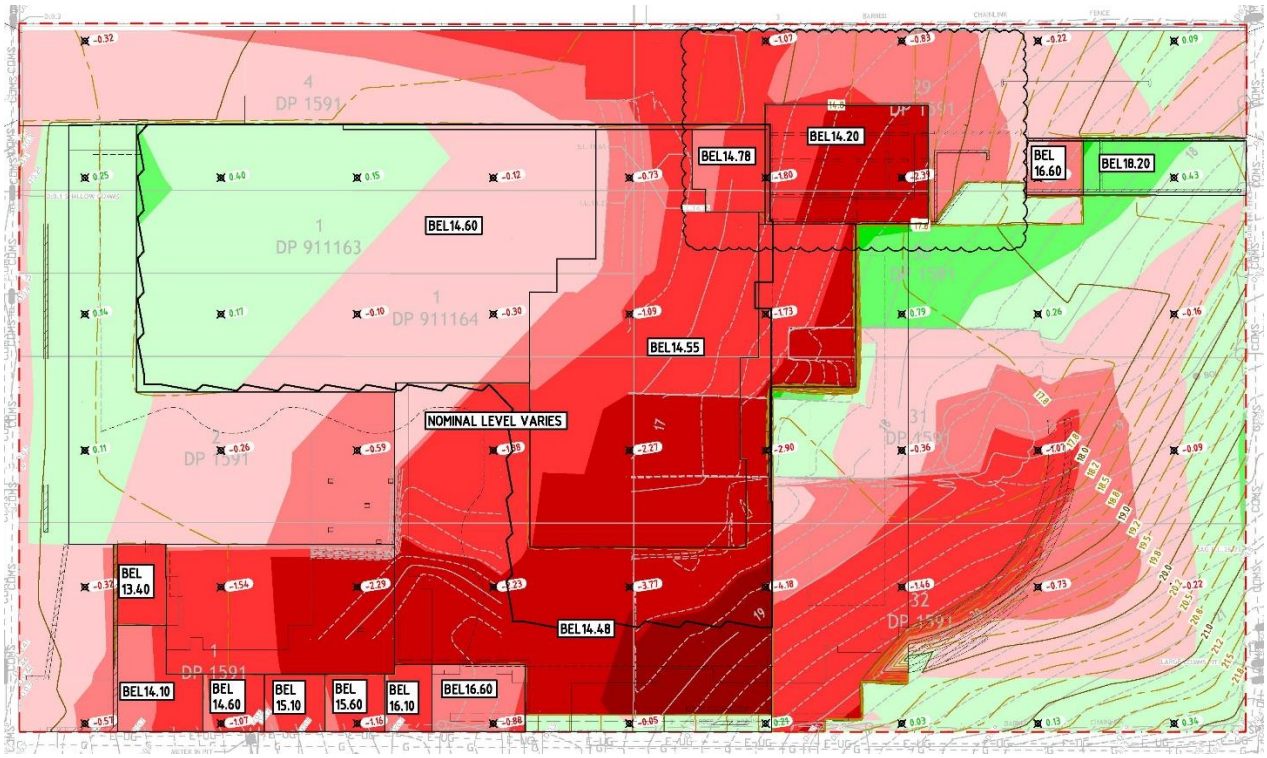
1 INTRODUCTION

Kleinfelder Australia Pty Ltd (Kleinfelder) was commissioned by The University of Newcastle (UoN) to undertake a Dewatering Management Plan (DWMP) at 305 Mann Street, Gosford (herein referred to as the 'Site'). The Site layout is presented in **Figure 1, Appendix A.**

UoN is seeking to redevelop the Site into the Central Coast Campus of the University of Newcastle. Consent is sought for the proposal as State Significant Development (SSD-47749715). The purpose of this plan is to guide the treatment and disposal of water encountered in the excavation necessary for construction of the development and to assess the impact of this water take in response a letter from DPE Water (See **Section 1.2**).

1.1 PROPOSED DEVELOPMENT

Kleinfelder understands that the proposed structure comprises a four-storey educational establishment building on the western portion of the site, retail, on-site parking and publicly accessible open space along the western, southern and eastern parts of the site. The building is to have an underground carpark level and therefore significant excavation of soils will be required along with the construction of retaining walls. The proposed earthworks plan is shown in **Figure 1-1** below:



Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)	Volume (m3)
1		-6.000	-4.000	32.0
2		-4.000	-2.000	625.8
3		-2.000	-1.000	1023.5
4		-1.000	-0.500	947.8
5		-0.500	0.000	1419.2
6		0.000	0.500	248.3
7		0.500	1.000	32.7
8		1.000	1.500	0.1

Figure 1-1: Proposed Earthworks Plan (Updated on 9 Feb 2024)

Anticipated earthworks volumes are cut 3,420m^{3}and fill 353m^3, with a balance of 3067m^3. It is anticipated that this material will have to be removed from site.

1.2 BACKGROUND

The University of Newcastle has submitted a State Significant Development (SSD-47749715) application for the expansion of its Gosford Campus situated at 305 Mann Street, Gosford. The following responses have been received in relation to Groundwater.

- DPE Water has requested that the proponent prepare an assessment of the dewatering activities against the 'minimal impact considerations' of the NSW Aquifer Interference Policy (AIP).

Previous investigations undertaken have identified indicators of acidic soils, within the proposed civil excavation footprint of the Development Area, exceeding the minimum 'action criteria' threshold from the NSW Acid Sulfate Soil Assessment Guidelines, 1998 ('ASSMAC'). An Acid Soil Management Plan Has been prepared by Kleinfelder to address the risks surrounding the acidic soils on site.

A Detailed Site Investigation (DSI) prepared by Kleinfelder detected minor recorded exceedances of the ANZG 95% Freshwater criteria for heavy metals (Copper, Nickel and Zinc), the PFAS NEMP 2020 Freshwater 99% limit for PFOS and the NHMRC Managing Risks in Recreational Water criteria for Benzene in the groundwater, therefore, any groundwater extracted during dewatering activities conducted during construction is not considered suitable for discharge to the stormwater network without pre-treatment. Prior approval will need to be sought, with respect to discharge quality parameters and volumes/flow rates, from the local water authority to discharge to the sewer network, or potentially, water may need to be pumped, possibly stored and treated on-site prior to discharge.

1.3 OBJECTIVES

The primary objective of this DWMP is to provide management procedures that will ensure any pumped-out groundwater discharged from site will be of an acceptable quality and complies with the requirements of the Protection of the Environment Operations Act 1997 (POEO Act 1997).

Furthermore, this DMP outlines monitoring procedures regarding the periodic measurements of estimated groundwater levels, flow and discharge volume, as well as the required measures to minimise risks of contamination, or other interference, of the local aquifer system.

Kleinfelder understands that this DMP will also form the basis for:

- The approval to enable connection and discharge to Council's sewer system; and
- The groundwater dewatering license exemption, which is to be granted by WaterNSW.

1.4 REGULATORY FRAMEWORK

The following regulatory instruments and guidelines were considered:

- Contaminated Land Management Act 1997 (the CLM Act 1997) and Contaminated Land Management Regulation 2022
- Protection of the Environment Operations Act 1997 (the POEO Act 1997);
- Environmental Planning and Assessment Act 1979 (the EP&A Act 1997); in particular
- Resilience and Hazards State Environmental Planning Policy, 2022;
- State Environmental Planning Policy (Precincts Regional) 2021 Pt 5.8 Gosford City Centre;
- NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 1999;
- Water Management Act 2000;
- NSW Aquifer Interference Policy, 2012; and
- NSW DPIE (October 2022) Minimum requirements for building site groundwater investigations and reporting, Information for developers and consultants.

2 SITE CHARCTERISATION

2.1 SITE LOCATION

The Site is located at 305 Mann Street, Gosford 2308, approximately 90 km southwest of Newcastle. A summary of the Site details is outlined in **Table 2-1**.

Table 2-1: Site Details

Site Name	Former Mitre 10 Warehouse
Site Address	305 Mann Street, Gosford, NSW 2308
Current Title Identification	• Lots 1, 2, 4, 29, 30, 31 & 32. • Section 1 – DP 1591 • Lot 1 – DP 911163, DP 911164
Local Council	Central Coast Council
Site Zoning	B4 – Mixed Use
Site Owner	University of Newcastle
Current Site Use	Vacant commercial premises (most recent past operation as a Mitre 10 hardware store).
Proposed Site Use	UoN campus, consistent with current zoning (B4 Mixed Use).

2.2 SITE FEATURES

The Site covers an area of approximately 4675 m^2. Structures and features at the Site include a large warehouse (which housed the former Mitre 10 store) occupying the western portion, a central vegetated garden area and a concreted open car park that occupies the remainder of the Site.

The concreted open car park and central garden area slope toward the northwest and are in poor condition with several cracks and vegetation growing throughout.

2.3 SURROUNDING LAND USE

Adjacent, surrounding land use comprises:

- **North** – Numerous commercial businesses are located northwards along Mann Street, zoned as Mixed Use (B4). Approximately 150 m north-east and 180 m north-west are residential properties, zoned as General Residential (R1). The Gosford Golf Club is located approximately 400 m north-west, within a Public Recreation (RE1) planning zone.
- **East** – Variable zoning including Mixed Use (B4), General Residential (R1) and Public Recreation (RE1) is present directly east. Further east is the Rumbalara Reserve located approximately 170 m from Site.
- **South** – Mixed Use (B4) zoning continues south of the Site for approximately 250 m, with Commercial Core (B3) zoning beyond. Hotel Gosford, Woolworths and Chemist Warehouse are all located along Mann Street within 500 m of the Site.
- **West** – A rail infrastructure facility, within an Infrastructure (SP2) planning zone, runs north-south approximately 50m west of the Site, adjacent to Showground Road. Central Coast Local Health District and Gosford Hospital are located 100m west of the Site, zoned as Infrastructure (SP2). South of the hospital is residential housing zoned as General Residential (R1), with Gosford High Waterview Park located approximately 500 m south-west under Public Recreation (RE1) zoning.

2.4 CLIMATE, HYDROLOGY AND DRAINAGE

Typical landforms within the regional landscape are made up of undulating to rolling rises and low hills, with local relief of <60 m and slope gradients below 25%. The surface elevation on-site ranges from 15 m to 22 m Australian Height Datum (AHD).

It is considered that surface water from the site during periods of rainfall would run off the concrete surfaces (including roof drainage) and enter stormwater drains adjacent to Mann St. Where concrete is not present i.e., in the central vegetated garden, rainfall would infiltrate the soil profile.

The nearest surface water bodies to the site include:

- Brisbane Water – estuary system located approximately 1.1 km to the south-west.
- Narara Creek - located approximately 1 km north-west of the site, flows in a south-westerly direction into Brisbane Water.

Monthly climate statistics from the Gosford (Narara Research Station) automatic weather station (AWS 061087), located approximately 5 km northwest of the Site, indicate the site experiences warm summers to cold winters with an average maximum temperature of 23.0°C and an average minimum temperature of 11.1°C. The average annual rainfall is approximately 1,330 mm, with the highest rainfall period between January and March and the lowest rainfall period from July to October.

2.5 GEOLOGY

The Soil Landscape Map of Gosford – Lake Macquarie (Soil Landscape Series Sheet 9131-9231, Scale 1:100,000, 1993), indicates that the Site is located within the Erina Landscape, which comprises undulating to rolling rises and low hills on the Terrigal Formation. Soils within this landscape are generally moderately deep to deep, commonly prone to waterlogging, mass movement and high erosion. These soils are also commonly highly acidic.

Geological mapping from https://minview.geoscience.nsw.gov.au (See

Figure 2-1 below) indicates that the Site soils comprise the Burralow Formation of the Gosford Sub-group which form part of the Narrabeen Group of Triassic age.

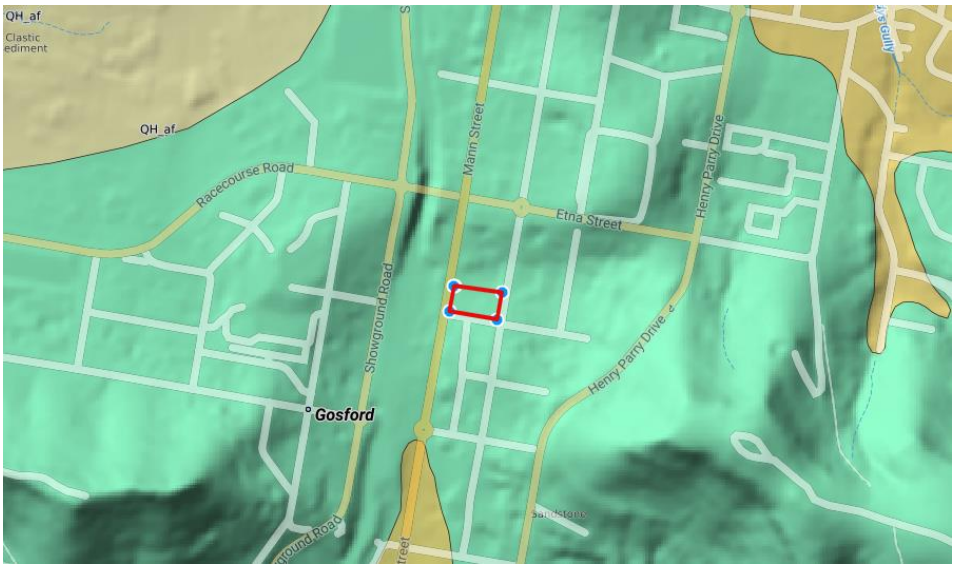


Figure 2-1: Geological Map

The Burralow Formation comprises fine-grained, micaceous, quartz to quartz-lithic sandstone; interbedded with siltstone, grey shale and red-brown claystone. The upper layers of the Burralow Formation are likely to have weathered to a sandy Clay/clayey Sand.

Given that the Site has been previously developed it was considered likely that there would be some fill present.

