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Supporting Information for Works Approval

Cargill Project Crux: Oilseed Crushing Plant, Rockingham Industrial Zone

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Supporting Information for Works Approval

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Appendix 6
Contamination Assessment

Appendix 7
Transport Impact Assessment

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1. Introduction

1.1 Background

Cargill Australia Limited (Cargill) proposes to construct and operate an oilseed crushing plant (the proposed development) within the Rockingham Industrial Zone (RIZ), within East Rockingham, Western Australia. The oilseed facility would primarily process canola seeds into canola oil, and may potentially process other oilseeds in the future, such as carinata seeds, using the same processes and infrastructure.

Western Australia typically accounts for over 50% of Australian grain exports due to its strategic location making it viable for transporting such products to key clients both domestically and internationally in the Food, Feed and Fuel markets. Local canola production continues to increase and with an insignificant domestic crush market there is an abundant and increasing exportable surplus. As such, the project seeks to build an oilseed crushing plant adjacent to and supported by the Co-operative Bulk Handling (CBH) Kwinana Grain Terminal with a daily capacity of up to 3,000 tonnes (the Project Crux). This document will provide supporting information for the works approval application to meet the regulatory requirements under Part V of the Environmental Protection Act 1986 (the EP Act). The crushing plant will operate as a prescribed premises (Category 19) under the EP Act.

1.2 Site information

Cargill has identified a potential site in Rockingham Industrial Zone (RIZ) for the proposed development at Lot 108 Patterson Road, East Rockingham (Lot on Plan: P400167 108) (the site). The site context is shown in **Figure 1** and a summary of site information is provided as **Table 1**.

Table 1: Summary of site information

Item	Details
Local Government Area	City of Rockingham
Suburb	East Rockingham
Address	Lot 108 Patterson Road, East Rockingham
Size	13.3 hectares
Lot details	Lot 108

The RIZ is located about 40 kilometres south of the Perth Central Business District and approximately 2 kilometres northeast of Rockingham. The RIZ extends from the coast just north of the CBH Grain Terminal to the east to the Leda Nature Reserve and is generally bounded by Office Road to the north and Dixon Road to the south. The western-most portion of the RIZ is adjacent to Kwinana Beach.

The identified potential site is a subset of Lot 108 and is approximately 13.3 hectares in size. Other industries in the precinct include grain accumulation and exports, fertilizer distribution, fuel storage, mineral processing, wastewater treatment and a proposed green hydrogen facility.

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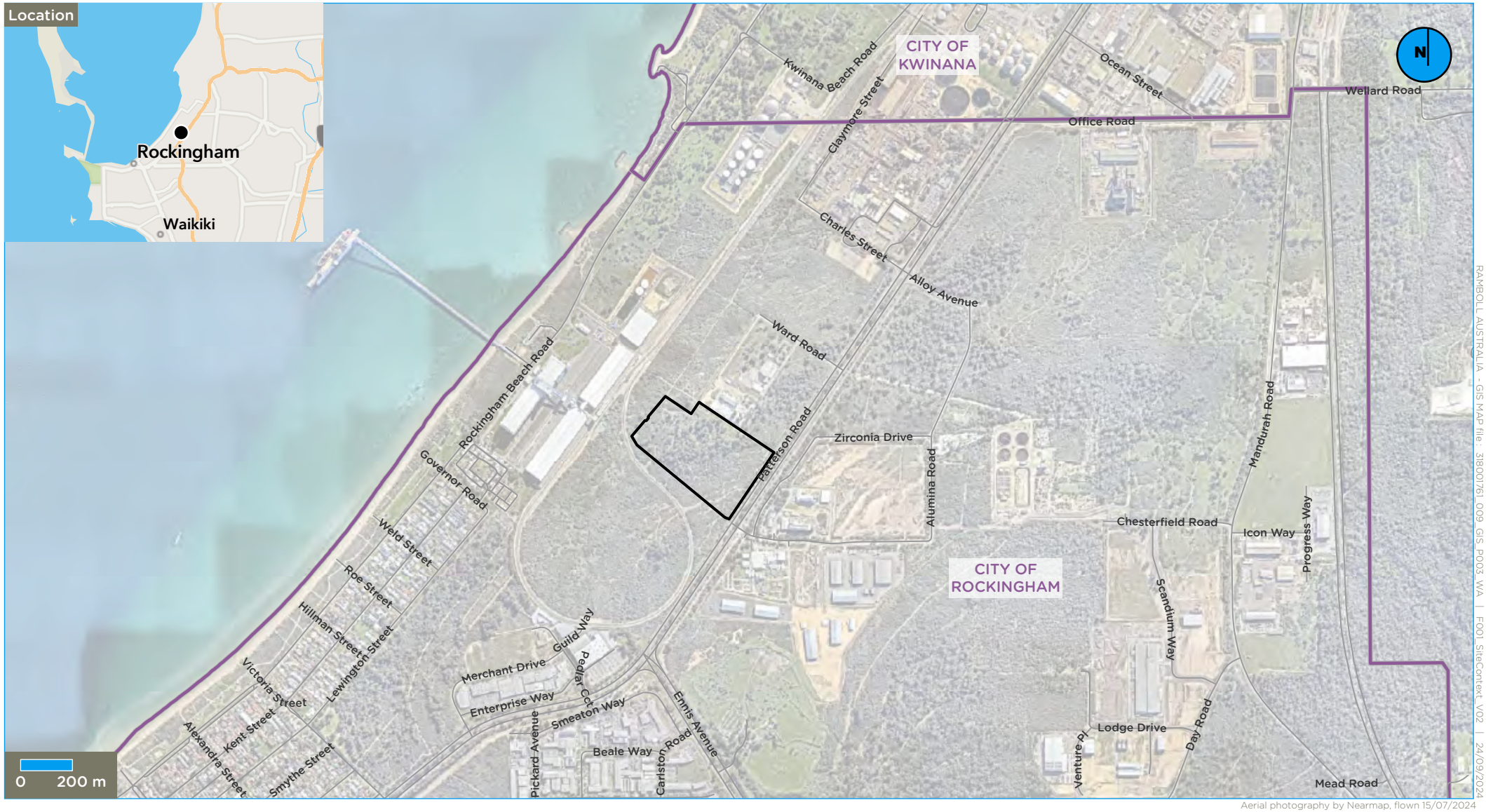
1.3 Strategic context

The site is located within the RIZ at the southern end of the broader Kwinana Industrial zone. It is zoned as General Industrial in the City of Rockingham Town Planning Scheme. Adjacent land uses are generally as follows:

- Immediately north of the site is the WA Kaolin storage facility and the Halliburton Chemicals manufacture plant. These uses are reasonably intensive manufacturing operations and are located 200 and 400 metres northeast of the site, respectively.
- Immediately east of the site are food processing and mineral processing industries.
- The CBH grain terminal is located on the coast to the northwest of the site and will provide important synergy with the proposed development.
- To the south of the site is the Dixon Road light industrial areas which are characterised by less intensive industry including car dealerships, Bunnings, and caravan retailers.
- The coastal areas to the west are well utilised from a recreational perspective including a formal reserve and dog beach, some 900 metres from the site. An established caravan park is opposite one of these reserves and is about 800 metres from the site.

In summary, the site is on the southern end of the heavy industrial zone before the land uses change moving southwards to light industry and residential.

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Legend

- Project boundary
- Local Government Area (LGATE)

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Figure 1 : Site context

Cargill Project Crux: Oilseed Crushing Plant, Rockingham Industrial Zone - Works Approval

2. Proposed Development

2.1 Land description

The proposed development site is located on the undulating dune system, ranging in elevation from 5 to 8 metres above sea level. The site is bordered by Patterson Road to the southeast, the Kwinana loop railway to the west and WA Kaolin to the north.

2.2 Project description

Cargill Australia proposes to build an oilseed crushing plant adjacent to the CBH Kwinana Grain Terminal in East Rockingham. The capacity of the proposed plant is 3,000 tonnes per day (tpd).

At a high level, the components of the oilseed crushing plant will encompass:

- Oilseed truck logistics facilities (seed silos).
- Oilseed processing, with the solvent Hexane.
- Meal storage & loading out facility.
- Crude degummed oil (canola) storage & loading out (oil pipe to the jetty).
- Natural gas or biomass steam boiler.
- Wastewater treatment plant.
- Compressed air station.
- Firefighting facilities.
- Weigh bridges.
- Switchgear station & MCC room.
- Buildings including offices, laboratory, maintenance facilities, other utilities, and truck parking areas.

Subject to further discussion with Western Power, the site may also need to allow space for Western Power's substation, including the step-down transformer and switchgear. The site layout is presented in both **Figure 2** and **Figure 3**.

2.2.1 Operational plant process and equipment

The key processes to be undertaken at the facility for the processing of oilseeds are as follows:

- Storage – Oilseeds are unloaded in receival pits and stored onsite in vertical steel silos.
- Preparation/Pre-pressing – Preparation includes such steps as cleaning, sifting, drying, preheating, dehulling, flaking and screw pressing. Pre-pressing splits the seed, ruptures the oil cells, and prepares the product for the solvent extraction plant.
- Solvent extraction – Extraction involves washing the product with solvent to obtain the seed oil, with meal as a product. The seed oil is produced with a small component of hexane present and is further processed and refined through distillation to remove the hexane. The meal undergoes a heating and drying process to remove hexane and moisture, with the final meal product sold as a protein source for feedstock.
- Neutralisation – Involves neutralising the fatty acids in the oil with caustic soda and phosphoric acid.
- Refining – Involves a bleaching process where trace metals and other impurities are removed from the oil using absorbing clay. The oil may then undergo a deodorisation stage where additional impurities are removed under temperature and vacuum. This stage is only a possibility at this point.
- Product Storage – The refined oils are stored in bulk storage tanks.
- Domestic and Process Wastewater Management - The onsite sources of process wastewater are the boilers, cooling towers, pre-press facility, the biofilter, the extraction facility and refinery. This water is collected and directed to the wastewater treatment plant onsite and

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then via a pump station on to the Water Corporation's Industrial Wastewater Treatment System.

2.2.2 Site access and vehicle movements

The proposed development would be situated on the western side of Patterson Road and to the south of Ward Road within the RIZ. The proposed development is proposed to be accessed by a two-way accessway running along the western boundary of the Halliburton Chemicals manufacture plant site which would connect into Ward Road at the northern end. At its eastern end, Ward Road connects to Patterson Road facilitating access to the site at the regional road level.