2.6 Acid Sulfate Soils

A review of the Acid Sulfate Soils (ASS) Map performed as part of the Enviro Screen report (LIR, 2022) obtained by Kleinfelder, identified the Site and land within its 500m buffer to be Class 5, meaning that "development consent is required for the carrying out of works within 500m of adjacent Class 1, 2, 3 or 4 land that is below 5m AHD and by which the water table is likely to be lowered below 1m AHD on adjacent Class 1, 2, 3 or 4 land".

Class 4 land is present within 500m of the site to the south-east; however, this land is at an elevation of above 16m AHD.

2.7 Previous Investigations

2.7.1 Geotechnique 2004 and SMEC 2016

Driller's logs from previous environmental investigations identified subsurface conditions at the Site to primarily consist of four lithological units:

- Surface Cover – Concrete (underlain by gravel), pavers or imported gravel, ranging in thickness from near surface to approx. 0.35m below ground level (bgl).
- Fill – Generally reworked silty clayey Sand, fine to medium grained with some gravels, ranging in depth from approx. 0.3m to 1.25m bgl.
- Topsoil (where fill is absent) –silty clayey Sand, fine to medium grained, dark brown, typically 0.2m to 0.4m thick below ground surface.
- Natural Soil – Generally firm to stiff and stiff silty Clay, medium to high plasticity with occasional; layers of medium dense clayey Sand, fine to medium grained, or encountered beneath the fill and/or topsoil layers at depths ranging from approx. 0.4m and 1.25m bgl and extending to the maximum depth of investigation of 3.0m bgl.

Bedrock was not encountered in these investigations.

Groundwater was not encountered in these previous investigations.

2.7.2 Kleinfelder 2022

Kleinfelder undertook a contaminated land DSI and a Geotechnical Investigation in October and November 2022 respectively. The subsurface profile encountered was generally consistent across the investigation locations.

- Surface cover comprised a shallow layer of concrete/asphalt where present, underlain by sandy clay / gravelly sand Fill material.
- Very soft to soft and firm Silty / sandy Clay and bands of loose clayey Sand.
- Stiff and very stiff silty Clay / Clay with trace sand medium to high plasticity.
- Completely weathered clayey Sandstone / Siltstone (white to red, firm to stiff) with occasional small bands of ironstone bedrock
- Weathered very low or low strength Siltstone and Claystone with some bands of high strength sandstone.
- Medium to high strength Sandstone, reddish brown with grey and yellow mottling, with occasional thin (0.1-0.5m) bands of low medium and high strength Siltstone and Claystone.

Groundwater was recorded at between 2.2 and 4.4 m bgl in boreholes and monitoring wells during the period of investigation.

The DSI prepared by Kleinfelder detected minor recorded exceedances of the ANZG 2018 Freshwater 95% criteria for heavy metals (Copper, Nickel and Zinc), the PFAS NEMP 2020 Freshwater 99% criteria for PFOS and the NHMRC Managing Risks in Recreational Water criteria for Benzene in the groundwater.

SPOCAS and CRS testing for Acid Sulphate Soils indicated that samples of the natural soils, at depths of between 1m and 6m m bgl, exceeded the >1000 tonne soil threshold for provision of an ASS and Groundwater Management Plan; however, the site is at an elevation of around 18m AHD and is not mapped a being an Acid Sulphate Soil site. Although the laboratory results indicated some acidic soils with acid forming reactions on

oxidation, less saline conditions than normally expected for ASS/PASS were noted and some parameters were atypical of ASS/PASS soils. The origin of the acidity may therefore potentially not be as a result of typical ASS/PASS soils and could be associated with the local geological strata. This is supported by the soil landscape mapping in Section 2.5 which identifies the Terrigal Formation to be commonly highly acidic. Notwithstanding the above, management of acidic and potentially acid forming soils, in accordance with ASS/PASS guidance, is recommended to minimise the risk of environmental harm, even if the source of the acidity remains unconfirmed.

3 GROUNDWATER CONDITIONS

3.1 GROUNDWATER LEVELS

Groundwater was encountered in all boreholes during drilling, at the depths indicated in **Table 3-1** below.

Table 3-1: Groundwater Strikes During Drilling

Borehole	Depth Encountered (m bgl)	Standing Level after 5mins	Stratum of Groundwater Strike
BH1	4.0	No Rise	Silty Clay
BH2	3.9	2.9	Clay
BH3	2.3	No Rise	Clay
BH4	3.5	No Rise	Clay
BH5	3.5	No Rise	Clay
BH6	Not Encountered	-	-
BH7	5.9	No Rise	Weathered Siltstone
BH8	3.2	No Rise	Clay
BH9	Not Encountered	-	-
BH10	Not Encountered	-	-
BH11	1.5	No Rise	Clayey Sand

A total of three additional groundwater monitoring wells were installed in BH1, BH7 and BH8 during the DSI and three additional wells, BH9, BH10 and BH11 were installed in April 2023, to provide additional information on groundwater levels within the soft to firm and stiff to very stiff clay layers. A borehole location plan is Included as **Figure 1** in **Appendix A** and borehole logs are included as **Appendix B**. At-rest groundwater levels were monitored on 23 November 2022 and 4 May 2023 and maximum recorded levels are shown in **Table 3-2** below:

Table 3-2: Groundwater Level Monitoring

Borehole	Depth of Well (m bgl)	Depth to Water (m bgl)
BH1	6.55	4.44
BH7	6.81	3.23
BH8	6.98	2.24
BH9	6.00	2.45
BH10	3.00	2.50
BH11	3.00	2.61

Groundwater is known to fluctuate due to local and regional factors including, but not limited to, irrigation, precipitation events, site topography, seasonal changes, well pumping, and periods of wet or dry weather. Therefore, subsurface water conditions at other times may be different from those described in this report.

3.2 GROUNDWATER ASSESSMENT

Field parameters were measured and recorded for groundwater during the first two Kleinfelder GMEs on-site in November 2022 and April 2023, **Table 3-3** summarises these results with detailed results provided in Appendix C.

Table 3-3: Groundwater field parameters

Location	Date	TEMP	DO	SC	TDS	PH	ORP	TURB
		deg C	ppm	uS/cm	mg/L	pH units	mV	NTU
BH1	23-Nov-22	21.1	1.65	420	273	5.71	118	--
	27-Apr-23	26.3	4.33	224.2	142	5.47	194	943.22
BH7	23-Nov-22	18	4.93	304	197	7.34	49	--
	27-Apr-23	19.0	3.00	244.7	179	4.87	158.6	220.12
BH8	23-Nov-22	18.6	2.71	300	195	5.82	112	--
	27-Apr-23	19.5	3.20	245.3	178	5.08	241.9	573.34

3.3 ADOPTED GUIDELINES

3.3.1 Human Health

3.3.1.1 NHMRC (2021) and NEMP (2020) – Australian Drinking Water Guidelines (recreational) and Human Health Guideline values (Recreational Water Quality)

The Australian Drinking Water Guidelines (ADWG) are intended to provide a framework for good management of drinking water supplies that assure safety at point of use. The provided guidance values are based on health-based and aesthetic quality of water. Groundwater at the site will not be extracted for drinking purposes during siteworks or in future site operation. In accordance with the approach recommended by NHMRC (2008) *Guidelines for Managing Risks in Recreational Water,* the ADWG criteria will be adopted for volatile compounds, to assess the risk of incidental ingestion for intrusive maintenance workers. For non-volatile compounds, the ADWG criteria will be adopted and adjusted by a factor of 10 to be applicable for incidental ingestion, as outlined in NHMRC 2008. For PFAS, the NHMRC Guidance on Per and Polyflouroalkyl substances in Recreational Water will be referred to.

The National Environment Protection Measures (NEMP) 2020 Per and Poly-Fluoroalkyl Substances are intended to provide a framework in relation to recreational use of waters as recommended by NHRMC 2019. The NEMP 2020 guidelines will be adopted as criteria for PFAS compounds relating to recreational use of waters when they are potentially used off-site.

3.3.2 Ecological

To assess the potential risk to ecological receptors at the point of groundwater discharge, laboratory results from this assessment will be compared to the *Australian and New Zealand and Australian States and Territories (ANZAST) 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines* (ANZG). The ANZG refers to the *Australian and New Zealand Environment and Conservation Council (ANZECC) 2000* guidelines and presents default guideline values (DGV's) for assessing water quality to ecological receptors. Different levels of species protection are applied according to the current or desired ecosystem condition and associated level of protection.

Based on the environmental setting of the Site, determined in **Section 2** of the Kleinfelder DSI SAQP, the ANZG DGVs for slight to moderately disturbed ecosystems have been adopted, considered to be protective of Brisbane Water (*ANZECC 2000*).

A summary of the adopted soil and groundwater guideline values is presented in **Tables T3-T10 in Appendix C**.

3.4 Groundwater Gauging and Hydrocarbon Observations

Three groundwater monitoring wells were installed during the time of the soil investigation. Stabilised groundwater levels were measured for wells BH1, BH7 and BH8 (4.4, 3.2 & 2.4mbTOC respectively). PID headspace readings did not identify any volatiles within the groundwater wells.

3.5 Geochemical Parameters

Geochemical parameters recorded during the investigation are presented in **Tables T3-T10, Appendix C**. The geochemical parameters indicate the following:

- Groundwater ranges presented in **Table 3-3** above from pH 7.34 (BH7) to 4.81 (BH7) with an average pH of 5.08 indicating slightly acidic groundwater conditions.
- Electrical conductivity ranged from 224.2 µs/cm (BH1) to 420 µs/cm (BH1), indicating groundwater is fresh.

3.6 Analytical Results

Six groundwater samples have been submitted for analysis as part of two GMEs. Analytical results obtained during the investigations are presented in **Tables T3-T10**, **Appendix C** compared to the adopted assessment criteria presented in **Section 3.3** Analytical results identified that BTEXN, TRH, PAH, Heavy Metals (Copper, Nickel and Zinc), and PFAS analytes were detected above the LOR. A total of 6 heavy metal results exceeded the ANZG 95% Freshwater criteria. One sample exceeded the PFAS NEMP 2020 Freshwater 99% limit for PFOS in groundwater from BH8.

3.7 Groundwater

Phase Separated Hydrocarbons & Sensory Observations

Phase Separated Hydrocarbons (PSH) are hydrocarbon contamination present on the surface (light aqueous phase) or beneath the base (dense aqueous phase) of the water column. No measurable PSH were detected during Kleinfelder GMEs on-site. However, a moderate hydrocarbon odour was noted in BH7 during field works during two consecutive GMEs.

Human Health and Environmental Criteria

Aromatic hydrocarbons and heavy metals were detected in groundwater samples analysed. Groundwater analytical results with concentrations above the LOR are summarised below:

- BTEX were detected in BH7 groundwater well samples during the past two GMEs. Concentrations of Benzene exceed the NHMRC Recreational Water criteria of 10µg/L during the April GME, whilst Naphthalene concentrations exceeded the ANZG 2018 Freshwater 95% Level Of Species Protection (LOSP). Remaining BTEX concentrations were below the ANZG 2018 Freshwater 95% criteria which have been selected as the most appropriate criteria.
- Concentrations of Copper exceed the ANZG 2018 Freshwater 95% criteria in one sample.
- Concentrations of Nickel exceed the ANZG 2018 Freshwater 95% criteria in one sample.
- Concentrations of Zinc exceed the ANZG 2018 Freshwater 95% criteria in all three samples.
- PFAS concentrations of PFOS and PFOA were detected in two samples at BH8. The concentrations of PFOS exceeded the PFAS NEMP 2020 Freshwater 99% limit during both GMEs. PFAS concentrations did not exceed the NHRMC criteria for recreational waters.
- PAH concentrations of Naphthalene and Acenaphthene were detected above LOR at BH7, with the April GME results exceeding the ANZG 2018 Freshwater 95% LOSP criteria for Naphthalene.
- TRH and TPH concentrations were detected above LOR in groundwater samples from BH7 during both GMEs. These results do not exceed adopted criteria on-site.
- The pH value of the groundwater from all wells was below the range considered appropriate (6.5-8.5) for recreational waters by NHMRC.

Concentrations Organophosphorus & Organochlorine pesticides & Polychlorinated Biphenyls were not reported above the LOR.

3.8 Groundwater Abstraction Bores

A registered groundwater bore search was performed by Land Insight. The search identified 48 licensed groundwater bores within a 2 km radius of the Site, with the majority greater than 1 km distance. Most of the bores are located in two main clusters, the largest cluster of 16 bores being approximately 1.1 km north of the Site, and the smaller cluster of six located approximately 1.4 km west (neither of which is down gradient of the Site with respect to groundwater). Most bores were licensed for monitoring purposes (30) or town water supply (4) and installed at depths ranging from approximately 40 to 200 mbgl and are therefore unlikely to extract groundwater from the shallow aquifer that may be impacted by dewatering at the Site. Further details are included in the Central Coast Campus, DSI (KLF, 2022)

3.9 Dewatering During Construction Activities

Based on the minor recorded exceedances of ANZG Freshwater criteria for three heavy metals, PFOS, PAH and BTEXN concentrations, which exceed the adopted criteria presented in **Section 3.3,** and the presence of acidic soils on site, groundwater extracted during any dewatering activities conducted during construction is not considered suitable for discharge to the stormwater network without pre-treatment. Prior approval will need to be sought from the local water authority to discharge to the sewer network, or potentially, water may need to be pumped, possibly stored and treated on-site prior to discharge. Given the prevailing water quality, contaminant concentrations may pose an issue with respect to gaining approval to discharge to the sewer network without treatment, if that is determined to be the most appropriate method of water discharge during construction. Alternatively, discharge water could be stored locally and removed from site by tanker to an appropriately licensed waste disposal facility.

The stages of excavation, dewatering and treatment is presented in the table below:

Table 3-4: Work Stages for Excavation and Dewatering Activities

Activity	Start Date	Finish Date
Construction of Piling and Shoring System	Early March 2024	Early April 2024
Excavation of Basement Site	Mid-March 2024	Mid April 2024
Construction Activities at Basement Level	Mid June 2024	Mid August 2024
Total Excavation Volume	3,420m^3	
Total Treated Groundwater	Up to 122,430 l	
End of dewatering	Late August 2024	

4 DISCHARGE WATER QUALITY GUIDELINES

The current Central Coast Councils Liquid Trade Wastes Acceptance Limits (LTWALs), are provided in Appendix D and are summarised in **Table 4-1, Table 4-2 & Table 4-3** below. On review of the LTWALs it is apparent that the groundwater will potentially not be suitable for discharge to sewer systems without pre-treatment, as pH is generally found to be less than 7.0, Benzene at BH7 was reported greater than 0.001 and concentrations of PFAS, which are prohibited, were reported above LOR at BH1. It should be noted, however, that this assessment is based on well samples only, which are noted to be variable in quality. The chemistry of the dewatering returns is not currently known but would be influenced by seepage rates and locations within the excavation and the prevailing chemistry in those areas. Hence, the chemistry of extracted water would not be akin to that of any single borehole and would represent a mixture of observed chemistries in the wells, with the contribution from individual areas not yet known. Consequently, it would be premature to assume that all the contaminants exceeding LTWALs would be present at those concentrations in the extracted water. It is, however, likely that the pH of extracted waters would require correction prior to sewer disposal if this was arranged.

4.1 ACCEPTANCE LIMITS

4.1.1 General Acceptance Limits

Table 4-1: General Acceptance Limits

Parameter	Limits
Flow rate	The maximum daily and instantaneous rate of discharge (kL/h or L/s) is set on the available capacity of the sewer. Large dischargers are required to provide a balancing tank to even out the load on the sewerage works.
BOD_5 and suspended solids	Normally, approved at 300 mg/L for each of the parameters. Concentration up to 600 mg/L May be accepted
COD	Normally, not to exceed BOD_5 by more than three times the concentration limit. This ratio is given as a guide only, to prevent the discharge of non-biodegradable waste.
Total dissolved solids	Up to 4000 mg/L may be accepted. Acceptance limits may be reduced depending on available effluent disposal options and will be subject to a mass load limit.
Temperature	Less than 38ºC
pH	Within the range of 7.0 to 9.0
Oil and Grease	100 mg/L if the volume of the discharge does not exceed 10% of the design capacity of the treatment works, and 50 mg/L if the volume is greater than 10%.
Detergents	All industrial detergents are to be biodegradable. A limit on the concentration of 50 mg/L (as MBAS) may be imposed on large liquid trade wastes.
Colour	Colour must be biodegradable. No visible colour when diluted to the equivalent dilution afforded by domestic sewage flow. Specific limits may be imposed on industrial discharges where colour has a potential to interfere with sewerage treatment processes and the effluent management.
Radioactive substances	If expected to be present (e.g Iodine 131 from ablation), acceptance requirements will be set on a case-by-case assessment.
PFOS and PFOA	Prohibited

4.1.2 Inorganic and Organic Contaminants

Table 4-2: Inorganic and Organic Contaminants Acceptance Limits

Inorganic compounds		Organic compounds	
Parameter	**Maximum concentration (mg/L)**	**Parameter**	**Maximum concentration (mg/L)**
Ammonia (as N)	50	Benzene	<0.001
Boron	5	Toluene	0.5
Bromine	5	Ethylbenzene	1
Chlorine	10	Xylene	1
Cyanide	1	Formaldehyde	30
Fluoride	30	Phenolic compounds (except pentachlorophenol)	
Nitrogen (total Kjeldahl)	100	Petroleum hydrocarbons 1. C6-C9 (flammable) 2. Total Recoverable Hydrocarbons (TRH)	 5 30
Phosphorus (total)	20	Pesticides general (except organochlorine and organophosphorus)	0.1
Sulphate (as SO_4)	500	Polynuclear aromatic hydrocarbons (PAHs)	5
Sulphide (as S)	1		

4.1.3 Metals

Table 4-3: Metals Acceptance Limits

Parameter	Maximum Concentration (mg/L)	Allowed daily mass limits (g/d)
Aluminium	100	-
Arsenic	0.5	2
Cadmium	1	5
Chromium*	3	10
Cobalt	5	15
Copper	5	15
Iron	100	-
Lead	1	5
Manganese	10	30
Mercury	0.01	0.05
Molybdenum	5	15
Nickel	1	5
Selenium	1	5
Silver#	2	5
Tin	5	15
Zinc	1	5
Total metals excluding aluminium, iron, manganese and molybdenum		Less than 30mg/L and subject to total mass loading requirements

5 DEWATERING CONDITIONS AND CONTROLS

5.1 ESTIMATED GROUNDWATER VOLUMES

Falling head permeability testing has been undertaken in monitoring wells installed in four boreholes, BH1, BH9, BH10 and BH11. The maximum recorded permeability values for each well are shown in **Table 5-1** below.

Table 5-1: Groundwater Level Monitoring

Monitoring Well	Maximum Recorded Permeability k (m/s)
BH1	1.4×10^{-8}
BH9	5.7×10^{-9}
BH10	1.2×10^{-8}
BH11	2.5×10^{-8}

A value of 2.5×10^{-8} has been adopted to calculate the estimated groundwater volume.

The cut for the retaining wall will be along the eastern and southern boundaries (See **Figure 1-1**) and the depth of cut is approximately 5m at the south-east corner of the building decreasing to 0m after 50m along both the boundaries. To allow for seasonal variation we have allowed for a maximum groundwater level of 2m bgl in the area of the wall. Therefore, the seepage area will be $45m^2$ of walls along both boundaries and potentially $450m^2$ of floor, a total of $540m^2$ this will result in a maximum inflow of $1.35x10^{-5}m^3/s$ or 1166L/day.

It is anticipated that the cut will be open for no longer than 3 months, so the maximum volume of groundwater-derived water to be disposed of during construction is likely to be approximately 104,976L or 0.105ML. It is noted that rainwater accumulation during this period will contribute additional volumes.

A Water Access Licence (WAL) is required for groundwater take above 3ML/year. If the take is less than or equal to 3ML of water per year for any aquifer interference activities listed in Clause 7 of Schedule 4 of the Water Management (General) Regulation 2018, an exemption may apply.

Under the exemption, a person can take up to 3 megalitres of groundwater through an aquifer interference activity per authorised project per water year without needing to obtain a WAL. DPE Water notes that there are requirements for an exemption, including:

- The water is not taken primarily for consumption or supply.
- The person claiming the exemption keeps a record of the water taken under the exemption and provides this to the Minister within 28 days of the end of the water year.
- The records are kept for 5 years.

As the expected take is less than 3ML/year, the project team should apply for a WAL exemption. Further information and an application for a WAL exemption is located at https://water.dpie.nsw.gov.au/licensing-and-trade/licensing/groundwater-wal-exemptions.

5.2 DEWATERING METHOD

Due to the geology of the site (clays) and the low seepage volumes it is anticipated that the dewatering will be undertaken by the sump and pump method, where water is collected in an excavated sump and/or tank and treated for contamination before being periodically pumped to sewer or tankered off site for disposal as appropriate.

Based on the current design, the assumed shoring approach for the excavation is contiguous bored pile walls with shotcrete facing, which should stabilise the exposed surfaces of the bulk excavation. It is expected, therefore, that the dewatering system will operate until the shored area is effectively drained. All contaminated extracted water resulting from the dewatering process will require treatment before discharging into a Council sewer pit and only following approval for discharge by Council is obtained. If this is not possible, impacted water should be tankered off-site to an appropriately licensed disposal facility.

With proper design and construction, the chosen shoring method is capable of retaining water in deep excavations. It should provide a relatively impermeable barrier, significantly reducing the rate of groundwater seepage into the excavation.

A fully tanked basement is to be adopted for the development. As such, permanent dewatering should not be required from within the completed basement.

5.3 Groundwater Drawdown Impacts

Most bores within 2km of the site were licenced for monitoring purposes (30) or town water supply (4) and installed at depths ranging from approximately 40 to 200 mbgl and are therefore unlikely to extract groundwater from the shallow aquifer that may be impacted by any drawdown of water due to dewatering at the site.

In specific cases, dewatering may induce ground subsidence on neighbouring properties due to the associated increase in vertical effective stress in the ground. It is beyond the scope of this DMP to assess the risk on neighbouring properties associated with ground settlement. It is recommended that a dilapidation report is completed by a suitably qualified engineer before the start of the construction works and following the completion of construction and the restoration of groundwater levels.

5.4 Water Quality Treatment

Treatment is necessary for the water extracted during dewatering. This is due to detected levels of pH, metals, PFAS, PAH and BTEXN. The extracted water is required to be monitored for any exceedance of contaminants prior to discharge to the sewerage system. The selection and design of the preferred treatment system would benefit from a bench trial by a specialist treatment contractor appointed by the project team and implemented by the Contractor.

The Central Coast Council Liquid Trade Waste, acceptance limits and prohibited substances, provided in Appendix D, states:

"Where an existing liquid trade waste discharge and the quality or volume does not meet Council's acceptance limits, the applicant is required to submit an 'Effluent Improvement Program' setting out how Council's requirements will be met. The Effluent Improvement Program must detail the methods and actions proposed to achieve the acceptance limits, and a timetable for implementation of the proposed actions."

As per discussion with the Contractor, a treatment facility is considered to treat the extracted water prior to discharge (A typical facility is presented in Figure 10).

The dewatering activity will include sump and pump system where a sump is excavated at the basement floor level and a submersible pump is used to discharge the water away from the working area. As per calculation shown in Section 5.1 the maximum discharge from the excavation is expected to be 1166L/day (0.013 Lit/Sec). A typical treatment unit has a storage capacity of 15,000 litres and is capable of treating water at a minimum rate of 1 Lit/Sec. As a redundancy if the treatment system stops working the facility has the capacity to store the water extracted for 10 days based on the calculated seepage rate. This is sufficient time to transport the discharged water into an approved facility if treatment onsite is not possible.

Figure 5-1: Typical Treatment Facility

5.5 GROUNDWATER QUALITY MONITORING REQUIREMENTS

To assess the ongoing suitability of extracted water for discharging to the municipal sewer system, water quality monitoring will be undertaken prior to commencement and for the duration of dewatering activities at the site. Ongoing monitoring is also required to ensure the treatment system (if any) is functioning as intended and confirm the quality of discharged water is within acceptable ranges.

The following frequency and methodology of sampling is proposed for the groundwater monitoring to be conducted at this site:

- Initial Assessment: An initial round of sampling must be conducted before the beginning of excavation. The collected groundwater sample should be a composite of all the boreholes in the excavation area and shall be tested for the target quality parameters listed in **Section 4** (as a minimum), to establish baseline (initial) conditions. An assessment against the proposed discharge water quality requirements will then be conducted. Should deviations from the adopted discharge criteria be technically justifiable, approval from Council must be sought to allow any adoption of alternative discharge criteria.
- With a regular monitoring regime, subject to statutory authority approval, treated water may be discharged directly to the sewer system or removed from site. The monitoring period should be reflective of the variability of the extracted water quality. Following confirmatory analysis to prove the effectiveness of any treatment methodology in producing a consistent water quality, a weekly sampling frequency should be adopted. It may be necessary to adjust sampling frequency depending upon the volume of temporary storage available (if used), fill rate and disposal frequency i.e., sample from tanks when filled and ready for disposal. The sampling program will comprise a minimum of three effluent (i.e., treated) samples, tested for the target parameters to confirm the system is functioning as intended. The weekly sampling frequency should be maintained for the duration of the discharge period, provided the analytical results indicate the treated water quality meets the adopted discharge criteria or risks are considered to be significantly low. Depending on the discharge water quality and the selected treatment method it may be possible to treat water in-line, without large temporary storage, e.g., pH dosing. In such an instance in-line monitoring would be prudent, with automated discharge controls linked to contaminant levels. The dewatering contingency measures described in **Section 5.7** should be adopted if exceedances to the adopted criteria are reported.

If the analytical results from the Initial Assessment indicate that groundwater treatment is not required, then monitoring of discharge should continue on a weekly basis as described above to ensure chemical concentrations remain within discharge parameters.

All laboratory analytical results for the groundwater samples must be documented and maintained by the appointed Contractor, for inspection upon request by Council. The contractor should seek advice from an appropriately qualified environmental consultant prior to deviating from any of the above monitoring requirements.

The water quality monitoring must be certified by an experienced and qualified consultant. The consultant is to review all testing samples and confirm (in writing) that the water quality meets the required standards. If testing establishes that the discharge standards are not met, release to the sewer system is to stop immediately and the procedures described in **Section 5.7** implemented.

The Site Manager should seek advice from the water quality consultant prior to deviating from the agreed monitoring program, to ensure the quality of discharged groundwater is not compromised. Once the Site Manager and Consultant have been appointed, their names and contact information are to be clearly displayed in the site office.

Summary of Specific Activities

The appointed contractor and/or Site Manager will be responsible for ensuring that the following activities (requirements) are undertaken during the dewatering program:

- Maintain erosion and sediment control measures in a functioning condition, until all earthwork activities are completed.
- Perform daily visual inspection of stormwater diversions and sediment / erosion control devices, ensuring they are operating effectively and at full capacity.
- Implement appropriate remedial measures where any controls or devices are not functioning effectively or are inappropriate.
- Collate records and comments on the condition of existing erosion and run-off controls (drains, silt fences, catch drains etc.), dewatering procedures and test results, and any site instructions issued to sub-contractors to undertake remedial works.
- Maintain rainfall data (to be filed on site).
- Confirm water quality parameters meet the relevant discharge limits, by disclosing supporting documentation upon request.
- Maintain a record of the amount of water taken and provide these records to the Department of Planning and Environment within 28 days of the end of the water year.
- Keep the records for 5 years.
- Reporting any incidents of poor drainage or uncontrolled discharge.
- Recording all daily inspection reports, environmental incidents and controlled discharge volumes, which may be reviewed during any environmental audit performed on the site.

5.6 Vibration, Noise and Odour Management

The following vibration, noise and odour risks must not occur during dewatering:

- Excessive vibration and noise levels associated with site plant / dewatering equipment; and
- Odours released from collected groundwater, which may pose a risk to human health and/or the aesthetic condition of the environment.