An emergency access way will be constructed as an extension to Ward Road (refer to **Figure 2**) in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Developments (IPWEA Subdivisional Guidelines), Liveable Neighbourhoods, Austroad Standards and/or any applicable standards for the local government area.

It is estimated that the proposed development would generate up to approximately 280 total weekday daily trips (both inbound and outbound) during operations. The development-traffic would comprise staff traffic and the transport task (i.e., delivery of goods to and distribution of product from the site) which would involve the use of heavy vehicles of up to 36.5m in length (i.e., B-Doubles).

Site access and vehicle movement considerations for the proposed development are further discussed in **Section 4.7**.

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RAMBOLL AUSTRALIA - GIS MAP file - 318001761_009_GIS_P003_WA | F002_SiteLayout_V05 | 1/11/2024

Legend

- Project boundary
- Building set back line*
- Landscaping set back line*
- Wetland set back line for the retention of sensitive water resource areas
- Indicative site layout
- Perimeter road / boundary landscape (vegetation retention where possible)
- Hardstand area
- Landscape area
- Railway
- Cadastre (LGATE 001)

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*Note: *in accordance with the Local Planning Policy No.3.8.8 East Rockingham Industrial Zones for General Industry Zones*

Figure 2 : Site layout

Cargill Project Crux: Oilseed Crushing Plant, Rockingham Industrial Zone - Works Approval



No.	DESCRIPTION
02	Canola Conveying/Storage/Receiving
03	Seed Handing
03	Preparation Building
03	Pelletizing
04	Extraction Building
04	C/G Solvent
04	Hexane Unloading Area
04	Extraction Cooling Tower
04	Dosing Room
05	Meal Silo & Work Tower
05	Meal Loading Building
06	Biofilter system
07	Refinery Building
07	Refinery Subsidiary Tank Farm
08	Oil Loading Bay
09	Oil Tanks Farm
10	Office Building
11	Gate
12	Lab
13	Maintenance workshop
00	Truck Parking Lot
00	Biomass Steam Boiler
00	Biomass Fuel Storage
00	Biomass Ash Treatment
31	WWTP & Stormwater Pit
00	HV Station
37	Utility Station
00	Weight Bridge & Sampling House
39	Solid Waste House
47	Fire Tank
52	Potential Trees of Interest

Figure 3: Conceptual layout of the Project Crux Plan

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3. Planning Overview

3.1 Planning framework

The site is zoned Industrial under the Metropolitan Region Scheme (MRS) and reserved under the MRS for primary regional roads. The site is also subject to Improvement Plan (IP) No. 14 – Kwinana-East Rockingham. IP 14 was gazetted in 1988 and promoted the coordination of industrial development in the East Rockingham area at a time when industrial land use planning was undertaken solely by the state government agencies.

The subject site is zoned general industry under the City of Rockingham Town Planning Scheme No. 2 ('TPS 2') and will be assessed against the provisions of Clause 4.10 of TPS No. 2 – Industrial Zones and the provisions of State Planning Policy 3.7 – Planning in Bushfire Prone Areas.

An assessment against the relevant provisions of the planning framework is provided in the Planning Approval being prepared in parallel to this Works Approval. It is intended that the lodgement of the works approval and development application will be co-ordinated to reduce administrative burden between respective departments.

3.2 Other approval licences and permits

The Rockingham Industry Zone (RIZ), encompassing the proposed development site, is subject to approvals granted under Federal and State environmental legislation, both of which were granted in 2011 independently of each other.

3.3 Environment Protection and Biodiversity Conservation Act 1999

The industrial development of the RIZ was assessed as a 'Controlled Action' in 2010 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An approval was granted in 2011, allowing the Controlled Action to be undertaken for the development of the RIZ for industrial purposes, noting however, that the approval does not specifically refer to the clearing of a certain area in hectares of vegetation however, given the approval relates to developing the RIZ which requires clearing, those activities are therefore approved.

3.4 Environment Protection Act 1986 (Part IV)

The RIZ Strategic Environmental Assessment was assessed under the *Environment Protection Act 1986* (EP Act) and approved in 2011 under Ministerial Statement (MS) 863. Since approval, several Derived Proposals have been submitted and approved in the RIZ.

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4. Environmental Issues

4.1 Environmental sensitive areas

Under the RIZ Strategic Environmental Approval (refer to **Section 3.31.3**), biodiversity assessments were undertaken for on the *'Sedgelands in Holocene Dune Swales*' Threatened Ecological Community (TEC) and Black Cockatoo habitat which were recorded in the RIZ area. Since that time the *'Tuart (Eucalyptus gomphocephala*) *Woodlands and Forests of the SCP'* TEC (the Tuart Forest TEC) has been listed for protection under the EPBC Act. As such, a more recent biodiversity assessment was undertaken (Refer to **Section 4.5**) to assess the presence of the Tuart Forest TEC within the proposed site.

The assessment determined that the TEC present within the site still qualified for TEC status, despite the vegetation condition being generally in the 'low' category. Further, since the site has undergone previous biodiversity evaluations during the Strategic Environmental Assessment, which led to the development approval within the RIZ in 2011 under the EPBC Act, the new proposal is not obliged to revisit the effects on Tuart communities on the provision all original requirements of the EPBC approval are met by the licensee.

In addition to the Tuart Forest TEC, two Priority Flora were recorded during the survey being:

- Priority 3 grass *Austrostipa mundula*
- Priority 4 forb *Conostylis pauciflora* subsp. *pauciflora* (Dawesville Conostylis).

Vegetation condition categories and priority flora species as identified in the biodiversity survey are shown in **Figure 4.**

4.1.1 Environmentally sensitive receptors

The area surrounding the Project Crux facility is mainly industrial, with the nearest industrial land use immediately bordering the northeast side of the site. Residential zones are situated around 650 meters to the west, while a tourism-related land use, the Cee & See Caravan Park, is located approximately 400 meters to the southwest. The site's periphery is marked by a railway line to the northwest, Patterson Road running along the southeast, and Ward Road to the northeast.

The location of the nearest sensitive receptor is demonstrated in **Figure 5.**

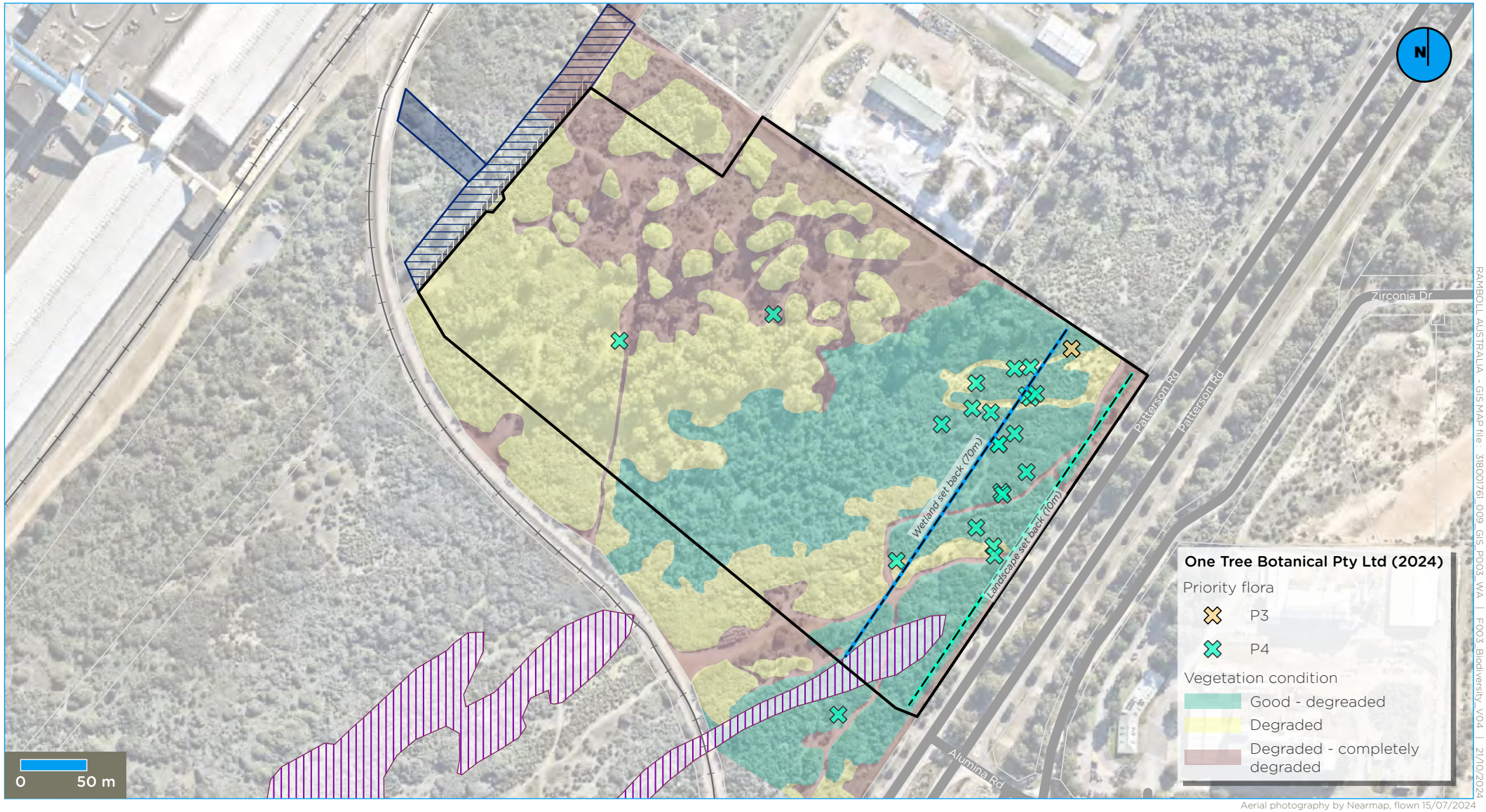
Under the RIZ Strategic Environmental Approval, a 91 hectare Conservation Area has been declared as an offset protection zone to be maintained during the industrial development of the RIZ. The Conservation Area is located approximately 680 metres to the southeast of the Project Crux site and is managed under a Conservation Management Plan.

Further, a total of 38 wetlands occur within the RIZ, of those 14 are contained within the Conservation Area. Of the 24 wetlands that are in the development area of the RIZ 19 are Conservation Category, due primarily to the presence of FCT19 identified as a TEC and five are Resource Enhancement.