It is the responsibility of the Site Manager to ensure appropriate management of vibration, noise and odour during dewatering operations. Appropriate management methodologies include:

- Undertaking dilapidation surveys of neighbouring buildings.
- All sub-contractors to work only within defined hours set by the DA conditions.
- All reasonable steps shall be taken to muffle and acoustically baffle plant and equipment exceeding applicable noise limits. Noise and vibration levels generated by site works must be within the limits set by the DA conditions, the site-specific environmental management plan and the Protection of Environmental Operation Act 1997.
- Give consideration to the noise emission from plant/equipment prior to its selection/mobilisation to site.

- Schedule the use of noisy equipment at the least-sensitive time of day.
- Situate noisy equipment at the greatest distance from the noise-sensitive area or orient the equipment so that noise emissions are directed away from sensitive areas, to achieve the maximum attenuation of noise.
- Where there are several noisy pieces of equipment, schedule operations to minimise cumulative impacts.
- Keep equipment well maintained.
- Ensure engine shrouds (acoustic linings) are installed (where feasible).

5.7 DEWATERING CONTINGENCIES

It is anticipated that the proposed dewatering strategy will be effective; however, contingent actions are required should the scenarios detailed in **Table 5-1** arise.

Table 5-1: Mitigation Measures for Potential Dewatering Issues

Anticipated Problems	Corrective/Preventive Actions
During the Monitoring Period (weekly), quality of treated water does not satisfy the adopted discharge criteria outlined in **Section Due to water deterioration or insufficient treatment.**	Discharge to the sewer system must be suspended. Extracted water should be retained onsite and stored in appropriate tanks for further on-site treatment and sampling by an environmental consultant until it is proven to meet the adopted discharge criteria. The water treatment design must include suitable storage, with sufficient capacity, to be used if such conditions arise. Capacity should be sufficient to receive dewatering inputs during the period of additional analysis and treatment adjustment. Alternatively, should a trade waste application be in place, groundwater will be discharged under the license agreement. Additionally, the onsite treatment system issues should be diagnosed and adjusted. A higher frequency of treated, exit water sampling will be necessary initially, to achieve the designed treatment goals.
Failure of treatment system or storage tanks/bunding, causing release of untreated water.	Immediate suspension of treatment plant and discharge. Temporary storage tank capacity should be available to receive ongoing discharge, assuming the dewatering system cannot be shut off. Leaking tank contents should be decanted to additional storage or tinkered from site to an appropriately licensed discharge facility. Similarly, tinkering off site should be arranged if the treatment system fails with limited storage available. Bunding should be in place around storage areas to contain potential spills or leaks to ensure contaminated water is not released off-site. Regular, documented tank and bund inspections should take place. Remediation and cleanup of spills shall be conducted with released untreated water contained collected and returned to the treatment system once repaired.
Visual and / or olfactory anomalies (e.g., change in water colour, turbidity, odour, presence of oil / grease) are observed in extracted groundwater.	The onsite treatment system should be diagnosed and adjusted. The contractor is to seek advice from environmental consultant in regard to any additional assessment and treatment that may be required. Additionally, should trade waste application be in place, groundwater will be discharged under the license agreement, subject to discharge criteria being met.
Chemical/ fuel spill and leaks from machinery	Stop earthworks, notify site project manager. Use accessible soil or appropriate absorbent material to absorb the spill (if practicable). Stockpile the impacted material in a secure location, on builder's plastic to avoid cross contamination. Inspect groundwater and note any visual and/or changes. The contractor should also seek advice from the environmental consultant regarding the additional assessment and treatment that may be required.

Anticipated Problems	Corrective/Preventive Actions
Excessive rainfall	Ensure sediment and surface water controls are in place and functioning as intended, as per the designs provided in the site-specific Soil and Water Management Plan. Any non-conformance is to be documented and rectified. The capacity of the dewatering system to dispose of larger volumes of water should be evaluated and if required, a temporary system or increased storage should be utilised following correspondence with Council/ Water NSW and the environmental consultant.
Excessive noise	Identify the source and isolate if possible. Modify the actions of the source or erect temporary noise barriers if required.
Excessive organic odours / vapours	In accordance with Council's Contaminated Land Policy, no nuisance odours are to be detected at any site boundary during the dewatering stage. Primary odour monitoring at storage tanks or other high emissions sources should be conducted to reduce risk of site boundary odour emissions breaches. Should odour emissions be detected at a site boundary, the following measures will be implemented: 1. Stop work, to allow odour to subside. 2. Monitor ambient air across the site and boundaries with a portable photo-ionisation detector (PID), a LEL meter (LEL) and a landfill gas analyser (LGA). 3. Implement control measures, including respirators for on-site workers, use of odour suppressants and wetting down of excavated material. 4. If any occupants of adjoining premises raise issues regarding odour, these should be investigated. Notification should be in writing, providing the contact details of the responsible site personnel. 5. Record logs for volatile emissions and odours.
Perceived impacts on the stability of adjacent structures	Contractor to seek advice from qualified professional (such as a geotechnical and/or structural consultant) in regard to the additional assessment and monitoring that may be required.
Complaint management	Notify Client, Project Managers and Environmental Consultant (if required) following complaint. Report and log complaint as per management procedures. Implement control measures to address reason of complaint (if possible). Notify complainant of results of remedial actions.

6 CONCLUSIONS

Due to the geology of the site (clays) and the low seepage volumes expected, it is anticipated that the dewatering will be undertaken by the sump and pump method, where water is collected in an excavated sump and/or tank for contamination treatment within an on-site treatment plant and periodically pumped to sewer or tankered off site for disposal as deemed appropriate after consultation with Central Coast Council regarding Trade waste Acceptance Limits and other appropriate guidelines.

Dewatering at the site can expect a maximum inflow of up to $1.35x10^{-5}m^3/s$ or 1166L/day, it is anticipated that the cut will be open for no longer than 3 months, so the maximum volume of water to be disposed of during construction is likely to be approximately 104,976L or 0.105ML. As the expected take is less than 3ML/year, the project team should apply for a WAL exemption. The extracted groundwater requires treatment on-site to adjust pH and reduce concentrations of contaminates of PAHs, metals, BETXN and PFAS to allow disposal to sewer, subject to a trade waste agreement being in place with Council. A medial filtration system is capable of treating this volume onsite and provide contingency for storage of water to be tankered off site for disposal.

Most bores within 2km of the site were licensed for monitoring purposes (30) or town water supply (4) and installed at depths ranging from approximately 40 to 200 mbgl and are therefore unlikely to extract groundwater from the shallow aquifer that may be impacted by any drawdown of water due to dewatering at the site.

Section 5 Details dewatering considerations and controls that must be adhered to in order to adequately control the risks to the Site and surrounding areas.

It is considered that the dewatering during construction at the Site should have minimal impact on the shallow aquifer from which water is to be abstracted.

7 REFERENCES

- Kleinfelder, Central Coast Campus Geotechnical Investigation Report, 305 Mann Street Gosford, NCA22R147463, December 2022
- Kleinfelder, Central Coast Campus - Detailed Site Investigation, 305 Mann Street, Gosford NSW, NCA22R14011, December 2022
- Australian Standard – AS 1726-2017 Geotechnical Site Investigation.
- State Significant Development Application (SSD-47749715) 305 Mann Street Gosford
- NSW Acid Sulfate Soil Assessment Guidelines 1998
- Contaminated Land Management Act 1997 (the CLM Act 1997)
- Protection of the Environment Operations Act 1997
- Environmental Planning and Assessment Act 1979 in particular
- State Environmental Planning Policy 55 - Remediation of Land
- State Environmental Planning Policy (Precincts Regional) 2021 Pt 5.8 Gosford City Centre
- NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 1999
- Water Management Act 2000, NSW Government
- Water Management (General) Regulation 2018, NSW Government
- NSW Aquifer Interference Policy, NSW Government
- NSW DPIE (2021) Minimum requirements for building site groundwater investigations and reporting, Information for developers and consultants
- Proposed Residential & Commercial Redevelopment, Lots 1, 2, 4, 29-32 Section 1 In Dp1591, Lot 1 In Dp911163 & Lot 1 In Dp911164, Corner of Mann & Beane Streets, Gosford, Stage 2 Contamination Assessment, Report No 10060/1-Ac, 6 February 2004, Geotechnique.
- Preliminary, Site Investigation Report, 305 Mann Street, Gosford, SMEC 2016
- NHMRC (2021) – Australian Drinking Water Guidelines (recreational)
- ASC NEPM (2013) and CRC Care (2011) – Health Screening Levels (HSLs) for Petroleum Hydrocarbons
- Australian and New Zealand and Australian States and Territories (ANZAST) 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines (ANZG).
- Central Coast Councils Liquid Trade Waste Acceptance Limits

APPENDIX A – FIGURES

The information included on tihs graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timelines or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

Legend

- Site boundary
- New Bore Hole Locations
- Bore Hole Locations

N

0 10 20 30 40 m

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Project Reference: 20232408.005

Date Drawn: 09/05/2023

Drawn by: M. Mathews

Data Source: NSW Public Imagery

Site Layout

University of Newcastle
305 Mann Street
Gosford NSW 2250

Figure:

1

APPENDIX B – BOREHOLE LOGS

ROCK CORING LOG BH1

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

FIELD EXPLORATION | MONITORING WELL CONSTRUCTION

Surface Condition: Asphalt

Completion Method: Flush mount cap in concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Lithologic Description
0							FILL: **CONCRETE**: grey, no odour, no staining
							FILL: **Sandy CLAY with Gravel**: coarse sand, subrounded gravel, subrounded sand, low to medium plasticity, dark gray, no odour, moist, soft, no staining
			BH2_0.5		0		**CLAY with Silt**: high plasticity, orangish red, no odour, moist to wet, stiff to very stiff, no staining
1			BH2_1.0		0		**Sandy CLAY**: coarse sand, subrounded sand, low to medium plasticity, yellow to white, no odour, dry to moist, medium to stiff, no staining
2			BH2_2.0		0		
	Continuous Flight Auger						**Silty CLAY**: low plasticity, red to white, no odour, dry, very stiff, no staining
3							
4 ▽							
							Completely Weathered SILTSTONE: brown to reddish white, no odour, very stiff, no staining
5							**Completely Weathered SILTSTONE**: red to yellowish white, no odour, very stiff, no staining
6	Coring						
7							

Bentonite / Neat Cement Grout
2" SCH 40 Solid PVC Riser
Bentonite Chips
20/40 Sand Pack
2" SCH 40 Slotted 0.010 PVC Pipe
Bentonite Chips

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PROJECT NO.: 20232408.001A

DRAWN BY: AK

CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH1

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	18/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH2

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Asphalt Lithologic Description
							FILL: **ASPHALT**: grey
							FILL: **Sandy GRAVEL**: coarse gravel, subangular gravel, subangular sand, low plasticity, dark grey, dry to moist
	Continuous Flight Auger		BH2_0.5		0		**Clayey SAND**: coarse sand, subangular to subrounded sand, non-plastic to low plasticity, light grey, moist, loose
1			BH2_1.0		0		
							CLAY with Sand: coarse sand, subangular to subrounded sand, low to medium plasticity, yellow, moist
2							
							CLAY: low plasticity, grey, moist, very soft
							CLAY: medium to high plasticity, orangish red, dry to moist, firm to stiff
3			BH2_3.0		0		
							CLAY with Sand: coarse sand, subrounded sand, low to medium plasticity, orangish red, wet, firm
4							**CLAY with Sand**: coarse sand, subrounded sand, low to medium plasticity, grey, moist, firm
							CLAY: medium to high plasticity, orangish red, dry to moist, stiff
5							
6	Coring						
7							

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PROJECT NO.: 20232408.001A

DRAWN BY: AK

CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH2

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH3

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Asphalt Lithologic Description
							FILL: **ASPHALT**: grey, dry
							FILL: **Sandy CLAY**: coarse sand, subangular sand, low plasticity, yellowish brown, moist, soft
			BH3_0.5		0		
							CLAY: medium to high plasticity, reddish brown, dry to moist, firm to stiff
1			BH3_1.1		0		
2							
▽							
			BH3_2.6		0		NOTE: Density change @2.5m, stiff with low plasticity. Iron oxide staining
3	Continuous Flight Auger						
4							NOTE: Density change @4m, medium very stiff.
5							**Silty CLAY**: low plasticity, white, dry, very stiff
6							
7	Coring						

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CHECKED BY:	DK
DATE:	15/11/22

ROCK CORING LOG BH3

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	17/10/22	**Drilling Company:**	Tucker Environmental	**SAMPLE LOG BH4**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column	
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.	

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Asphalt Lithologic Description
							FILL: **CONCRETE**: grey
			BH4_0.2		0		FILL: **Gravelly SAND**: coarse sand, subangular to subrounded gravel, subangular to subrounded sand, yellow, dry to moist
			BH4_0.5		0		FILL: **Silty SAND**: coarse sand, angular to subangular sand, low plasticity, black, dry to moist, loose
1			BH4_1.0		0		**Silty CLAY**: medium to coarse sand, low to medium plasticity, black, moist, soft
							Clayey SAND: coarse sand, subrounded sand, low plasticity, dark grey, moist, soft
2			BH4_2.0		0		**CLAY with Sand**: coarse sand, subrounded sand, medium to high plasticity, yellowish brown, moist, firm
3							
▽							Note: No sand and moisture change to wet @3.5m
4	Continuous Flight Auger						
5							
6							Note: Colour change to light grey at 5.9m to 6.1m Note: Colour change to reddish orange @6.1m
7							
8							
9							
10							

The borehole was terminated because of practical auger refusal at approximately 9.6 m. below ground level on Bedrock.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 3.5 m. below ground surface during drilling.
GENERAL NOTES:
The sample was backfilled with auger cuttings.

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PROJECT NO.:	20232408.001A
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CHECKED BY:	DK
DATE:	15/11/22

SAMPLE LOG BH4

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	17/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.

SAMPLE LOG BH5

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Concrete / Lithologic Description
0	Continuous Flight Auger		BH5_0.2		0		FILL: **CONCRETE**: grey, dry, Note: Orange plastic layer at 0.15
							FILL: **GRAVEL**: fine to coarse gravel, subangular to subrounded gravel, low plasticity, grey, dry
			BH5_0.5		0		**Silty CLAY**: low to medium plasticity, dark grey, moist, soft to firm
1			BH5_1.0		0		**Sandy CLAY**: fine to medium sand, subangular to subrounded sand, medium plasticity, grey, moist to wet, soft to firm
2			BH5_1.9		0		**CLAY**: medium plasticity, yellowish grey, moist to wet, soft to firm
							CLAY: high plasticity, orangish red, dry to moist, firm to stiff
3							
▽							Note: Moisture change to wet @3.5m
4							
5							
6							
7							
							CLAY: high plasticity, greyish white, wet, firm to stiff
8							
9							

The borehole was terminated because of practical auger refusal at approximately 8.3 m. below ground level on Bedrock.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 3.5 m. below ground surface during drilling.
GENERAL NOTES:
The sample was backfilled with auger cuttings.

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PROJECT NO.: 20232408.001A
DRAWN BY: AK
CHECKED BY: DK
DATE: 15/11/22

SAMPLE LOG BH5

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	21/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.

SAMPLE LOG BH6

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description
0	Continuous Flight Auger						FILL: **CONCRETE**: grey, dry
							FILL: **Sandy CLAY**: subrounded sand, low plasticity, yellow
			BH6_0.5		0		FILL: **Silty SAND**: low plasticity, dark grey, loose
1			BH6_1.0		0		**CLAY with Sand**: subrounded sand, low to medium plasticity, yellowish orange, soft to firm
2							**CLAY**: medium plasticity, orangish red, stiff
3							**CLAY with Silt**: medium to high plasticity, pinkish white, stiff to very stiff, iron oxide staining
4			BH6_4.0		0		Note: Band of Ironstone @ 4.2-4.25m.
5							
6							
7							
8							
9							

The borehole was terminated because of practical auger refusal at approximately 4.5 m. below ground level on Bedrock.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The sample was backfilled with auger cuttings.

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PROJECT NO.: 20232408.001A

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CHECKED BY: DK

DATE: 15/11/22

SAMPLE LOG BH6

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	21/10/22	**Drilling Company:**	Tucker Environmental	**MONITORING WELL LOG BH7**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column	
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.	

FIELD EXPLORATION | MONITORING WELL CONSTRUCTION

Surface Condition: Concrete

Completion Method: Flush mount cap in concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Lithologic Description
0	Continuous Flight Auger						FILL: grey
							FILL: **Gravelly SAND**: coarse sand, subangular to subrounded gravel, subangular to subrounded sand, grey, dry
			BH7_0.5		0		
1			BH7_1.0		0		**Silty CLAY with Sand**: coarse sand, subrounded sand, low plasticity, dark brown, dry to moist, very soft to soft
							Sandy CLAY: coarse sand, subrounded sand, low plasticity, yellowish brown, moist, very soft to soft
2							**CLAY**: medium to high plasticity, reddish brown, moist, firm
3							Note: Stiff @3.0m
4			BH7_4.0		1.0		**CLAY**: high plasticity, white with reddish brown, moist, firm to stiff
5							**Weathered SILTSTONE**: low to medium plasticity, white, dry, very stiff
							Note: Fractured Ironstone layer @5.0-5.1m. Moist to wet
▽ 6			BH7_6.0		102.1		Note: Wet @5.9m, becoming hard @ 6.0m moderate hydrocarbon odour
7							
8							
9							

Bentonite / Neat Cement Grout

2" SCH 40 Solid PVC Riser

Bentonite Chips

20/40 Sand Pack

2" SCH 40 Slotted 0.010 PVC Pipe

The borehole was terminated because of practical auger refusal at approximately 7.3 m. below ground level on Bedrock.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 6 m. below ground surface during drilling.

GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 7.3 m.
Monitoring Well installed to a depth of 7.3m.

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MONITORING WELL LOG BH7

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	11/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

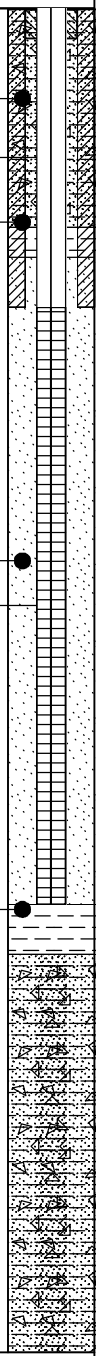
ROCK CORING LOG BH8

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description
0								FILL: **CONCRETE**
0.5			BH8_0.5		0			FILL: **SAND with Gravel**: coarse sand, sub-angular, yellow, dry, loose
1			BH8_1.0		0			**Sandy CLAY**: medium sand, rounded, low plasticity, dark grey, moist, very soft to soft
2			BH8_2.0		0			
3			BH8_3.0		0			Note: consistency change, firm to stiff @ 3.1-3.2m Note: Wet @ 3.2m
4			BH8_4.0		0			**CLAY with Sand**: high plasticity, reddish brown, dry to moist, very soft to soft
5			BH8_5.0		0			**SAND with Clay**: coarse sand, non-plastic to low plasticity, grey, dry to moist
6			BH8_6.0		0			**CLAY**: medium to high plasticity, red and brown, dry to moist, soft to medium Note: colour change to grey at 6.5m
11								**Weathered SILTSTONE**: high plasticity, red and white, dry, medium stiff
12								Note:White and Hard at 12.0m
13								

MONITORING WELL CONSTRUCTION

Completion Method:
Flush mount cap in concrete



KLEINFELDER
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PROJECT NO.:	20232408.001A
DRAWN BY:	JR
CHECKED BY:	DK
DATE:	15/11/22

ROCK CORING LOG BH8

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	11/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH8

FIELD EXPLORATION | MONITORING WELL CONSTRUCTION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description	Completion Method: Flush mount cap in concrete
14									
15									
16									
17									Bentonite / Neat Cement Grout
18									
19									
20									
21									
22									
23									
24									
25									
26									

The borehole was terminated at approximately 24.8 m. below ground level. Rock was encountered at a depth of 12.4 m. during this borehole. Coring started at a depth of 12.4 m.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 3 m. below ground surface during drilling.

GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 9 m.
The rock coring was backfilled with auger cuttings.

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PROJECT NO.: 20232408.001A

DRAWN BY: JR

CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH8

UON Gosford Campus
305 Mann Street
Gosford, NSW

HAND EXPLORATION LOG HA01

Date Begin - End:	18/10/22	**Drilling Company:**	Kleinfelder
Logged By:	A.King	**Drill Crew:**	A.King
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Cloud/Rain	**Auger Diameter:**	50 mm. O.D.

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Asphalt Lithologic Description
							FILL: **CONCRETE**: grey
	Hand Auger		HA01_0.3		0		FILL: **SAND**: coarse sand, subrounded sand, orange, dry, loose
1			HA01_1.4		0		**CLAY**: coarse sand, low plasticity, brown, moist, soft
							Silty SAND: coarse sand, subangular sand, low plasticity, greenish grey, dry to moist, very soft
2			HA01_2.0		0		

The borehole was terminated at approximately 2.1 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The hand exploration was backfilled with excavated material.

KLEINFELDER
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PROJECT NO.: 20232408.001A
DRAWN BY: AK
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DATE: 15/11/22

HAND EXPLORATION LOG HA01

UON Gosford Campus
305 Mann Street
Gosford, NSW

HAND EXPLORATION LOG HA02

Date Begin - End:	11/10/22	**Drilling Company:**	Kleinfelder
Logged By:	A.King	**Drill Crew:**	A.King
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Auger Diameter:**	50 mm. O.D.

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Concrete / Lithologic Description
							FILL: **CONCRETE**: grey, no odor, no staining
							FILL: **GRAVEL with Sand**: grey, no odor, dry, no staining
			BH8_0.3		0		
							CLAY: high plasticity, red to yellow, no odor, dry, stiff to very stiff, no staining
			BH8_0.6		0		
							Note: Consistency change to Hard @ 0.7m.
1			BH8_1.0		0		
2							The borehole was terminated at approximately 1.8 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The hand exploration was backfilled with auger cuttings.

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DATE: 15/11/22

HAND EXPLORATION LOG HA02

UON Gosford Campus
305 Mann Street
Gosford, NSW

HAND EXPLORATION LOG HA03

Date Begin - End:	18/10/22	**Drilling Company:**	Kleinfelder
Logged By:	A.King	**Drill Crew:**	A.King
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Cloud/Rain	**Auger Diameter:**	50 mm. O.D.

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Grass & Weeds Lithologic Description
			HA03_0.1		0		FILL: **Silty GRAVEL**: coarse gravel, subangular to subrounded gravel, dark grey, moist, loose, Brick chunks
			HA03_0.2		0		FILL: **Silty CLAY**: low to medium plasticity, dark grey, moist, soft
			HA03_0.3		0		FILL: **CLAY and Sand**: subangular to subrounded sand, medium plasticity, yellowish grey, moist, medium stiff
							FILL: **Sandy GRAVEL with Silt**: coarse gravel, subangular to subrounded gravel, subangular to subrounded sand, dark grey, moist, loose
							CLAY: medium to high plasticity, yellow, moist, soft to medium
			HA03_0.8		0		
1	Hand Auger						Note: colour change to reddish yellow, high plasticity, soft to very soft.
							CLAY: medium to high plasticity, pale red to grey, dry to moist, soft to medium
			HA03_0.9		0		
2							

The borehole was terminated at approximately 2 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The hand exploration was backfilled with excavated material.

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PROJECT NO.: 20232408.001A
DRAWN BY: AK
CHECKED BY: DK
DATE: 15/11/22

HAND EXPLORATION LOG HA03

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	18/10/22	**Drilling Company:**	Kleinfelder
Logged By:	A.King	**Drill Crew:**	A.King
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Cloud/Rain	**Auger Diameter:**	50 mm. O.D.

HAND EXPLORATION LOG HA04

FIELD EXPLORATION

Surface Condition: Concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Lithologic Description
							FILL: **ASPHALT**: grey
			HA04_0.3		0		FILL: **SAND**: coarse sand, subangular to subrounded sand, yellowish grey, wet, dense
							FILL: **SAND**: coarse sand, subangular to subrounded sand, dark grey, moist, loose
			HA04_0.8		0		FILL: **SAND**: coarse sand, subangular to subrounded sand, dark brown, dry, loose
1	Hand Auger						Note: Colour change to yellow @1m
							CLAY: medium plasticity, orangish red yellow, dry, medium stiff
2			HA04_2.0		0		

The borehole was terminated at approximately 2.1 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The hand exploration was backfilled with excavated material.

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PROJECT NO.: 20232408.001A
DRAWN BY: AK
CHECKED BY: DK
DATE: 15/11/22

HAND EXPLORATION LOG HA04

UON Gosford Campus
305 Mann Street
Gosford, NSW

HAND EXPLORATION LOG HA05

Date Begin - End:	11/10/22	**Drilling Company:**	Kleinfelder
Logged By:	A.King	**Drill Crew:**	A.King
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	See Drilling Method Column
Weather:	Overcast	**Auger Diameter:**	50 mm. O.D.

FIELD EXPLORATION

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description
							CONCRETE: grey, no odor, no staining
			BH8_0.3		0		**SAND with Gravel**: fine to coarse sand, sub-rounded, yellow, no odor, dry, loose, no staining
			BH8_0.7		0		**Silty CLAY**: low plasticity, grey, no odor, dry, soft, no staining Note: colour change to black @0.8m
1			BH8_1.5		0		**CLAY with Sand**: low to medium plasticity, yellow, no odor, moist, very soft to soft, no staining
							CLAY: medium plasticity, red, no odor, moist, soft to medium, no staining
2							

The borehole was terminated at approximately 2 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
Monitoring Well installed to a depth of 9.0m.

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PROJECT NO.: 20232408.001A
DRAWN BY: JR
CHECKED BY: DK
DATE: 15/11/22

HAND EXPLORATION LOG HA05

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	27/4/23	Drilling Company:	FICO Group
Logged By:	M. Mathews	Drill Crew:	Shaun
Hor.-Vert. Datum:	Not Available	Drilling Equipment:	Truck mounted drilling rig, FG101
Plunge:	-90 degrees	Drilling Method:	Continuous Flight Auger
Weather:	Clear, 23 deg C	Auger Diameter:	100 mm. O.D.

BORING LOG BH9

FIELD EXPLORATION | MONITORING WELL CONSTRUCTION

Surface Condition: Concrete

Completion Method: Flush mount cap in concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	FID (ppmv)	Graphical Log	Lithologic Description
0								CONCRETE
								Silty CLAY with Sand (CH): high plasticity, dark brown to dark grey, fine subangular to rounded sand, moist
1								CLAY with Silt (CH): high plasticity, orange-brown, moist, firm
								with white mottling
2								changing to red in colour; some coarse gravel
3								
4								

Neat Concrete
Bentonite Chips
2" SCH 40 Solid PVC Riser
8/16 Sand Pack
2" SCH 40 Slotted 0.010 PVC Pipe

The bore was terminated at approximately 3 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 3 m.

PROJECT NO.: 20232408.001A		BORING LOG BH9	
DRAWN BY:	MM	UON Gosford Campus 305 Mann Street Gosford, NSW	
CHECKED BY:	PB		
DATE:			Page: 1 of 1

Date Begin - End:	27/4/23	Drilling Company:	FICO Group
Logged By:	M. Mathews	Drill Crew:	Shaun
Hor.-Vert. Datum:	Not Available	Drilling Equipment:	Truck mounted drilling rig, FG101
Plunge:	-90 degrees	Drilling Method:	Continuous Flight Auger
Weather:	Clear, 22 deg C	Auger Diameter:	100 mm. O.D.