The wetlands are predominantly located in linear swales and range in length from 60m – 1.05 kilometres long. The vegetation within the wetlands is a mix of dampland and sumpland type vegetation, with the most common tree species being *Melaleuca rhaphiophylla* and *Banksia littoralis*. *Melaleuca huegelii* is also present in many wetlands indicating the limestone substrate of some swales (PGV Environmental, 2011).

Approximately two wetland areas, identified as Resource Enhancement encroach on the Project Crux site but remain outside the development footprint, as shown within **Figure 4.**

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RAMBOLL AUSTRALIA - GIS MAP file: 318001761_009_GIS_P003_WA | F003_Biodiversity_V04 | 21/10/2024

Aerial photography by Nearmap, flown 15/07/2024

Legend

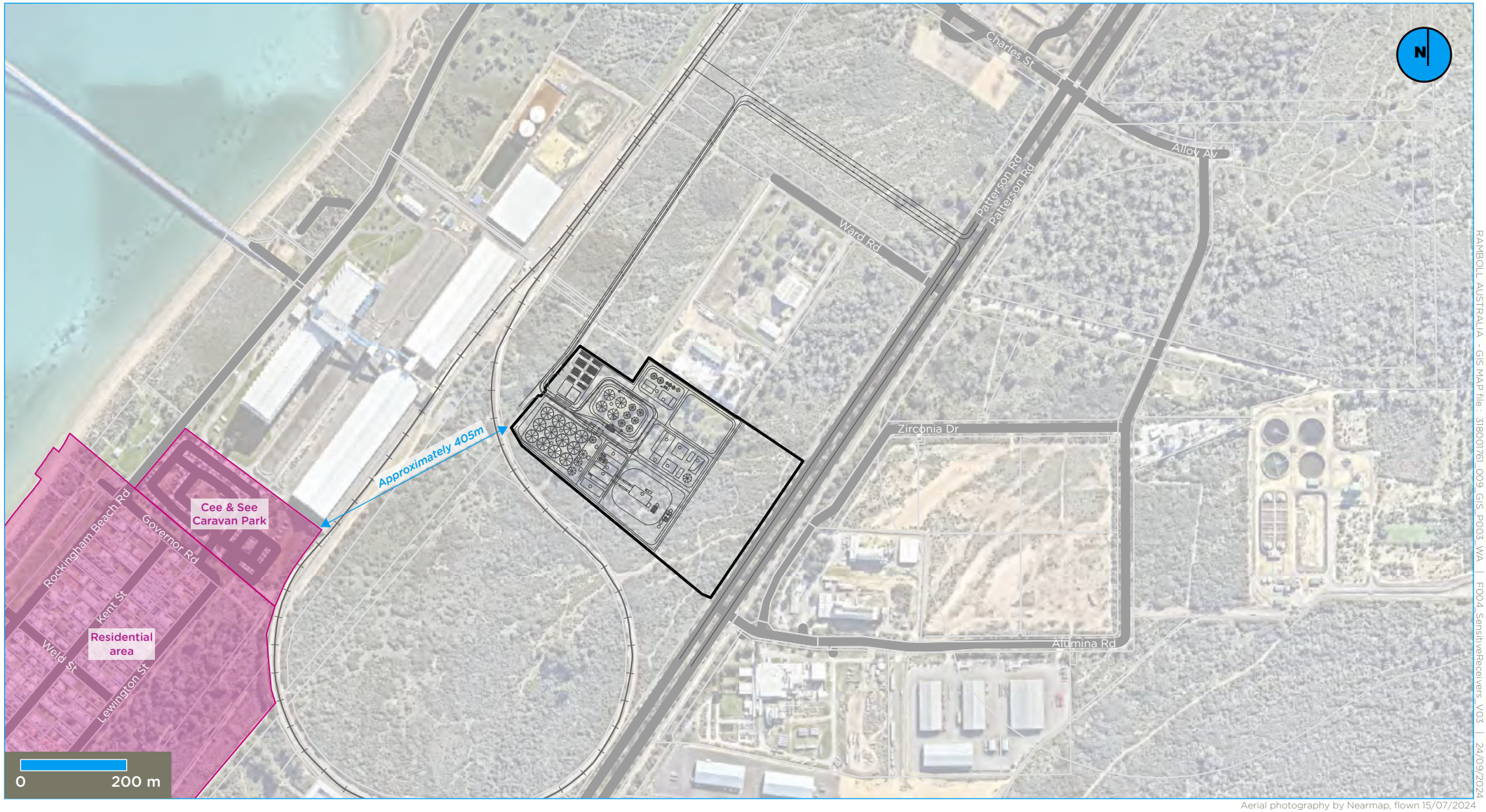
- Project boundary
- Landscaping set back line*
- Wetland set back line for the retention of sensitive water resource areas
- Indicative easement to CBH
- Proposed access road
- Service easement
- Resource Enhancement (Geomorphic Wetlands, Swan Coastal Plain (DBCA-019))
- Railway
- Cadastre (LGATE 001)

*Note: *in accordance with the Local Planning Policy No.3.8.8 East Rockingham Industrial Zones for General Industry Zones*

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Figure 4 : Biodiversity values

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RAMBOLL AUSTRALIA - GIS MAP file - 31800176_009_GIS_P003_WA | F004_SensitiveReceivers_V03 | 24/09/2024

Aerial photography by Nearmap, flown 15/07/2024

Legend

- Project boundary
- Indicative site layout
- Nearest sensitive receptors (residential)
- Railway
- Cadastre (LGATE 001)

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Figure 5 : Nearest sensitive receptors (residential)

Cargill Project Crux: Oilseed Crushing Plant, Rockingham Industrial Zone - Works Approval

4.2 Air quality

4.2.1 Overview

An air quality assessment has been undertaken for the project and is presented in the report titled *Cargill Crux: Air Dispersion Modelling* (Ramboll, 2024) and is provided as **Appendix 1**.

4.2.1.1 Existing environment

Pollutants of concern

Cargill are currently assessing two design options for the boiler required for the proposed development being either a biomass fired boiler, or a gas fired boiler. Biomass boilers potentially emit a number of pollutants of concern including the following:

- Nitrogen Dioxide (NO_2)
- Particulate Matter < 2.5 ($PM_{2.5}$)
- Polyaromatic Hydrocarbons (PAHs)
- Sulphur Dioxide (SO_2)
- Total Volatile Organic Compounds (VOCs) as Benzene
- Arsenic (As) & Compounds
- Beryllium (Be) & Compounds
- Chromium (III) (Cr-III) Compounds
- Chromium (VI) (Cr-VI) Compounds
- Copper (Cu) & Compounds (Dusts)
- Lead (Pb) & Compounds
- Mercury (Hg) & Compounds
- Nickel (Ni) & Compounds
- Polychlorinated Dioxins and Furans (TEQ)

The only pollutant of concern associated with the gas fired boiler option would be nitrogen dioxide.

Sensitive receptors

Sensitive receptors in proximity to the proposed development includes predominately industrial land use types (the closest being directly adjacent to the northeast of the site) with some areas of residential land uses (approximately 650 metres to the west of the site) in addition to tourism (the 'Cee & See Caravan Park') land uses (approximately 400 metres southwest of the site). The site is bound by a railway line to the northwest, Patterson Road to the southeast and Ward Road to the northeast.

Sensitive receptors identified for the purpose of the air quality dispersion modelling assessment included:

- R1 Wells Park
- R2 Golf Course
- R3 Thomas Oval
- R4 Oval
- R5 Residence
- R6 North Rockingham
- R7 Residence 3
- R8 Hope Valley
- R9 Calista Primary School
- R10 Wombat Wallow Childcare Centre

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Ambient air quality

The existing air quality of the site is representative of Kwinana airshed which comprises mixed-use industrial and residential land uses, the operational railway line and major highway.

The assessment by Ramboll (2024) characterised air quality by comparing predicted ground-level concentrations of various pollutants with relevant ambient air quality criteria for all pollutants of concern potentially associated with the proposed development. The criteria is presented in **Table 2** and was adopted was derived from the *Air Quality Modelling Guidance Notes* (Department of Environment, 2006), the draft *Guideline: Air Emissions* (DWER, 2019) and the National Environment Protection Measures (NEPMs). In the absence of available data from the NEPM guides, the annual average guideline for SO_2 was sourced from the Kwinana Environmental Planning Policy (1999).

Table 2: Ambient air quality criteria

Pollutant	Averaging Period	Criteria µg/m³	Reference
Nitrogen Dioxide (NO_2)	1-hour	151	NEPC (2021)
	Annual	28	
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	23	
	Annual	7	
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	0.0003	DWER (2019)
Sulfur Dioxide (SO_2)	1-hour	262	NEPC (2021)
	24-hours	52	
	Annual	52	DWER (2019)
Total VOCs (as Benzene)	1-hour	29	
	Annual	9.6	
Arsenic (As) & Compounds	1-hour	0.09	DWER (2019)
	24-hours	0.027	
	Annual	0.0027	
Beryllium (Be) & Compounds	1-hour	0.004	
Cadmium (Cd) & Compounds	1-hour	0.018	
Chromium (III) (Cr-III) Compounds	1-hour	9	
	24-hours	0.46	
Chromium (VI) (Cr-VI) Compounds	1-hour	0.09	
	Annual	0.00018	
Copper (Cu) & Compounds	1-hour	18	
	24-hours	0.92	
Lead (Pb) & Compounds	Annual	0.46	
	1-hour	0.55	

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Pollutant	Averaging Period	Criteria µg/m³	Reference
Mercury (Hg) & Compounds (Inorganic)	Annual	0.18	
Nickel (Ni) & Compounds	1-hour	0.18	
	24-hours	0.14	
	Annual	0.003	
Polychlorinated Dioxins and Furans (TEQ)	1-hour	0.000002	

4.2.1.2 Potential impacts

Construction

Activities that are likely to affect air quality during construction of the proposed development would involve construction vehicles generating exhaust emissions, excavation and backfilling activities generating dust and, vehicles travelling over access tracks and surfaces generating airborne dust. However, these activities are anticipated to be localised and temporary in nature as to have limited nuisance air quality impacts to sensitive receptors.

Operation

Anticipated impacts to local air quality during operations predominantly relate to plant emissions and dust, both of which are discussed in the following sections.

Plant emissions

The assessment used two Gaussian dispersion models, DISPMOD (Version 2005) and AERMOD (Version 23132), chosen for their complementary capabilities. Predicted GLCs for the pollutants of concern have been estimated using the AERMOD and DISPMOD models and meteorological data has been adapted from the nearest Bureau of Meteorology (BoM) monitoring station, Hope Valley.