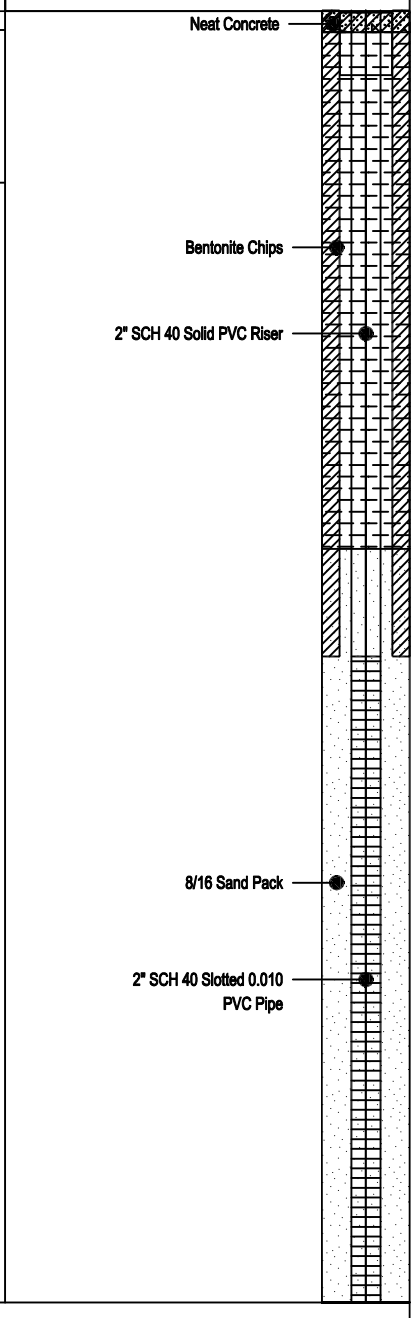
BORING LOG BH10

FIELD EXPLORATION

MONITORING WELL CONSTRUCTION

Completion Method:
Flush mount cap in concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description
0								CONCRETE
								Silty CLAY with Sand (CH): high plasticity, dark brown to dark grey, fine subangular to rounded sand, moist
1								CLAY with Silt (CH): high plasticity, orange-brown, moist, firm
								with white mottling
2								changing to red in colour; some coarse gravel
								changing to pink
3								
4								white to light grey
5								
6								



The bore was terminated at approximately 6 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 6 m.

PROJECT NO.: 20232408.001A		BORING LOG BH10	
DRAWN BY:	MM	UON Gosford Campus 305 Mann Street Gosford, NSW	
CHECKED BY:	PB		
DATE:			Page: 1 of 1

Date Begin - End:	27/4/23	Drilling Company:	FICO Group
Logged By:	M. Mathews	Drill Crew:	Shaun
Hor.-Vert. Datum:	Not Available	Drilling Equipment:	Truck mounted drilling rig, FG101
Plunge:	-90 degrees	Drilling Method:	Continuous Flight Auger
Weather:	Clear, 24 deg C	Auger Diameter:	100 mm. O.D.

BORING LOG BH11

FIELD EXPLORATION

MONITORING WELL CONSTRUCTION

Completion Method:
Flush mount cap in concrete

Depth (metres)	Drilling Method	Sample Type	Sample Number	Recovery (NR=No Recovery)	PID / FID (ppmv)	FID (ppmv)	Graphical Log	Surface Condition: Concrete Lithologic Description
								CONCRETE
								FILL Sandy Silty CLAY with Gravel (CH): high plasticity, dark brown to dark grey, fine to medium sand, fine to medium angular gravel, some gravel-sized brick pieces
1								Silty SAND with Clay (SM): fine, brown-grey, high plasticity fines, moist
								becoming wet, and light brown-grey
2								CLAY with Sand and Silt (CH): high plasticity, light brown-yellow mottled red, fine sand, wet
3								red
4								

Neat Concrete
Bentonite Chips
2" SCH 40 Solid PVC Riser
8/16 Sand Pack
2" SCH 40 Slotted 0.010 PVC Pipe

The bore was terminated at approximately 3 m. below ground level.

GROUNDWATER LEVEL INFORMATION:
Groundwater was encountered at 1.5m

GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 3 m.

PROJECT NO.: 20232408.001A		BORING LOG BH11	
DRAWN BY:	MM	UON Gosford Campus 305 Mann Street Gosford, NSW	
CHECKED BY:	PB		
DATE:			Page: 1 of 1

APPENDIX C – GROUNDWATER MONITORING RESULTS

Well ID	Date	DTW (mBTOC)	Total Well Depth (m)	Dry Indicator (Y/N)	LNAPL (mBTOC)	LNAPL Thickness (m)	Remark	Technician
BH1	23-Nov-22	4.442	6.55	N	ND	ND	Light brown, NO/NS, slow recharge	M. Ferguson
	27-Apr-23	4.029	6.015	N	ND	ND	Light brown, NO/NS	A. King
BH7	23-Nov-22	3.23	6.81	N	ND	ND	Pink/orange, moderate HC odour, NS, moderate recharge	M. Ferguson
	27-Apr-23	1.903	6.667	N	ND	ND	Cloudy pinky brown, low HC odour, no sheen	A. King
BH8	23-Nov-22	2.239	6.98	N	ND	ND	Orange, NO/NS, fast recharge	M. Ferguson
	27-Apr-23	2.189	6.871	N	ND	ND	Cloudy light brown, no odour, no sheen	A. King

Notes:
DTW = Depth to water
mBTOC = Metres below top of casing
m = Metres
ND = Not detected

		TEMP	DO	SC	TDS	PH	ORP	TURB
Well ID	Date	deg C	ppm	uS/cm	mg/L	pH units	mV	NTU
BH1	23-Nov-22	21.1	1.65	420	273	5.71	118	--
	27-Apr-23	26.3	4.33	224.2	142	5.47	194	943.22
BH7	23-Nov-22	18	4.93	304	197	7.34	49	--
	27-Apr-23	19.0	3.00	244.7	179	4.87	158.6	220.12
BH8	23-Nov-22	18.6	2.71	300	195	5.82	112	--
	27-Apr-23	19.5	3.20	245.3	178	5.08	241.9	573.34

Analyte			BTEXN								Total Petroleum Hydrocarbons					Total Recoverable Hydrocarbons						
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Naphthalene	Sum of BTEX	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	C_{10} - C_{36} sum	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	$>C_{10}$ - C_{16}	$>C_{10}$ - C_{16} minus Naphthalene (F2)	$>C_{16}$ - C_{34}	$>C_{34}$ - C_{40}	$>C_{10}$ - C_{40} (sum)
LOR			1.0	2.0	2.0	2.0	2.0	2.0	5.0	1.0	20	50	100	50	50	20	20	100	100	100	100	100
Units			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
ANZG 2018 FRESHWATER 95% LOSP			950	180	80	--	350**	--	16**	--	--	--	--	--	--	--	--	--	--	--	--	--
CRC CARE HSLS IMW - GW - SAND 2 TO <4M			NL	NL	NL	--	--	NL	NL	--	--	--	--	--	--	--	NL	--	NL	--	--	--
NEPM 2013 HSL C - GW - SAND - 2 TO <4M			NL	NL	NL	--	--	NL	NL	--	--	--	--	--	--	--	NL	--	NL	--	--	--
NHMRC - RISK IN RECREATIONAL WATER X10			10	8000	3000	--	--	6000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sample Name	Sample Date	SWL (mBTOC)																				
BH1	23-Nov-22	4.442	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	27-Apr-23	4.029	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH7	23-Nov-22	3.230	**8.0**	< 2.0	**29**	**7.0 ***	< 2.0	**9.0 ***	**19**	**41**	**140**	**440**	**400 ***	< 50	**920 ***	**280 ***	**210 ***	**450**	**430**	**300 ***	< 100	**890 ***
	27-Apr-23	1.903	**12**	< 2.0	**16**	**3.0**	**3.0**	**6.0**	**39**	**34**	**440**	**620**	< 100	< 50	**620**	**450**	**420**	**650**	**610**	< 100	< 100	**650**
BH8	23-Nov-22	2.239	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	27-Apr-23	2.189	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
ANZECC - Australia and New Zealand Environment and Conservation Council
NL - Not limiting
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, total xylenes, naphthalene
Bold indicates a detection above the laboratory limit of reporting
"*" denotes duplicate/triplicate sample result adopted for analytical use due to RPD >50%
Highlighting indicates an exceedance of the corresponding criteria (highlighting corresponds to the guideline with the highest criteria value where analytical result exceeds more than one guideline)
RPD - Relative Percentage Difference
**- Low reliability, see ANZECC 8.3.7.7

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
The Cooperative Research Centre for Contamination Assessment and Remediation of the Environment - Water Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater for Vapour Intrusion for Intrusive Maintenance Worker Shallow Trench in Sand
The National Environment Protection Measures (2013) - Health Screening Levels - Table 1A(4) - Groundwater for Vapour Intrusion - Recreational and Open Space - Sand
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			Anions and Cations																	Alkalinity					Inorganics		
			Sodium	Calcium	Magnesium	Potassium	Sulphate	Chloride	Fluoride	Reactive phosphorus as P	Total Phosphorus	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Total Ammonia as Nitrogen	Total Kjeldahl Nitrogen as N	Nitrogen	Total Cations	Total Anions	Sodium Adsorption Ratio	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Hydroxide Alkalinity as CaCO3	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Electrical Conductivity @ 25°C	Total Dissolved Solids	pH
LOR			1.0	1.0	1.0	1.0	1.0	1.0	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.01	0.01	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.01
Units			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	meq/L	meq/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	pH units
ANZG 2018 FRESHWATER 95% LOSP			--	--	--	--	--	--	--	--	--	--	--*	--	0.9	--	--	--	--	--	--	--	--	--	--	--	--	--
NHMRC - RISK IN RECREATIONAL WATER X10			--	--	--	--	5000	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sample Name	Sample Date	SWL (mBTOC)																										
BH1	23-Nov-22	4.442	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**429**	-	**5.8**
	27-Apr-23	4.029	**39**	**2.0**	< 1.0	< 1.0	**37**	**26**	< 0.1	< 0.01	**0.73**	< 0.01	**0.1**	**0.1**	**0.1**	< 0.1	< 0.1	**1.8**	**1.72**	**6.39**	**11**	< 1.0	< 1.0	**11**	**5.0**	**219**	**142**	**5.48**
BH7	23-Nov-22	3.230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**308**	-	**5.48**
	27-Apr-23	1.903	**27**	**3.0**	**3.0**	**4.0**	**74**	**22**	< 0.1	< 0.01	**0.06**	< 0.01	< 0.01	< 0.01	**0.09**	**0.2**	**0.2**	**2.46**	**2.22**	**2.64**	**3.0**	< 1.0	< 1.0	**3.0**	**20**	**276**	**179**	**4.85**
BH8	23-Nov-22	2.239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**317**	-	**5.83**
	27-Apr-23	2.189	**30**	**7.0**	**4.0**	**5.0**	**61**	**28**	< 0.1	< 0.01	**0.24**	< 0.01	**2.74**	**2.74**	**0.01**	**0.6**	**3.3**	**2.11**	**2.12**	**2.24**	**3.0**	< 1.0	< 1.0	**3.0**	**34**	**269**	**175**	**5.06**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
mg/L - Milligrams per litre
µS/cm - Microsiemens per centimeter
Bold indicates a detection above the laboratory limit of reporting
*- In the absence of an ANZG (2018) default guideline value, refer to the "Grading" guideline values published in the NIWA report, which were used to inform the current New Zealand nitrate toxicity.

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			Metals														
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
LOR			0.001	0.001	0.001	0.05	0.0001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.01	0.005
Units			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
ANZG 2018 FRESHWATER 95% LOSP			0.013	--	--	0.94	0.0002	0.001	--	0.0014	--	0.0034	1.9	0.0006	0.011*	0.011	--	0.008
NHMRC - RISK IN RECREATIONAL WATER X10			0.1	20	0.6	40	0.02	0.5	--	20	--	0.1	5	0.01	0.2	0.1	--	--
Sample Name	Sample Date	SWL (mBTOC)																
BH1	23-Nov-22	4.442	< 0.001	-	-	-	< 0.0001	< 0.001	-	< 0.001	-	< 0.001	-	< 0.0001	**0.004**	-	-	**0.015**
	27-Apr-23	4.029	< 0.001	**0.03**	< 0.001	**0.11**	< 0.0001	< 0.001	**0.001**	**0.004**	**0.17**	< 0.001	**0.049**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.01**
BH7	23-Nov-22	3.230	< 0.001	-	-	-	< 0.0001	**0.001**	-	**0.007**	-	**0.001**	-	< 0.0001	**0.018**	-	-	**0.074**
	27-Apr-23	1.903	**0.001**	**0.037**	< 0.001	**0.07**	< 0.0001	< 0.001	**0.002**	**0.002**	**15**	< 0.001	**0.033**	< 0.0001	**0.006**	< 0.01	< 0.01	**0.047**
BH8	23-Nov-22	2.239	< 0.001	-	-	-	< 0.0001	< 0.001	-	< 0.001	-	< 0.001	-	< 0.0001	**0.003**	-	-	**0.024**
	27-Apr-23	2.189	< 0.001	**0.085**	< 0.001	**0.06**	< 0.0001	< 0.001	< 0.001	**0.006**	< 0.05	< 0.001	**0.018**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.006**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
ANZECC - Australia and New Zealand Environment and Conservation Council
mg/L - Milligrams per litre
Bold indicates a detection above the laboratory limit of reporting
Highlighting indicates an exceedance of the corresponding criteria (highlighting corresponds to the guideline with the highest criteria value where analytical result exceeds more than one guideline)
*- Low reliability, see ANZECC 8.3.7.1

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			Polycyclic Aromatic Hydrocarbons																
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[k]fluoranthene	Benzo[b] & Benzo[j]fluoranthene	Benzo[a]pyrene	Indeno[1,2,3-c,d]pyrene	Dibenz[a,h]anthracene	Benzo[g,h,i]perylene	Total PAH	Benzo[a]pyrene TEQ
LOR			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0	0.5	0.5
Units			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
ANZG 2018 FRESHWATER 95% LOSP			16*	--	--	--	2	0.4	1.4	--	--	--	--	--	0.2	--	--	--	--	--
NHMRC - RISK IN RECREATIONAL WATER X10			--	--	--	--	--	--	--	--	--	--	--	--	0.1	--	--	--	--	--
Sample Name	Sample Date	SWL (mBTOC)																		
BH1	23-Nov-22	4.442	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
	27-Apr-23	4.029	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
BH7	23-Nov-22	3.230	**10**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	**10**	< 0.5
	27-Apr-23	1.903	**19**	< 1.0	**1.8**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	**20**	< 0.5
BH8	23-Nov-22	2.239	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
	27-Apr-23	2.189	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
ANZECC - Australia and New Zealand Environment and Conservation Council
µg/L - Micrograms per litre
Bold indicates a detection above the laboratory limit of reporting
Highlighting indicates an exceedance of the corresponding criteria (highlighting corresponds to the guideline with the highest criteria value where analytical result exceeds more than one guideline)
*- Low reliability, see ANZECC 8.3.7.7