Four scenarios were modelled by Ramboll (2024) to assess the potential air quality impacts from the proposed boiler operations of the proposed development as described in **Table 3**. These scenarios included different configurations of biomass and gas boilers and included consideration of future planned development in the Kwinana Industrial Area (KIA). Predicted GLCs were compared against the relevant ambient air quality criteria as reproduced in **Table 2**. The modelling considered both the individual contributions of each scenario (the 'isolation assessment') and cumulative impacts of each scenario with existing background pollutant levels (the 'cumulative assessment').

Table 3: Air quality modelling scenarios

Scenario ID	Boiler Configuration	Description
SC1	Biomass	Biomass boiler
SC2		Biomass boiler and future KIA sources
SC3	Gas	Gas boiler
SC4		Gas boiler and future KIA sources

The modelling results demonstrated that for the majority of pollutants of concern, there would be no predicted exceedances in the relevant air quality criteria identified in **Table 2**. The predicted exceedances that were identified during the modelling are summarised in **Table 4**, noting that

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where offsite exceedances were predicted, generally, the contour maps demonstrated that the exceedance was within proximity to the site boundary and in compliance with the criteria at the sensitive receptors within the modelling domain.

Table 4: Predicted exceedances

Pollutant	Averaging Period	Criteria (µg/m³)	Predicted Exceedance
Biomass Boiler			
NO_2	1-hour	151	Exceedances were predicted for the cumulative assessment for both SC1 and SC2 where the maximum cumulative offsite predicted GLC was 178.5 µg/m³, however, the contours showed the exceedance only occurred near the site boundary
$PM_{2.5}$	24-hours	23	Exceedances were predicted for the isolation and cumulative assessment for both SC1 and SC2, where maximum predicted GLC was 24.02 µg/m³, based on the contour plots, these predicted GLCs are modelled to occur only at/close to the boundary of the site and be within acceptable limits at sensitive receptors.
	Annual	7	Exceedances were predicted offsite and at sensitive receptor locations for the isolation and cumulative assessment of both SC1 and SC2, where the maximum predicted GLC was 8.53 µg/m³. Although exceedances are predicted across the modelling domain for the cumulative assessment, the model predicted results in isolation show that Cargill's contribution of $PM_{2.5}$ at each of the sensitive receptor locations is no more than 2% of the annual average $PM_{2.5}$ criteria, and that the exceedance is most associated with elevated monitored background concentrations of $PM_{2.5}$.
PAH	Annual	0.0003	Exceedances were predicted offsite for the cumulative assessment of both SC1 and SC2. However, predicted concentrations were below the criteria at each of the sensitive receptors within the modelling domain and the maximum offsite predicted GLC was within close proximity to the boundary of the site.
Gas Boiler			
NO_2	1-hour	151	Exceedances were predicted offsite for the cumulative assessment of both SC3 and SC4. However, predicted cumulative concentrations were below the relevant 1-hour average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the site boundary.

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Dust
Potential dust emissions from the operations would include any dust lift off from unsealed surfaces during windy conditions which would be localised.

As operations involve grain handling activities, there is a potential for combustible dust to present a safety risk. Combustible dust refers to finely divided soil particles (≤500 µm in nominal size) which may form an explosive mixture with air at atmospheric pressure and normal temperatures. Some combustible dusts can cause explosions if there is a combination of a dust concentration within the explosive range and the presence of an ignition source. However, the potential for grain dust combustion would be suitably managed through the mitigation measures outlined in **Section 4.2.2**.

4.2.2 Management

Proposed measures to manage and/or mitigate air quality impacts from the project are detailed in the following **Table 5**.

Table 5: Management and mitigation measures – air quality

ID	Management/ mitigation measure	Timing
AQ1	A community liaison phone number and permanent site contact will be established so that the air quality related complaints, if any, can be received and addressed in a timely manner.	Construction
AQ2	Potentially affected sensitive receptors will be advised of the proposed construction period at least one week prior to the commencement of works.	Construction
AQ3	Dust suppression will be implemented (including the use of water trucks, control of vehicle movements / restricted speeds) during construction.	Construction
AQ4	Exposed areas will be minimised where practical to reduce wind-blown dust emissions from the site.	Construction
AQ5	Design principles will follow *NFPA 61 - Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities* (the NFPA)	Operation
AQ6	Dust collectors (Point of Use) would be installed on equipment as required (such as conveying and elevating equipment) and dust Suppression Hoppers will be fitted on static loadout points.	Operation
AQ7	Explosion venting will be installed in accordance with NFPA where required, including explosion venting on elevators and dust collectors	Operation
AQ8	Critical safety devices will be installed on conveying and handling equipment that stop/prevent operation in a situation where a possible ignition source is generated due to mechanical failure or other. Including but not limited to: • Belt and pulley alignment sensors. • Zero speeds / no motion sensors • Bearing temperature sensors	Operation

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ID	Management/ mitigation measure	Timing
AQ9	Cargill will maintain the community liaison phone number and site contact so that community complaints around air quality can be received relating to operations.	Operation

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4.3 Odour

4.3.1 Overview

An odour risk assessment has been undertaken for the project in accordance with the DWER Guideline: Odour Emissions (DWER, 2019) and is presented in the report titled Cargill Crux Project East Rockingham Works Approval Application: Odour risk assessment (OPAM Consulting, 2024) and is provided as **Appendix 2**.

4.3.1.1 Existing environment

Sensitive receptors

The odour risk assessment (OPAM Consulting, 2024) identifies several sensitive receptors in the vicinity of the Project Crux facility. The closest is a caravan park (the 'Cee & See Caravan Park') located approximately 400 meters southwest of the plant boundaries. Sensitive receptors near the Cargill site also include industrial or commercial land uses, considering a worst-case scenario for odour impact. These include manufacturing, servicing, storage, distribution, showrooms, and warehouses located about 500 meters south of the proposed Cargill facility in a light industry and commercial zone.

The following facilities have been noted as nearby sensitive receptors or having particular relevance in the odour assessment:

- SAMI Bitumen
- Nutrien Ag Solutions
- PUMA Fuel Tank Farm
- Coogee Chemicals
- BHP Nickel West Refinery
- Fertiliser facilities
- Mt Barker Chicken - meat processing

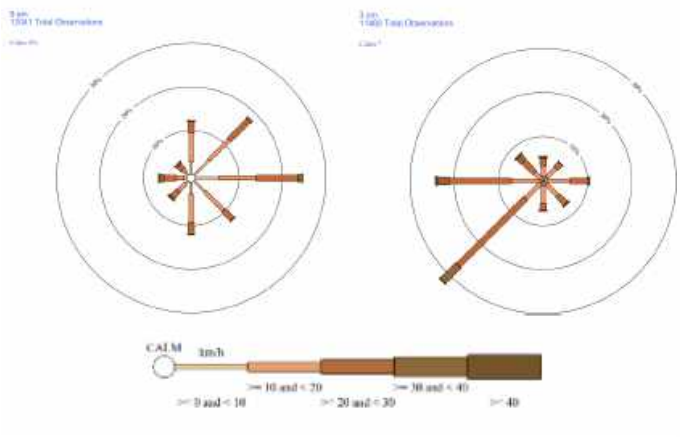
These receptors have been considered in the odour impact prediction by OPAM Consulting (2024) to ensure the facility undertakes appropriate risks assessment and mitigation strategies in its planning and operational phases.

Prevailing wind conditions

The proposed Cargill facility is proposed to be located within a coastal region in the southern part of the Kwinana Industrial Area. The surrounding terrain can generally be described as undulating from sea level to ~10 metres for the land within 4 kilometres east of the coastline and approximately 10 to 30 metres for land greater than 4 kilometres east of the coastline (OPAM Consulting, 2024).

Wind data from the BoM in addition to field data collected from the Odour Field Assessments (OFAs) performed by OPAM Consulting (2024) was analysed to characterise the prevailing wind conditions for the project site. The wind roses are shown as **Figure 6** and do not represent data from the same time periods. The odour assessment concluded that the prevailing wind directions have slightly evolved for the last five years compared to previous longer periods. Morning winds appears to be more easterly to east-southeasterly over the last 5 years compared to the last 34 years when they were more easterly to north-easterly. Afternoon winds appear to be more southerly and south-westerly while they were more south-westerly and westerly over the last 34 years.

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BoM Jandakot Airport 9am and 3pm
(Apr. 2019 – Apr. 2024)



BoM weather station of Jandakot Airport
(Apr. 2019 – Apr. 2024) 8.52% of calm

Figure 6: Wind roses

A total of ten OFAs were conducted following a method based on the European Standard *Ambient air - Determination of odour in ambient air by using field inspection - Part 2: Dynamic olfactometry (*EN 16841 Part 2:2016 standard) for a dynamic plume method assessment using a handheld portable anemometer for measuring air speed.

The OFAs were conducted under winds ranging from NE to SE and S to WNW. The winds surveyed varied from for those taken at ground level (almost still up to 4 meters per second) and those taken at a height of ten meters (six to nine meters per second). Ten odour maps were created for each OFA undertaken and represent the results of the dynamic plume measurements during the OFAs. The odour maps are provided in the odour risk assessment as **Appendix 2.**

The assessment recorded the types of odours in the plant's vicinity, with points on odour maps corresponding to odour characteristics such as chemical, petrochemical, grainy, cooking/meat processing-related, and vegetative odours. A summary of the odours recognised is provided as **Table 6**.

Table 6: Types of odours recognised in the vicinity of the proposed Cargill facility

Odours recognised	Identified source
Chemical odour, ammonia, caustic	BHP Nickel West
Petrol, petrochemical	PUMA fuel tank farm
Grainy odour	CBH Grain Terminal
Cooking chicken, sauce, spices	MT Barker chicken – meat processing
Kaolin, powdery odour	WA Kaolin
Floral, grassy, soil, dirt, eucalyptus	Vegetation
Burnt plastic, burnt bread type, smoke, metal, sour, cement and wet cement	Unidentified source

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The results found that the current odour background of the proposed development site is low. The area along the coast, which is predominantly residential, will be downwind from the plant during easterly to northeasterly winds.

4.3.1.2 Potential impacts

Construction
Activities associated with the construction of the proposed development are unlikely to generate any odour emissions.