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			Polychlorinated Biphenyls
			Total PCBs
LOR			1.0
Units			µg/L
Sample Name	Sample Date	SWL (mBTOC)	
BH1	23-Nov-22	4.442	< 1.0
BH7	23-Nov-22	3.230	< 1.0
BH8	23-Nov-22	2.239	< 1.0

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre
PCB - Polychlorinated Biphenyl

Analyte			Organochlorine Pesticides																							Organophosphorus Pesticides																	
			4,4'-DDE	4,4'-DDD	4,4'-DDT	alpha-BHC	beta-BHC	gamma-BHC	delta-BHC	Aldrin	Heptachlor epoxide	cis-Chlordane	trans-Chlordane	Chlordane	alpha-Endosulfan	beta-Endosulfan	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Dieldrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Azinphos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyriphos	Chlorpyriphos-methyl	Demeton-s-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenamiphos	Fenthion	Malathion	Monocrotophos	Parathion	Parathion-methyl	Pirimiphos-ethyl	Prothiophos
LOR			0.5	0.5	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.0	2.0	2.0	0.5	0.5
Units			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	µg/L	µg/L
ANZG 2018 FRESHWATER 95% LOSP			--	--	0.01	--	--	0.2	--	--	--	--	--	0.08	--	--	--	0.02	--	--	--	0.09	0.1	--	--	--	0.02	--	--	--	0.01	--	0.01	--	0.15*	--	--	--	0.05	--	0.004	--	--	--
NHMRC - RISK IN RECREATIONAL WATER X10			--	--	90	--	--	100	--	--	--	--	--	20	--	--	--	--	--	--	--	3	--	3000	3	--	300	100	5	20	100	--	--	40	50	70	40	5	70	700	20	200	7	5	--
Sample Name	Sample Date	SWL (mBTOC)																																											
BH1	23-Nov-22	4.442	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
	27-Apr-23	4.029	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
BH7	23-Nov-22	3.230	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
	27-Apr-23	1.903	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
BH8	23-Nov-22	2.239	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
	27-Apr-23	2.189	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
ANZECC - Australia and New Zealand Environment and Conservation Council
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre
DDT - Dichlorodiphenyltrichloroethane
DDE - Dichlorodiphenyldichloroethylene
DDD - Dichlorodiphenyldichloroethane
*- Low reliability, see ANZECC 8.3.7.16

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			PFAS Compounds																										Sum of PFAS		
			Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorobutanoic acid (PFBA)	Perfluoro-n-pentanoic aicd (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanesulfonate (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer Sulfonate (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate (8:2 FtS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
LOR			0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.01	0.01	0.01
Units			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
PFAS NEMP 2020 - HUMAN HEALTH RECREATION			--	--	--	--	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	--	--	2	--	--
PFAS NEMP 2020 FRESHWATER 99% LOSP			--	--	--	--	--	--	--	--	--	--	--	19	--	--	--	--	--	--	--	--	--	--	--	0.00023	--	--	--	--	--	--	--	--
Sample Name	Sample Date	SWL (mBTOC)																																
BH1	23-Nov-22	4.442	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
	27-Apr-23	4.029	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH7	23-Nov-22	3.230	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
	27-Apr-23	1.903	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH8	23-Nov-22	2.239	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	**0.05**	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	**0.05**	**0.05**	**0.05**
	27-Apr-23	2.189	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	**0.01**	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	**0.04**	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	**0.04**	**0.05**	**0.05**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre
Bold indicates a detection above the laboratory limit of reporting
Highlighting indicates an exceedance of the corresponding criteria (highlighting corresponds to the guideline with the highest criteria value where analytical result exceeds more than one guideline)

Criteria:
Per- and Por-Fluoroalkyl Substances National Environment Protection Measures - Human Health Guideline Values - Recreational Water Quality Guideline Value (NHMRC 2019)
Per- and Por-Fluoroalkyl Substances National Environment Protection Measures Freshwater 99% Species Protection - High Conservation Value Systems

Analyte			Phenolic Compounds (Non-Chlorinated)					Phenolic Compounds (Chlorinated)						
			Phenol	2-Methylphenol (o-Cresol)	3- & 4-Methylphenol (m&p cresol)	2-Nitrophenol	2,4-Dimethylphenol	2-Chlorophenol	4-Chloro-3-methylphenol	2,4-Dichlorophenol	2,6-Dichlorophenol	2,4,6-Trichlorophenol	2,4,5-Trichlorophenol	Pentachlorophenol
LOR			1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZG 2018 FRESHWATER 95% LOSP			320	--	--	--	--	490	--	160	--	20	--	10
NHMRC - RISK IN RECREATIONAL WATER X10			--	--	--	--	--	3000	--	2000	--	200	--	100
Sample Name	Sample Date	SWL (mBTOC)												
BH1	27-Apr-23	4.029	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
BH7	27-Apr-23	1.903	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
BH8	27-Apr-23	2.189	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
ANZECC - Australia and New Zealand Environment and Conservation Council
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre
*- Low reliability, see ANZECC 8.3.7.10

Criteria:
Australian and New-Zealand Guidelines (2018) Freshwater 95% Level Of Species Protection Toxicant Default Guideline Values
National Health and Medical Research Council - Guidelines for Managing Risks in Recreational Water Factor 10

Analyte			BTEXN								Total Petroleum Hydrocarbons					Total Recoverable Hydrocarbons						
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Naphthalene	Sum of BTEX	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	C_{10} - C_{36} sum	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	$>C_{10}$ - C_{16}	$>C_{10}$ - C_{16} minus Naphthalene (F2)	$>C_{16}$ - C_{34}	$>C_{34}$ - C_{40}	$>C_{10}$ - C_{40} (sum)
Units			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
Sample Name	Sample Date	Sample Type																				
BH7_23112022	23-Nov-22	Primary	**8.0**	< 2.0	**29**	**4.0**	< 2.0	**4.0**	**19**	**41**	**140**	**440**	< 100	< 50	**440**	**150**	**110**	**450**	**430**	< 100	< 100	**450**
QC01_23112022	23-Nov-22	Duplicate	**8.0**	< 2.0	**30**	**4.0**	< 2.0	**4.0**	**20**	**42**	**130**	**460**	< 100	< 50	**460**	**160**	**120**	**470**	**450**	< 100	< 100	**470**
Relative Percentage Difference			**0%**	NC	**3%**	**0%**	NC	**0%**	**5%**	**2%**	**7%**	**4%**	NC	NC	**4%**	**6%**	**9%**	**4%**	**5%**	NC	NC	**4%**
BH7_23112022	23-Nov-22	Primary	**8.0**	< 2.0	**29**	**4.0**	< 2.0	**4.0**	**19**	**41**	**140**	**440**	< 100	< 50	**440**	**150**	**110**	**450**	**430**	< 100	< 100	**450**
QC01A_23112022	23-Nov-22	Triplicate	**11**	< 1.0	**47**	**7.0**	**2.0**	**9.0**	**30**	-	**200**	**520**	**400**	< 100	**920**	**280**	**210**	**590**	**560**	**300**	< 100	**890**
Relative Percentage Difference			**32%**	NC	**47%**	**55%**	**0%**	**77%**	**45%**	NC	**35%**	**17%**	**120%**	NC	**71%**	**60%**	**63%**	**27%**	**26%**	**100%**	NC	**66%**
BH1_27042023	27-Apr-23	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
QC01_27042023	27-Apr-23	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
QC01A_27042023	27-Apr-23	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	< 50	< 100	< 100	< 100	< 20	< 20	< 50	< 50	< 100	< 100	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, total xylenes, naphthalene
Bold indicates a detection above the laboratory limit of reporting
Orange highlighting indicates an RPD in excess of 30%
RPD - Relative Percentage Difference

Analyte			Metals														
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
Units			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
Sample Name	Sample Date	Sample Type																
BH7_23112022	23-Nov-22	Primary	< 0.001	-	-	-	< 0.0001	**0.001**	-	**0.007**	-	**0.001**	-	< 0.0001	**0.018**	-	-	**0.074**
QC01_23112022	23-Nov-22	Duplicate	< 0.001	-	-	-	< 0.0001	< 0.001	-	< 0.001	-	< 0.001	-	< 0.0001	**0.01**	-	-	**0.022**
Relative Percentage Difference			NC	NC	NC	NC	NC	**0%**	NC	**150%**	NC	**0%**	NC	NC	**57%**	NC	NC	**108%**
BH7_23112022	23-Nov-22	Primary	< 0.001	-	-	-	< 0.0001	**0.001**	-	**0.007**	-	**0.001**	-	< 0.0001	**0.018**	-	-	**0.074**
QC01A_23112022	23-Nov-22	Triplicate	< 0.001	-	-	-	< 0.0002	< 0.001	-	**0.003**	-	< 0.001	-	< 0.0001	**0.021**	-	-	**0.053**
Relative Percentage Difference			NC	NC	NC	NC	NC	**0%**	NC	**80%**	NC	**0%**	NC	NC	**15%**	NC	NC	**33%**
BH1_27042023	27-Apr-23	Primary	< 0.001	**0.03**	< 0.001	**0.11**	< 0.0001	< 0.001	**0.001**	**0.004**	**0.17**	< 0.001	**0.049**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.01**
QC01_27042023	27-Apr-23	Duplicate	< 0.001	**0.028**	< 0.001	**0.13**	< 0.0001	< 0.001	**0.001**	< 0.001	**0.21**	< 0.001	**0.046**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.006**
Relative Percentage Difference			NC	**7%**	NC	**17%**	NC	NC	**0%**	**120%**	**21%**	NC	**6%**	NC	**67%**	NC	NC	**50%**
BH1_27042023	27-Apr-23	Primary	< 0.001	**0.03**	< 0.001	**0.11**	< 0.0001	< 0.001	**0.001**	**0.004**	**0.17**	< 0.001	**0.049**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.01**
QC01A_27042023	27-Apr-23	Triplicate	< 0.001	**0.03**	< 0.001	**0.14**	< 0.0002	< 0.001	**0.001**	**0.001**	**0.23**	< 0.001	**0.049**	< 0.0001	**0.002**	-	< 0.005	**0.007**
Relative Percentage Difference			NC	**0%**	NC	**24%**	NC	NC	**0%**	**120%**	**30%**	NC	**0%**	NC	**67%**	NC	NC	**35%**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
mg/L - Milligrams per litre
Bold indicates a detection above the laboratory limit of reporting
Orange highlighting indicates an RPD in excess of 30%
RPD - Relative Percentage Difference

Analyte			Polycyclic Aromatic Hydrocarbons																
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[k]fluoranthene	Benzo[b] & Benzo[j]fluoranthene	Benzo[a]pyrene	Indeno[1,2,3-c,d]pyrene	Dibenz[a,h]anthracene	Benzo[g,h,i]perylene	Total PAH	Benzo[a]pyrene TEQ
Units			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
Sample Name	Sample Date	Sample Type																		
BH7_23112022	23-Nov-22	Primary	**19**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	**10**	< 0.5
QC01_23112022	23-Nov-22	Duplicate	**20**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	**10**	< 0.5
Relative Percentage Difference			**5%**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**2%**	NC
BH7_23112022	23-Nov-22	Primary	**19**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	**10**	< 0.5
QC01A_23112022	23-Nov-22	Triplicate	**30**	< 1.0	**1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	**16**	-
Relative Percentage Difference			**45%**	NC	**0%**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**42%**	NC
BH1_27042023	27-Apr-23	Primary	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
QC01_27042023	27-Apr-23	Duplicate	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
QC01A_27042023	27-Apr-23	Triplicate	< 10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
Bold indicates a detection above the laboratory limit of reporting
Orange highlighting indicates an RPD in excess of 30%
RPD - Relative Percentage Difference

Analyte			Polychlorinated Biphenyls
			Total PCBs
Units			µg/L
Sample Name	Sample Date	Sample Type	
BH7_23112022	23-Nov-22	Primary	< 1.0
QC01_23112022	23-Nov-22	Duplicate	< 1.0
Relative Percentage Difference			NC
BH7_23112022	23-Nov-22	Primary	< 1.0
QC01A_23112022	23-Nov-22	Triplicate	< 5.0
Relative Percentage Difference			NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
PCB - Polychlorinated Biphenyl

Analyte			Organochlorine Pesticides																						Organophosphorus Pesticides																			
			4,4'-DDE	4,4'-DDD	4,4'-DDT	alpha-BHC	beta-BHC	gamma-BHC	delta-BHC	Aldrin	Heptachlor epoxide	cis-Chlordane	trans-Chlordane	Chlordane	alpha-Endosulfan	beta-Endosulfan	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Dieldrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Azinphos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyriphos	Chlorpyriphos-methyl	Demeton-s-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenamiphos	Fenthion	Malathion	Monocrotophos	Parathion	Parathion-methyl	Pirimiphos-ethyl	Prothiophos
Units			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	µg/L	µg/L
Sample Name	Sample Date	Sample Type																																										
BH7_23112022	23-Nov-22	Primary	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
QC01_23112022	23-Nov-22	Duplicate	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH7_23112022	23-Nov-22	Primary	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
QC01A_23112022	23-Nov-22	Triplicate	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	< 2.0	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 2.0	< 0.2	< 0.2	< 2.0	-	-	< 20	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
QC01_27042023	27-Apr-23	Duplicate	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
QC01A_27042023	27-Apr-23	Triplicate	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	< 2.0	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 2.0	< 0.2	< 0.2	< 2.0	< 0.5	< 0.5	< 20	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
DDT - Dichlorodiphenyltrichloroethane
DDE - Dichlorodiphenyldichloroethylene
DDD - Dichlorodiphenyldichloroethane