Operation
Operational activities at the proposed development site that have the potential to generate odours include:

- The preparation building being the first stage of oil extraction from the seeds and encompasses various stages including sieving, heating and cracking the seeds before pressing them to extract oil content has the potential to generate odours.
- The use of hexane and the solvent extraction system within the extraction building has the potential to generate hydrogen sulfide odours.

The potential odour emissions would be suitably managed and mitigated via the proposed engineered controls and monitoring requirements outlined in the following **Section 4.3.2**.

4.3.2 Management

Proposed measures to manage and/or mitigate odour impacts from the project are detailed in the following **Table 7**.

Table 7: Management and mitigation measures - odour

ID	Management/ mitigation measure	Timing
O1	A community liaison phone number and permanent site contact will be established so that the odour related complaints, if any, can be received and addressed in a timely manner.	Construction
O2	Potentially affected sensitive receptors will be advised of the proposed construction period at least one week prior to the commencement of works.	Construction
O3	The following engineered process controls would be implemented in the design and operation of the Project Crux plant: • The preparation building is to be sealed and maintained under negative pressure so that any fugitive emissions would be limited. • Barometric louvers would be installed in the preparation building a manner so that homogenous airflow within the building is maintained and the renewal of foul air with fresh air is maintained. • Operations inside the preparation building will also be covered with point source extraction to capture the foul air and direct it through a cyclone prior to a scrubber and finally a biofilter. • The extraction building will include a fully sealed process to avoid hexane and high hydrogen sulfide concentration emissions to atmosphere. • In order to prevent an overpressure on the extraction plant from a restricted outlet, the vent gas stream will be equipped with an air	Design / operation

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ID	Management/ mitigation measure	Timing
	break. This stream will be equipped with hexane and hydrogen sulfide detectors.	
O4	The following criteria would be monitored and/or tested at the Project Crux plant to ensure sufficient odour management: • The sealing and confinement of the preparation building will be tested once built to verify that limited fugitive emissions occur. • Negative pressure within process areas would be monitored. • Temperature and relative humidity of the air entering the biofilters would be continuously monitored. • The back pressure of the media will also be monitored to inform about possible blockages and degradation of the media with time. • Visual inspection of the surface area of the media will be undertaken daily to verify the absence of weeds, vermin and to possibly detect the presence of short cuts resulting in partially or untreated air. • Internal assessments would be undertaken to verify odour concentrations of a composite sample collected at the outlet of the biofilter will be around 500 ou.	Operation
O5	Contingency and corrective actions would be implemented in the extraction building, the preparation building and the biofilters (preparation and extraction). Corrective actions would include (but not limited to) fixing or repairing issues as soon as practical, responding to negative pressure monitoring, visual inspections of equipment, and testing of equipment.	Operation

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4.4 Bushfire

4.4.1 Overview

A bushfire Management Plan has been undertaken for the project and is presented in the report titled *Bushfire Management Plan: Lot 108 Patterson Road, East Rockingham* (Ecosystem Solutions, 2024) and is provided as **Appendix 3**.

4.4.1.1 Existing environment

The site is located within a bushfire prone area, as declared by *State Planning Policy 3.7: Planning in Bushfire Prone Areas*. As such, a Bushfire Attack Level (BAL) assessment was completed for the site including a site inspection completed by Ecosystem Solutions in May 2024. The site inspection involved classifying all vegetation within 150 metres of the site and the slope under the vegetation determined in accordance with *AS 3959:2018: Construction of buildings in bushfire-prone areas.*

The BMP states that the site was not classified as 'High risk land-use' or 'Vulnerable land use' as per the definitions within the by *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (refer to **Appendix 3**).

The BAL assessment included an investigation of the Asset Protection Zone which is mapped by Ecosystem Solutions (2024) as the area within the development footprint. Ecosystem Solutions (2024) concluded that a final rating of BAL-FZ applies to the site. However, with the application of management measures, such as the ongoing management of the Asset Protection Zone in perpetuity, a BAL-29 can be achieved for all habitable buildings. Management measures have been included in **Section 4.4.2**.

Ecosystem Solutions (2024) concluded that no active revegetation is required. Any future planting of vegetation, or failure to maintain the Asset Protection Zone to the standard detailed in this BMP, can change the BAL rating significantly.

4.4.1.2 Potential impacts

<u>Construction</u>

There is a risk that ignition sources would be generated from equipment or machinery during construction works.

<u>Operation</u>

There is a risk that electrical failure at the proposed development could lead to bush fire ignition. Such risks would be managed through the mitigation measures outlined in **Section 4.4.2,** such as completing regular maintenance on equipment and machinery and ensuring construction personnel operate machinery in a safe manner and by having firefighting equipment on site.

4.4.2 Management

Proposed measures to manage and/or mitigate bushfire impacts from the project are detailed in the following **Table 8.**

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Table 8: Management and mitigation measures - bushfire

ID	Management/ mitigation measure	Timing
BF1	The design of the facility is to incorporate a suitable emergency access route for the provision of safe access to /from the public road system for fire fighting emergency vehicles.	Design
BF2	The construction contractors would implement a hot works permit system which includes checking the local fire danger ratings and any total fire bans in place. The permit should only be issued if conditions are safe.	Construction
BF3	Where possible, hot works should be scheduled for the mornings or times of day with cooler temperatures when the risk of fire is lower.	Construction
BF4	Construct the extension to Ward Road in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Developments (IPWEA Subdivisional Guidelines), Liveable Neighbourhoods, Austroad Standards and/or any applicable standards for the local government area.	Construction
BF5	Construct the Emergency Access Way and all internal access ways in accordance with the *Guidelines for Planning in Bushfire Prone Area* (Western Australian Planning Commission, 2021).	Construction
BF6BF6	Equipment and machinery will be regularly maintained to minimise the risk of sparks.	Construction and Operation
BF7	During operations, Cargill would implement a hot works permit system which includes checking the local fire danger ratings and any total fire bans in place. The permit should only be issued if conditions are safe.	Operation
BF8	The emergency access route for the provision of safe access to/from the public road system for fire fighting emergency vehicles would be maintained and kept free of obstructions.	Operation
BF9	Firefighting equipment will be kept on site at all times. Personnel will be trained to use the equipment	Operation
BF10	The Asset Protection Zone will be established and maintained in accordance with Schedule 1 of the *Guidelines for Planning in Bushfire Prone Area* (Western Australian Planning Commission, 2021) and the *Bushfire Management Plan: Lot 108 Patterson Road, East Rockingham* (Ecosystem Solutions, 2024).	Operation
BF11	Construct and maintain the Emergency Access Way in accordance with the *Guidelines for Planning in Bushfire Prone Area* (Western Australian Planning Commission, 2021).	Operation
BF12	Construct and maintain all internal access ways in accordance with the *Guidelines for Planning in Bushfire Prone Area* (Western Australian Planning Commission, 2021).	Operation
BF13	Place a notice on the Certificate of Title, advising of the existence of this Bushfire Management Plan within the facility. Wording to be provided by City of Rockingham.	Operation

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Noise management

4.4.3 Overview

An environmental noise assessment has been undertaken for the project in accordance with the Western Australian *Environmental Protection (Noise) Regulations 1997 (WA)* and is presented in the report titled *Cargill Golden Crux Project East Rockingham Canola Processing Facility: Environmental Noise Assessment* (Herring Storer Acoustics, 2024) and is presented in **Appendix 4**.

4.4.3.1 Existing environment

Sensitive receptors

The nearest noise sensitive premises was identified to be the Caravan Park (the 'Cee & Sea Caravan Park) located approximately 400 metres to the southwest of the site.

- R1 (Caravan Park)
- R2 (Closest Residential Premise)
- R3 (Residential Premise over 100m from Industrial Land Use)
- R4 (Residential Premise over 450m from Industrial Land Use)

Noise criteria

The environmental noise assessment by Herring Storer Acoustics (2024) identified the noise criteria for the proposed development in accordance with the *Environmental Protection (Noise) Regulations 1997.* For noise-sensitive areas such as residential premises, the regulations assign allowable noise levels based on an influencing factor (IF) calculated from land usage within specified radii around the premises. The noise criteria are reproduced in the following **Table 9**.

Table 9: Assigned outdoor noise levels

Type of premises receiving noise	Time of day	Assigned level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises: highly sensitive area (i.e., within 15 metres of a dwelling)	Monday to Saturday (7am to 7pm)	45 +IF	55 + IF	65 + IF
	Sunday and public holidays (9am to 7pm)	40 + IF	50 + IF	65 + IF
	All days (7pm to 10pm)	40 + IF	50 + IF	55 + IF
	Monday to Saturday (10pm to 7am) and Sunday and public holidays (10pm to 9am)	35 + IF	45 + IF	55 + IF
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80

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Type of premises receiving noise	Time of day	Assigned level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90
Note:	The $L_{A\ 10}$ noise level is the noise level that is exceeded for 10% of the time The $L_{A\ 1}$ noise level is the noise level that is exceeded for 1% of the time The $L_{A\ max}$ noise level is the maximum noise level recorded IF = Influencing Factor dB = decibels			

4.4.3.2 Potential impacts

Construction

Noise generating activities from the project during construction may include:

- noise generated from the use of equipment / machinery.
- vehicle noise including heavy vehicles and reversing alarms within the site, as well as vehicles delivering equipment and materials to the site.
- installation and removal of a construction compound.
- loading and unloading of materials and plant.

Noise levels during construction would be sufficiently managed through the implementation of the mitigation measures outlined in **Section 4.4.4**.

Operation

Operational noise from the plant may include components such as canola truck logistics, processing, oil storage, and a solvent extraction plant. The environmental noise assessment (Herring Storer Acoustics, 2024) modelled noise emissions at the nearest neighbouring residential premises using the computer programme SoundPlan. Sound power levels used for the noise modelling were based on both manufacturer data and measured sound pressure levels of similar equipment proposed for use on site.

The noise levels were modelled under a 'worst-case' scenario involving nighttime operational hours, with the oilseed plant in operation, transport in and out of site and loading and unloading activities. The acoustic assessment showed that, in the worst-case scenario, the noise received at the premise is below the assigned noise level. The assessable noise level emissions from the plant ranged from 5 to 9 dB(A) below the assigned noise level, as such the proposed Cargill Facility would not be considered as significantly contributing to noise levels at the noise-sensitive premises (Herring Storer Acoustics, 2024).

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4.4.4 Management

Proposed measures to manage and/or mitigate noise impacts from the project are detailed in the following **Table 10**.

Table 10: Management and mitigation measures - noise

ID	Management/ mitigation measure	Timing
N1	A community liaison phone number and permanent site contact will be established so that the noise related complaints, if any, can be received and addressed in a timely manner.	Construction
N2	Potentially affected sensitive receptors will be advised of the proposed construction period at least one week prior to the commencement of works.	Construction
N3	Construction work must be conducted in accordance with *Australian Standard 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites*.	Construction
N4	An approved Noise Management Plan must be implemented for out-of-hours work (i.e. if works occur before 7am or after 7pm). The Noise Management Plan needs to be approved by the East Rockingham local government.	Construction
N5	Cargill will maintain the community liaison phone number and site contact so that community complaints relating to noise can be received relating to operations.	Operation
N6	Machinery, plant, and equipment will be maintained in accordance with suppliers' specifications.	Operation
N7	Machinery, plant, equipment and operational practices will be adopted based on the option that will produce the lowest practical level of noise.	Operation

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4.5 Biodiversity

4.5.1 Overview

A flora and vegetation survey has been undertaken for the project and is presented in the report titled *Cargill Crux Project Rockingham: Detailed Flora and Vegetation Survey* (One Tree Botanical, 2024) and is provided in **Appendix 5**. Previous biodiversity assessments have been undertaken for the site as part of the Strategic Environmental Assessment approval granted in 2011 under the EPBC Act for industrial development in the RIZ (refer to **Section 1.3**).

In the 2011 approval, the focus for biodiversity assessment was on the *'Sedgelands in Holocene Dune Swales*' Threatened Ecological Community (TEC) and Black Cockatoo habitat. Since that time the *'Tuart (Eucalyptus gomphocephala*) *Woodlands and Forests of the SCP'* TEC has been listed for protected under the EPBC Act. Cargill has been provided clarification that the original approval is not affected by this subsequent EPBC protection listing, however, for thoroughness the project has undertaken further assessment to avoid and minimise impacts to the Tuart vegetation and comply with *Biodiversity Conservation Act 2016* requirements.

Therefore, the focus of the more recent biodiversity assessment undertaken by One Tree Botanical (2024) was to assess the status of *'Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the SCP*' in the proposed project site.

4.5.1.1 Existing environment

The status of existing vegetation was assessed by One Tree Botanical (2024) across two surveys, the first being a mid-spring survey completed on the 12 to 15 September 2023 and a follow up late spring survey on 17 to 19 October 2023.

Survey methodology was undertaken in accordance with the *Technical Guide – Terrestrial Flora and Vegetation surveys for Environmental Impact Assessment* (EPA, 2016). Survey techniques employed included the following:

- traverses conducted on foot at approximately ten metre intervals across vegetated areas
- ten quadrats were established in representative vegetation across the study area
- forty-four relevés were recorded in unmarked areas from which data is collected
- opportunistic sampling included informal survey and recording of any points of interest encountered
- vegetation condition ratings were assigned based on criteria from EPA (2016)

Overall, a total of 129 taxa were recorded during the survey by One Tree Botanical (2024) of which 54 were identified as natives. Of the 54 native species, 35 were flora of 'other' conservation significance a total of 129 taxa were recorded of which 41.9% were native species. Key findings are summarised in the following sections.

<u>Threatened Flora Species</u>

Under the *Biodiversity Conservation Act 2016* (BC Act) state listed Threatened Flora (TF) are protected under a ranking system that categories flora species into different levels of protection Under the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act) TF species and Threatened Ecological Communities (TECs) are protected under a similar classification system.

No TF species or TECs listed under the EPBC Act or BC Act were recorded during the survey by One Tree Botanical (2024).

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Other Flora of Conservation Significance

Priority Flora refers to species that are not specially protected under current legislation, however, are species that have been identified and listed by the Department of Biodiversity and Attractions (DBCA) to guide and prioritise conservation actions. The four categories for Priority Flora are as follows:

- Priority 1: poorly known species that are potentially at risk, with few, if any, populations known to be in conservation areas.
- Priority 2: species with a limited number of populations, some of which may not be in areas managed for conservation.
- Priority 3: species that are known from several populations but are still at risk due to ongoing threats or declining trends.
- Priority 4: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list
- Priority 5: Conservation Dependent ecological communities

Two Priority Flora were recorded during the survey being:

- Priority 3 grass *Austrostipa mundula*
- Priority 4 forb *Conostylis pauciflora* subsp. *pauciflora* (Dawesville Conostylis).

The location of the Priority Flora as identified in the survey are shown in Figure 4: Biodiversity values **Figure 4.**

Vegetation Type and Condition

Six distinct vegetation types were identified in the area by One Tree Botanical (2024), all of which were described to exhibit varying degrees of degradation due to human activities and introduced flora (weed) species. These vegetation types ranged from shrublands and forests to weedy grasslands.

The condition of the vegetation types identified was found to be influenced by historic disturbances such as frequent fires, grazing, and possibly selective clearing. The understorey is heavily impacted by weeds, with some regions showing signs of natural regeneration. Most vegetation is rated from 'Good-Degraded' to 'Degraded-Completely Degraded' condition. The overall vegetation condition was mapped by One Tree Botanical (2024) and reproduced in **Figure 5**.

Weed species

Seventy-five introduced flora species (weeds) were recorded in the study area by One Tree Botanical (2024). Of those, 29 had a 'High Impact' rating, and of those, 25 were also rated as having 'Rapid Invasiveness' under the Swan Region Ecological Impact and Invasiveness criteria.

Floristic Community Types

Statistical analysis of the field survey data indicated the study area represented the following Floristic Community Types (FCTs):

- FCT19: represents commonwealth TEC 'Sedgelands of the Holocene Dune Swales' (Endangered). Also represents state listed (Critically Endangered) TEC sub-type 'SCP19b: Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain
- FCT24 represents *'Northern Spearwood shrublands and woodlands'*.
- FCT30a (non-apex) represents state listed (Critically Endangered) TEC: 'SCP30a: *Callitris preissi*i (or Melaleuca lanceolata) forests and woodlands of the Swan Coastal Plain
- There is also a secondary association with SCP29a: *'Coastal shrublands on shallow sands, southern SCP*' (FCT29a), which is a state-listed Priority Ecological Community (P3).

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Tuart (*Eucalyptus gomphocepala*) woodlands and forests of the SCP

The assessment of the *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* TEC was undertaken in accordance with the *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community* published by the Department of Climate Change, Energy, the Environment and Water in 2019 which provides the framework for establishing whether this community is protected under the EPBC Act.

The main 'patch' of *Eucalyptus gomphocephala* (Tuart) Forest was found to be adjacent to areas characterized by low diversity and high weed cover. The dominance of weeds implies competition with native species such as the Tuart, potentially impacting their growth and survival.

The *Eucalyptus gomphocephala* (Tuart) Forest present in the study area, fell into the category of patch sizes ranging from 2 to 5 hectares. In this category, the TEC marginally meets the criteria for classification as the 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the SCP' TEC, making it potentially eligible for protection under the EPBC Act.

However, the established condition thresholds for this TEC are notably low when considering the vegetation's health. There appears to be other considerations for this TEC, such as the rarity of undisturbed examples and their significance as habitats for wildlife.

Whilst the site was determined to be within the 'Low' category for vegetation condition, it still qualified for TEC status on the basis each quadrat assessed contained more than four native plant species. One Tree Botanical (2024) noted that this result was in stark contrast to what would be anticipated in moderately undisturbed Tuart vegetation communities on the SCP, where typically 30-40 species or more could be found.

Additionally, since the site has undergone previous biodiversity evaluations during the Strategic Environmental Assessment, which led to the development approval within the RIZ in 2011 under the EPBC Act, the new proposal is not obliged to revisit the effects on Tuart communities on the provision all original requirements of the EPBC approval are met by the licensee. Moreover, this additional biodiversity analysis is part of an effort to fulfil the overarching commitment to biodiversity conservation while proceeding with the project. As such, the proposed footprint of the development has been designed to minimise impacts to the Tuart communities present where feasible.

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4.5.1.2 Potential impacts

Construction

Main impacts to biodiversity during construction predominately relate to vegetation clearing and associated habitat loss required to accommodate the proposed development. The project also has the potential to distribute weed species through the transportation of materials on vehicles to and from the site.

Overall it was found that vegetation conditions ranged from 'Good to Completely Degraded', with widespread weed cover and high environmental impact. Some areas maintained a basic vegetation structure or had the potential to regenerate it, but these areas were found to be under significant disturbance.

Generally, it was found that the Tuart Forest community within the site is facing challenges due to weed invasion, historical land use, and the need for protective status based on their ecological value and current conditions, which dictate the extent of their viability and conservation priority. However, it still qualified for TEC and associated protection status.

The proposed plant has been designed to avoid and minimise impacts to the vegetation areas deemed to be of conservation significance, including the Tuart Forest. The proposal's development footprint has been based on setbacks adopted from the *Local Planning Policy No.3.3.8 East Rockingham Industrial Zones* which describes the required building setbacks for development within industrial zones in the RIZ including a 15 metre buffer between the primary street frontage (Patterson Road) and the development footprint. The objective of maintaining setbacks within the *Local Planning Policy No.3.3.8 East Rockingham Industrial Zones* is for the protection and enhancement of "*natural vegetation along Patterson Road and Mandurah Road, as major entry ways to the City, to ensure Industrial development is appropriately screened."* As such, the proposed footprint of the development has been designed to minimise impacts to the Tuart communities present where feasible.

Operation

Once the proposed development becomes operational impacts to biodiversity would be limited to the potential dust, noise, light and vibrations generated from the Project Crux plant which have the potential to impact terrestrial ecosystems including vegetation health and construction disruption of nocturnal native fauna behaviour. However, given that the surrounding area is predominantly industrial and commercial, such impacts are anticipated to be minor with the implementation of management measures outlined in **Section 4.5.2**.

4.5.2 Management

Proposed measures to manage and/or mitigate biodiversity impacts from the project are detailed in the following **Table 11**.