Analyte			PFAS Compounds																											Sum of PFAS		
			Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorobutanoic acid (PFBA)	Perfluoro-n-pentanoic aicd (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanesulfonate (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer Sulfonate (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate (8:2 FtS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
Units			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
Sample Name	Sample Date	Sample Type																														
BH7_23112022	23-Nov-22	Primary	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
QC01_23112022	23-Nov-22	Duplicate	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH7_23112022	23-Nov-22	Primary	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
QC01A_23112022	23-Nov-22	Triplicate	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.01**	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	**0.01**	< 0.05	< 0.1
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**0%**	NC	NC	NC	NC	NC	**0%**	NC	NC
BH1_27042023	27-Apr-23	Primary	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
QC01_27042023	27-Apr-23	Duplicate	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
QC01A_27042023	27-Apr-23	Triplicate	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
EPA - Environment Protection Authority
NC - Not calculated
µg/L - Micrograms per litre
Bold indicates a detection above the laboratory limit of reporting
RPD - Relative Percentage Difference

Analyte			Phenolic Compounds (Non-Chlorinated)					Phenolic Compounds (Chlorinated)						
			Phenol	2-Methylphenol (o-Cresol)	3- & 4-Methylphenol (m&p cresol)	2-Nitrophenol	2,4-Dimethylphenol	2-Chlorophenol	4-Chloro-3-methylphenol	2,4-Dichlorophenol	2,6-Dichlorophenol	2,4,6-Trichlorophenol	2,4,5-Trichlorophenol	Pentachlorophenol
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Sample Type												
BH1_27042023	27-Apr-23	Primary	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
QC01_27042023	27-Apr-23	Duplicate	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH1_27042023	27-Apr-23	Primary	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
QC01A_27042023	27-Apr-23	Triplicate	< 3.0	< 3.0	< 6.0	< 10	< 3.0	< 3.0	< 10	< 3.0	< 3.0	< 10	< 10	< 10
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre

Analyte			BTEXN								Total Petroleum Hydrocarbons					Total Recoverable Hydrocarbons						
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Naphthalene	Sum of BTEX	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	C_{10} - C_{36} sum	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	$>C_{10}$ - C_{16}	$>C_{10}$ - C_{16} minus Naphthalene (F2)	$>C_{16}$ - C_{34}	$>C_{34}$ - C_{40}	$>C_{10}$ - C_{40} (sum)
Units			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
Sample Name	Sample Date	Sample Type																				
TB_231122_23112022	23-Nov-22	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
TBLANK_27042023	27-Apr-23	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
RB01_23112022	23-Nov-22	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
RINSATE_27042023	27-Apr-23	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100

Notes:
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, total xylenes, naphthalene

Analyte			Metals														
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
Units			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
Sample Name	Sample Date	Sample Type																
TB_231122_23112022	23-Nov-22	Trip Blank	< 0.001	-	-	-	< 0.0001	< 0.001	-	< 0.001	-	< 0.001	-	< 0.0001	< 0.001	-	-	< 0.005
TBLANK_27042023	27-Apr-23	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RB01_23112022	23-Nov-22	Rinsate	< 0.001	-	-	-	< 0.0001	< 0.001	-	< 0.001	-	< 0.001	-	< 0.0001	< 0.001	-	-	< 0.005
RINSATE_27042023	27-Apr-23	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
mg/L - Milligrams per litre

Analyte			Polycyclic Aromatic Hydrocarbons																
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[k]fluoranthene	Benzo[b] & Benzo[j]fluoranthene	Benzo[a]pyrene	Indeno[1,2,3-c,d]pyrene	Dibenz[a,h]anthracene	Benzo[g,h,i]perylene	Total PAH	Benzo[a]pyrene TEQ
Units			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
Sample Name	Sample Date	Sample Type																		
TB_231122_23112022	23-Nov-22	Trip Blank	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
TBLANK_27042023	27-Apr-23	Trip Blank	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
RB01_23112022	23-Nov-22	Rinsate	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5
RINSATE_27042023	27-Apr-23	Rinsate	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.5	< 1.0	< 1.0	< 1.0	< 0.5	< 0.5

Notes:
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre

Analyte			Polychlorinated Biphenyls
			Total PCBs
Units			µg/L
Sample Name	Sample Date	Sample Type	
TB_231122_23112022	23-Nov-22	Trip Blank	< 1.0
RB01_23112022	23-Nov-22	Rinsate	< 1.0

Notes:
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre
PCB - Polychlorinated Biphenyl

Analyte			Organochlorine Pesticides																							Organophosphorus Pesticides																					
			4,4'-DDE	4,4'-DDD	4,4'-DDT	alpha-BHC	beta-BHC	gamma-BHC	delta-BHC	Aldrin	Heptachlor epoxide	cis-Chlordane	trans-Chlordane	Chlordane	alpha-Endosulfan	beta-Endosulfan	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Dieldrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Azinphos methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyriphos	Chlorpyriphos-methyl	Demeton-s-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenamiphos	Fenthion	Malathion	Monocrotophos	Parathion	Parathion-methyl	Pirimiphos-ethyl	Prothiophos
Units			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	µg/L	µg/L	µg/L
Sample Name	Sample Date	Sample Type																																												
TB_231122_23112022	23-Nov-22	Trip Blank	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
TBLANK_27042023	27-Apr-23	Trip Blank	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
RB01_23112022	23-Nov-22	Rinsate	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5
RINSATE_27042023	27-Apr-23	Rinsate	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 2.0	< 2.0	< 2.0	< 0.5	< 0.5

Notes:
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre
DDT - Dichlorodiphenyltrichloroethane
DDE - Dichlorodiphenyldichloroethylene
DDD - Dichlorodiphenyldichloroethane

Analyte			PFAS Compounds																											Sum of PFAS		
			Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	Perfluorobutanoic acid (PFBA)	Perfluoro-n-pentanoic aicd (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptane sulfonate (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer Sulfonate (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate (8:2 FtS)	10:2 Fluorotelomer Sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
Units			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
Sample Name	Sample Date	Sample Type																														
TB_231122_23112022	23-Nov-22	Trip Blank	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
R801_23112022	23-Nov-22	Rinsate	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
RINSATE_27042023	27-Apr-23	Rinsate	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01

Notes:
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre

Analyte			Phenolic Compounds (Non-Chlorinated)					Phenolic Compounds (Chlorinated)						
			Phenol	2-Methylphenol (o-Cresol)	3- & 4-Methylphenol (m&p cresol)	2-Nitrophenol	2,4-Dimethylphenol	2-Chlorophenol	4-Chloro-3-methylphenol	2,4-Dichlorophenol	2,6-Dichlorophenol	2,4,6-Trichlorophenol	2,4,5-Trichlorophenol	Pentachlorophenol
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Sample Type												
TBLANK_27042023	27-Apr-23	Trip Blank	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
RINSATE_27042023	27-Apr-23	Rinsate	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0

Notes:
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
µg/L - Micrograms per litre

APPENDIX D – CENTRAL COAST COUNCIL TRADE WASTE ACCEPTANCE LIMITS

Liquid Trade Waste

Acceptance limits and prohibited substances

Definition

Liquid trade waste (LTW) is any discharge to a sewerage system other than domestic waste from a hand wash basin, shower, bath or toilet.

Central Coast Council is referred to as Council.

Introduction

This Fact Sheet is provided to assist you to treat and dispose of liquid trade waste in an efficient and approved manner.

For further information, please contact Council's Trade Waste Section on 4350 5555.

For LTW application forms, refer to www.centralcoast.nsw.gov.au.

Effluent Improvement Programs

Where there is an existing liquid trade waste discharge and the quality or volume does not meet Council's acceptance limits, the applicant is required to submit an 'Effluent Improvement Program' setting out how Council's requirements will be met. The Effluent Improvement Program must detail the methods and actions proposed to achieve the acceptance limits, and a timetable for implementation of the proposed actions. Such actions may include more intensive monitoring, or improvements to work practices and/or pre-treatment facilities to improve the discharge quality and reliability.

Acceptance Limits

General Acceptance Limits

Parameter	Limits
Flow rate	The maximum daily and instantaneous rate of discharge (kL/h or L/s) is set on the available capacity of the sewer. Large dischargers are required to provide a balancing tank to even out the load on the sewerage works.
BOD_5 and suspended solids	Normally, approved at 300 mg/L for each of the parameters. Concentration up to 600 mg/L may be accepted.
COD	Normally, not to exceed BOD_5 by more than three times. This ratio is given as a guide only to prevent the discharge of non-biodegradable waste.
Total dissolved solids	Up to 4000 mg/L may be accepted. Acceptance limits may be reduced depending on available effluent disposal options and will be subject to a mass load limit.
Temperature	Less than 38ºC
pH	Within the range of 7.0 to 9.0
Oil and Grease	100 mg/L if the volume of the discharge does not exceed 10% of the design capacity of the treatment works, and 50 mg/L if the volume is greater than 10%.
Detergents	All industrial detergents are to be biodegradable. A limit on the concentration of 50 mg/L (as MBAS) may be imposed on large liquid trade wastes.
Colour	Colour must be biodegradable. No visible colour when diluted to the equivalent dilution afforded by domestic sewage flow. Specific limits may be imposed on industrial discharges where colour has a potential to interfere with sewerage treatment processes and the effluent management.
Radioactive substances	If expected to be present (e.g Iodine 131 from ablation), acceptance requirements will be set on a case-by-case assessment.

Inorganic compounds

Parameter	Maximum concentration (mg/L)
Ammonia (as N)	50
Boron	5
Bromine	5
Chlorine	10
Cyanide	1
Fluoride	30
Nitrogen (total Kjeldahl)	100
Phosphorus (total)	20

Organic compounds

Parameter	Maximum concentration (mg/L)
Benzene	<0.001
Toluene	0.5
Ethylbenzene	1
Xylene	1
Formaldehyde	30
Phenolic compounds non-halogenated	1
Petroleum hydrocarbons[1]	
1. C6-C9 (flammable)	5
2. Total Recoverable Hydrocarbons (TRH)	30
Pesticides general (except organochlorine	0.1

Sulphate (as SO_4)	500
Sulphide (as S)	1

and organophosphorus)	
Polynuclear aromatic hydrocarbons (PAHs)	5

1 Always ask a laboratory to carry out a silica gel clean up, if other than petroleum products are expected to be present liquid trade waste sample, eg. Animal fats, plant oil, soil, etc.

Metals

Parameter	Maximum Concentration (mg/L)	Allowed daily mass limits (g/d)
Aluminium	100	-
Arsenic	0.5	2
Cadmium	1	5
Chromium*	3	10
Cobalt	5	15
Copper	5	15
Iron	100	-
Lead	1	5
Manganese	10	30
Mercury	0.01	0.05
Molybdenum	5	15
Nickel	1	5
Selenium	1	5
Silver	2	5
Tin	5	15
Zinc	1	5
Total metals excluding aluminium, iron, manganese	Less than 30mg/L and subject to total mass loading requirements	

* Where hexavalent chromium (Cr^{6+}) is present in the process water, pre-treatment is required to reduce it to the trivalent state (Cr^{3+}), prior to discharge into the sewer.

Note: These limits will generally not be met if the sewage detention time in the pumping station and rising main is greater than 2 to 4 hours, unless the sewage is conditioned by the addition of oxygen or other agent to prevent the generation of hydrogen sulphide gas.

Deemed concentration of substances in domestic sewerage

Substances	Deemed Concentration (mg/L)
Biochemical Oxygen Demand (BOD_5)	300
Suspended Solids	300
Total Oil and Grease	50
Ammonia (as Nitrogen)	35
Total Kjeldahl Nitrogen	50
Total Phosphorus	10
Total Dissolved Solids	1000
Sulphate (SO_4)	50

Prohibited Substances

Prohibited substances
Organochlorine weedicides, fungicides, pesticides, herbicides and substances of a similar nature and/or wastes arising from the preparation of these substances
Organophosphorus pesticides and/or waste arising from the preparation of these substances
Per- and poly-fluoroalkyl substances (PFAS)
Any substances liable to produce noxious or poisonous vapours in the sewerage system
Organic solvents and mineral oil#
Any flammable or explosive substance#
Discharge from "Bulk Fuel Depots"
Discharges from chemicals and/or oil storage areas
Natural or synthetic resins, plastic monomers, synthetic adhesives, rubber and plastic emulsions
Roof, rain, surface, seepage or ground water, unless specifically permitted (clause 137A of the Local Government (Genera) Regulation 2021)
Solid matter#
Disposable products including wet wipes, cleaning wipes, colostomy bags, cat litter and other products marketed as flushable
Any substance assessed as not suitable to be discharged into the sewerage system
Liquid Waste that contains pollutants at concentrations which inhibit the sewerage treatment process – refer ***Australian Sewage Quality Management Guidelines,* June 2012, WSAA**; and any other substances listed in a relevant regulation

#In excess of the approved limit

Factors for consideration

Council's decision to accept liquid waste into its sewerage system will be based on the discharger satisfying Council's requirements. Therefore, when determining an application to discharge liquid waste to the sewerage system, Council will consider the following factors:

- The potential impacts of the proposed discharge on Council's ability to meet the objectives outlined in s. 1.2 of this document.
- The adequacy of the pre-treatment process(es) to treat the liquid trade waste to a level acceptable for discharge to the sewerage system, including proposed contingency measures in an event of the pre-treatment system failure
- The capability of the sewerage system (reticulation and treatment components) to accept the quantity and quality of the proposed liquid waste
- The adequacy of chemical storage and handling facilities, and the proposed safeguards for prevention of spills and leaks entering to the sewerage system
- The adequacy of the proposed due diligence program and contingency plan, where required.
- Proposed management of prohibited substances and other liquid waste not planned to be discharged to the sewerage system and safeguards to avoid any accidental discharge
- The potential for stormwater entering the sewerage system and adequacy of proposed stormwater controls
- The potential for growth of the community