Table 11: Management and mitigation measures – biodiversity

ID	Management/ mitigation measure	Timing
B1	Cargill will comply with the statutory requirements of the existing Strategic Environmental Assessment approvals granted in 2011 under both the EPBC Act and the EP Act.	Construction and operation

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ID	Management/ mitigation measure	Timing
B2	Construction activities relating to seed collection, vegetation clearing or salvation, fauna management, revegetation, landscaping and habitat creation will be undertaken in accordance with the RIZ CEMP (PGV Environmental, 2011).	Construction
B3	Disturbance will be restricted to the proposed development footprint resulting from the setbacks applied in accordance with the *Local Planning Policy No.3.3.8 East Rockingham Industrial Zones*.	Construction
B4	Targeted weed management will be implemented before and during the construction period as required to minimise the spread of weeds.	Construction
B5	Waste containing noxious weeds and seeds will be removed from the site and disposed of at a licenced facility so that spread of weeds is minimised.	Construction
B6	Native vegetation within setback and buffer areas will be retained and maintained in accordance with the RIZ EMP (PGV Environmental, 2011). Vehicle access will not be allowed in areas designated for retained vegetation.	Operation
B7	Operational activities relating to seed collection, vegetation clearing or salvation, fauna management, revegetation, landscaping and habitat creation will be undertaken in accordance with the RIZ EMP (PGV Environmental, 2011).	Operation
B8	All Declared Weeds under the *Agriculture and Related Resources Protection Act 1976* will be eradicated from the site.	Operation

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4.6 Contamination

4.6.1 Overview

A Draft Baseline Contamination Investigation (BCI) has been undertaken for the project and is presented in the report titled *Report on Baseline Contamination Investigation: Proposed Crux Project* (Douglas Partners, 2024) and is provided as **Appendix 6**.

At the time of writing, the draft BCI report was in the process of being finalised in response to the Contaminated Site Auditor comments (Rob Shapland of Australian Environmental Auditors). The Contaminated Auditor's comments stated that "*Overall, the document is of good quality and generally compliance with DWER guidance's*" and suggested that three minor report changes be made involving the inclusion of summary sections and defining the acronyms used in the report. As no material changes will be made to the draft BCI (as provided as **Appendix 6**), the final BCI will be issued when available.

As part of the leasing arrangement that would allow Cargill to lease the site from DevelopmentWA for a 60-year term for the construction and operation of the proposed development, Cargill are required to conduct a BCI that must be endorsed by an Auditor that holds an accreditation under Section 69 of the *Contaminated Sites Act 2003.*

As such, Cargill engaged Mr. Peter Anderson from Australian Environmental Auditors to complete an audit of the BCI by Douglas Partners (2024). The Auditor inputs have been documented in the Draft BCI (refer to **Appendix 6**).

4.6.1.1 Existing environment

Based on review of site history information, site walkover and proposed development Douglas Partners (2024) developed a preliminary a list Potential Areas of Environmental Concern (PAEC), Contaminants of Potential Concern (CoPC) and a Conceptual Site Model (CSM) for the site to then inform the development of a Sampling and Analysis Quality Plan (SAQP).

The Soil Assessment Criteria adopted by Douglas Partners (2024) were derived from Health Investigation Levels (HILs), Health Screening Levels (HSLs) and Environmental Investigation Levels (EILs) from Schedule B1 (Guidelines on investigation levels for soil and groundwater) of the National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC, 2013).

The SAQP was provided to the Auditor on 11 June 2024 and subsequently reviewed. The SAQP was then amended by Douglas Partners to include additional investigations to address the data gaps identified by the Auditor. The SAQP included a detailed programme of soil testing and groundwater testing and is summarised in the following **Table 12**.

Table 12: Potential CoPC's associated with operations

Component	SAQP[1]
Soils (sampling)	• A total of 39 test pits were undertaken between 18 and 20 June 2024. The test pits were excavated using an 8-tonne backhoe fitted with a 450 mm wide toothed bucket to depths of between 0.3 m and 3.0 m. • Soil samples were collected and horizons logged at broadly regular intervals based on observed changes in strata and upon obvious signs of potential contamination such as odours or staining.

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Component	SAQP[1]
Soils (subsurface bonded ACM)	• One bulk soil sample was collected per metre depth of potentially impacted strata per test pit location. • Each bulk sample was screened through a ≤7 mm aperture sieve. • All retrieved potential ACM fragments (where encountered) were weighed. • The Asbestos % weight for weight (w/w) in soil was calculated in accordance with the *Guidelines for the Assessment, remediation and management of asbestos-contaminated sites in Western Australia* (Department of Health, 2021).
Soils (chemical analysis)	• Forty-one primary soil samples were submitted to a NATA accredited laboratory for analysis of the following CoPC's: – Metals/metalloids – Total recoverable hydrocarbons (TRH) – Benzene, toluene, ethyl benzene, xylene and naphthalene (BTEXN) – Polycyclic aromatic hydrocarbons (PAH) – Per- and polyfluoroalkyl substances (PFAS) • Two background soil samples were also analysed for % iron, cation exchange capacity, pH and total organic carbon.
Groundwater (sampling)	• A total of eight groundwater wells were sampled and analysed on 23 July 2024. • Groundwater samples were collected using a low flow pump and water level was gauged using an electronic interface probe.
Groundwater (chemical analysis)	• Primary groundwater samples were submitted to a NATA accredited laboratory for the analysis of the following CoPC's: – Metals/metalloids – TFH – BTEXN – Volatile organic compounds (VOCs) – PAH – PFAS – Nutrients (nitrogen, nitrate, nitrite, ammonia, total Kjeldahl nitrogen and phosphorous). – Gross Alpha Beta – Hardness – Major cations and anions

1. SAQP programme included a Data Quality Control programme not listed above including intra-laboratory replicate samples and trip spike samples.

In addition to the SAQP programme, Douglas Partners (2024) conducted a site walkover whereby fly-tipped bonded fragments/sheets of potential asbestos containing materials (PACM) were observed at a number of surface locations. These PACM/ACM items would be managed in accordance with the measures outlined in **Section 4.6.2**.

Douglas Partners (2024) concluded that the concentrations of chemical contaminates in the analysed soil samples were below the adopted soil assessment criteria and are unlikely to present an unacceptable risk to ecological receptors. The apparent absence of broadscale chemical contamination is in general agreement with the site history which suggested that the site has

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been historically utilised for low-risk activities. Exceedances in ecological based criteria were reported for nickel and PFOS which were interpreted by Douglas Partners (2024) as follows:

- Given the one data point that recorded an exceedance in nickel, the 95% mean upper concentration limit was calculated across all samples and determined to be below the ecological criteria. in light of the statistical analysis, the elevated nickel in excess of the adopted EIL is not considered to be significant and unlikely to present an unacceptable risk to ecological receptors.
- Low detections of PFAS were reported in the majority of the analysed soil samples, with a comparatively higher concentration reported for PFOS reported at TP58 (0.05 – 0.15) which exceeded the adopted ecological criteria for indirect exposure of 10 µg/kg. Given the site's history and surrounding land uses, the source(s) of the trace PFAS in soil and in particular, the elevated PFOS at location TP58, is unclear. One possibility is the use and scattering of many discarded domestic items observed over the surface of the site which include common sources of PFAS.

Based on the recorded groundwater levels, the groundwater flow beneath the site has been gauged to be approximately northwest, which is in general agreement with the published mapping. The analytical results for groundwater indicate that the concentrations of CoPCs below the adopted criteria, except for a few instances of exceeding criteria, mainly for chloride and nutrients at certain locations. Douglas Partners (2024) concluded that reported concentrations of metals, nutrients and PFAS are unlikely to present a significant risk to the nearest marine water receptor given the distance to the nearest down-gradient receptor (ie 600 m) and low groundwater gradient.

4.6.1.2 Potential impacts

Construction

Construction activities have the potential to result in contamination from sources such as spills of fuels and oils from vehicles and machinery, or from the other chemicals or materials used at the site.

Operation

Potentially contaminating activities during operations would include the use of chemicals or substances that have the potential to be released into the environment. This risk is considered low with the use of sufficient storage of potentially hazardous materials.

4.6.2 Management

Proposed measures to manage and/or mitigate noise impacts from the project are detailed in the following **Table 13.**

Table 13: Management and mitigation measures - contamination

ID	Management/ mitigation measure	Timing
C1	All surface PACM/ACM observed during the site walkover will be removed from the site by a suitably qualified contractor and disposed in accordance with regulatory requirements prior to any clearing of ground disturbing activities. The completeness of the removal of known PACM/ACM should be validated by a suitably qualified professional.	Prior to construction

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ID	Management/ mitigation measure	Timing
C2	An unexpected finds protocol must be prepared to detail the steps to be followed if potential contamination is discovered during construction.	Construction
C3	All oils, fuels and other chemicals will be handled, stored and transported in a manner to minimise spill risk.	Construction
C4	All existing groundwater monitoring wells should be protected during earthworks and construction of the proposed development to the extent practicable. Monitoring wells which are destroyed during construction should be replaced.	Construction
C5	Periodic groundwater monitoring will be conducted during operation of the facility to allow early detection of groundwater impacts in the vicinity of the monitoring well locations associated with future operational use (as identified in **Table 12**). An initial monitoring frequency of one monitoring event every two years would be undertaken. Following the first two years, the monitoring frequency would be reviewed on an ongoing basis.	Operation
C6	At the end of the lease period, the sampling should be repeated to assess for any changes in the contamination status at the previous sampling locations	Operation

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4.7 Traffic

4.7.1 Overview

A transport impact assessment has been undertaken for the project in accordance with *Transport Impact Assessment Guidelines for Developments, Volume 4 – Individual Developments* (Western Australian Planning Comission, 2016) and is presented in the report titled *Proposed Industrial Facility, Lot 108 Patterson Road, East Rockingham: Transport Impact Assessment* (Transcore, 2024) and is provided as **Appendix 7**.

4.7.1.1 Existing environment

Road network

The Project Crux plant is proposed to be situated on the western side of Patterson Road and to the south of Ward Road within Kwinana Beach in the RIZ. The plant facility is proposed to be served by a two-way accessway running along the western boundary of the Halliburton Chemicals manufacture plant site and connecting to Ward Road at the northern end. At its eastern end, Ward Road connects to Patterson Road facilitating access to the site via the regional road level. A summary of the local road network characteristics is provided in **Table 14**.

Table 14: Existing road network

Access	Description	WA Main Roads Classification
Patterson Road	Dual-carriageway, four-lane road with a 20 metre wide landscaped median and on-road sealed shoulders/cycling lanes.	'Distributor B Road' under the Main Roads WA *Road Hierarchy for Western Australia* classification system
Ward Road	Single-carriageway, two-lane road that terminates at the western end and forms a T-intersection with Patterson Road at the eastern end.	'Industrial Road' under the Main Roads WA *Road Hierarchy for Western Australia* classification system

Restricted Access Vehicle (RAV) Network routes are designated for access by large heavy vehicle combinations, which is managed by Main Roads WA. Ward Road and Patterson Road (south of Kwinana Beach Road) are classified as RAV Network 4 roads. North of Kwinana Beach Road Patterson Road is classified as RAV 7 Network road. RAV 4 and RAV 7 classification permits operation of heavy vehicle combinations of up to 36.5m in length.

Traffic volumes

According to the latest available Main Roads WA traffic counts from 2021/2022 Patterson Road (south of Charles Street) carried approximately 34,100 vehicles per weekday (vpd). The classified counts for this road indicate approximately 7.1% participation of heavy vehicles in the total daily traffic mix.

There are no formal traffic counts available for Ward Road at present; however, based on Transcore's own traffic surveys from December 2023, there is currently minimal traffic activity observed on this road.

No crashes were recorded during the five-year period ending in December 2022 at the Patterson Road/Ward Road intersection based on the Main Roads WA crash statistics web site.

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4.7.1.2 Potential impacts

Construction
Construction traffic would access the site via Ward Road from the connection via Patterson Road. Construction of the new service road is likely to impede on the use of Ward Road, however, considering Ward Road is used for industrial users in accessing the WA Kaolin storage facility and Halliburton Chemicals manufacture plant site, the traffic impacts from construction are anticipated to be minimal.

The proposed development site is considered large enough to accommodate the required construction vehicle parking facilities within the site as to avoid queuing or impeding upon the local road network.

Operation
The plant is proposed to be served via a new service road which will be connecting to Ward Road which further connects to Patterson Road. The only users of Ward Road and the new service road would be industrial vehicle drivers, as such, the accessibility and operation of local roads for residents is expected to be minimally affected during operations.

It is estimated that the proposed development would generate up to approximately 280 total weekday daily trips (both inbound and outbound) with approximately 59 peak hour trips during the weekday AM and PM peak periods (shift changeover). The development-traffic comprises staff traffic and the transport task which involves use of heavy vehicles of up to 36.5m in length (i.e., B-Doubles). Considering the location of the subject site, its accessibility via major regional roads and roads within the generally industrial zone, the traffic impact from the proposed development on neighbouring areas will be insignificant.

Appropriate industrial standard driveways ranging in width between 8.0 – 10.0m will be required throughout the site designed to accommodate access, manoeuvring within the site and egress of vehicle combinations of up to 36.5m in length (i.e., B-Doubles). Waste collection and other service vehicles accessing the site will generally be of medium-large rigid vehicle type and as such will comfortably access, manoeuvre and egress the site.

4.7.2 Management

Proposed measures to manage and/or mitigate noise impacts from the project are detailed in the following **Table 15.**

Table 15: Management and mitigation measures - traffic

ID	Management/ mitigation measure	Timing
T1	Appropriate way-finding signs and line-marking will be designed and implemented within the site at visible locations to ensure safe and efficient internal traffic flows.	Design
T2	Appropriate industrial standard driveways ranging in width between 8.0 – 10.0m will be included in the design of the facility to accommodate access, manoeuvring within the site and egress of vehicle combinations of up to 36.5m in length (i.e., B-Doubles	Design
T3	Access and transport route(s) are to be planned to minimise the impact on residential areas and local roads where applicable and communicated to all Site personnel.	Construction

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ID	Management/ mitigation measure	Timing
T4	All parking required for construction would be designed to conform to provisions stipulated in *AS 2890.1* (Australian / New Zealand Standard: Parking facilities Part 1: Off-street parking).	Construction

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4.8 Hazards and wastes

4.8.1 Overview

The proposed development will require the use of potentially hazardous materials within the oil-processing plant to facilitate chemical reactions and other process required to produce oil. Further, the plant processes will generate wastes requiring disposal. The following sections provide a summary of the key hazardous materials used at the proposed plant and waste streams anticipated to be generated by the proposed plant.

4.8.1.1 Existing environment

The proposed development would use the chemicals that are classified as Dangerous Goods under the *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Comission Australia, 2018). Dangerous goods proposed to be stored on site include hexanes, hypochlorite solution, sodium hydroxide solution, dissolved acetylene, liquefied petroleum gases, compressed oxygen, caustic alkali solution, corrosive liquid, seed cake, phosphoric acid and sulphuric acid. A Dangerous Goods application will be required for the Project Crux and being prepared concurrently to the planning assessment.

Other materials present on site that aren't considered dangerous goods include the following:

- Grains (used as raw material)
- Vegetable oils (manufactured as a product)
- Hulls (manufactured as a product)
- Meal (manufactured as a product)
- Steam (used during process)
- Citric acid (used during process)
- Biomass for boiler fuel (used during process)
- Seed trash such as stones, chaff, sticks, or straw that is separated during screening (generated as a waste product)
- Wastewater (generated as a waste product)

Under the *Dangerous Goods Safety (Major Hazard Facilities) Regulations 2007*, a site is classified as Major Hazards Facility (MHF) based on the threshold quantities for dangerous goods outlined in Schedule 1 of the Regulations. The threshold quantity is given as 50,000 tonnes as per Table 2 of Schedule 1 of the MHF regulations under a generic group ("liquids of class 3 packing group II or III"). Note that a desk top search on Hexane indicates a density of 661 kg/m^3 which equates to 75,000 kilolitres.

Cargill will have a (maximum) 300m^3 of fresh hexane storage (excluding process vessels) within the proposed development which equates to 198 metric tonnes or 300,000 litres of (maximum) hexane within the site. Therefore, whilst the project will use hexane to extract vegetable oil from oilseeds, the amount of hexane required for operations is well below MHF thresholds.

4.8.1.2 Potential impacts

<u>Construction</u>

Handling of any dangerous goods required for construction would be the responsibility of the Construction Contractor.

<u>Operation</u>

Operation of the proposed development could result in incorrect handling of hazardous materials and dangerous goods such as chemicals used in oil-processing. The misuse and incorrect handling

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or storage of hexane could result in transport to the air or soils. If released to soil, hexane will usually quickly evaporate to the atmosphere. Hexane is only slightly soluble in water but is readily absorbed by the lipid phase (fatty parts) of aquatic organisms, which can result in transport in the environment. However, the risks associated with hazardous material handling would be suitably managed by the mitigation outlined in the following **Section 4.8.2**.

4.8.2 Management

Proposed measures to manage and/or mitigate noise impacts from the project are detailed in the following **Table 16**.

Table 16: Management and mitigation measures – hazards and wastes

ID	Management/ mitigation measure	Timing
H&W1	A Waste Management Plan will be prepared and implemented by Cargill and must address the control of litter from the individual development during construction and show plans to incorporate rubbish management in the design of the development on the lot in accordance with the RIZ EMP (PGV Environmental, 2011a).	Prior to construction and operation
H&W2	A Dangerous Goods licence will be sought for the project by the licensee prior to any dangerous goods being brought to site.	Prior to operation
H&W3	Any hazardous chemicals to be used during construction will be stored and handled in a manner consistent with their Material Data Sheet and all relevant Australian Standards to minimise spill risk. No potentially hazardous materials such as chemicals, fuels, and/or waste will be stored within or adjacent to drainage lines or unsealed surfaces.	Construction
H&W4	Chemicals will be stored in dedicated concrete bunds to contain any spills and covered with protective coatings to prevent concrete corrosion.	Operation
H&W5	Wastewater generated at the site would be managed under a Trade Waste agreement with the local wastewater treatment plant.	Operation
H&W6	Appropriate receptacles will be provided for the depositing of litter and other waste materials and their contents will be sent for reuse, recycling or disposal on a regular basis.	Operation
H&W7	Appropriate signage, awareness and encouragement of staff and contractors would be implemented to minimise waste generation and promote use of recycling practices.	Operation
H&W8	Retained vegetation and setback areas will be kept free of litter and Declared Weeds.	Operation
H&W9	All hazardous waste materials will be packaged appropriately and transported off site including dust discharged from dust collection systems.	Operation

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ID	Management/ mitigation measure	Timing
H&W10	Waste containing Declared Weeds and seeds will be removed from the site and disposed of at a licenced facility so that spread of weeds is minimised.	Operation

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Appendix 1
Air Quality Assessment

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Intended for
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Document type
Air Quality Assessment Report

Date
July, 2024

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APPENDICES

Appendix 1
Contour Plots

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1. INTRODUCTION

1.1 Background

Western Australia accounts for typically over 50% of Australia grain exports and is located strategically to key clients in Asia. Local canola production continues to increase and with an insignificant domestic crush market there is an abundant and increasing exportable surplus. The Project seeks to build a canola crush plant adjacent to the CBH Kwinana Grain Terminal with the capacity of up to 3000 tonnes per day (tpd).

Cargill has identified a potential site in the Rockingham Strategic Industrial Area (RSIA). The identified potential site is a subset of Lot 108 and is up to 13 hectares in size. Other industries in the precinct include chemical and fuel storage, mineral processing, wastewater treatment and a proposed green hydrogen facility.

Cargill will require a boiler at the site and is currently assessing two potential options; a biomass fired boiler and a gas fired boiler. Biomass boilers potentially emit a number of pollutants of concern including the following:

- Nitrogen Dioxide (NO_2);
- Particulate Matter < 2.5 ($PM_{2.5}$) ;
- Polyaromatic Hydrocarbons (PAHs);
- Sulphur Dioxide (SO_2);
- Total Volatile Organic Compounds (VOCs) as Benzene;
- Arsenic (As) & Compounds;
- Beryllium (Be) & Compounds;
- Chromium (III) (Cr-III) Compounds;
- Chromium (VI) (Cr-VI) Compounds;
- Copper (Cu) & Compounds (Dusts);
- Lead (Pb) & Compounds;
- Mercury (Hg) & Compounds;
- Nickel (Ni) & Compounds; and
- Polychlorinated Dioxins and Furans (TEQ).

The only pollutant of concern associated with the gas boiler is NO_2.

Cargill engaged Ramboll Australia Pty Ltd (Ramboll) to undertake an air quality study with the intent of assessing the potential impact of emissions from the proposed boilers (biomass or gas boiler) on local and regional air quality.

1.2 Purpose of this Report

This report presents the assessment of potential air quality impacts arising from emissions of various pollutants of concern associated with the proposed boiler configurations (biomass and gas boiler). The approach, methodology and results of the predicted impacts are outlined in the following sections.

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2. PROJECT INFORMATION

2.1 Site Description

The Crux site is located in the Kwinana Industrial Area (KIA) approximately 37 km southwest of Perth (Figure 1). A general layout of the site is provided in Figure 1 below with the plant shown within the blue boundary.

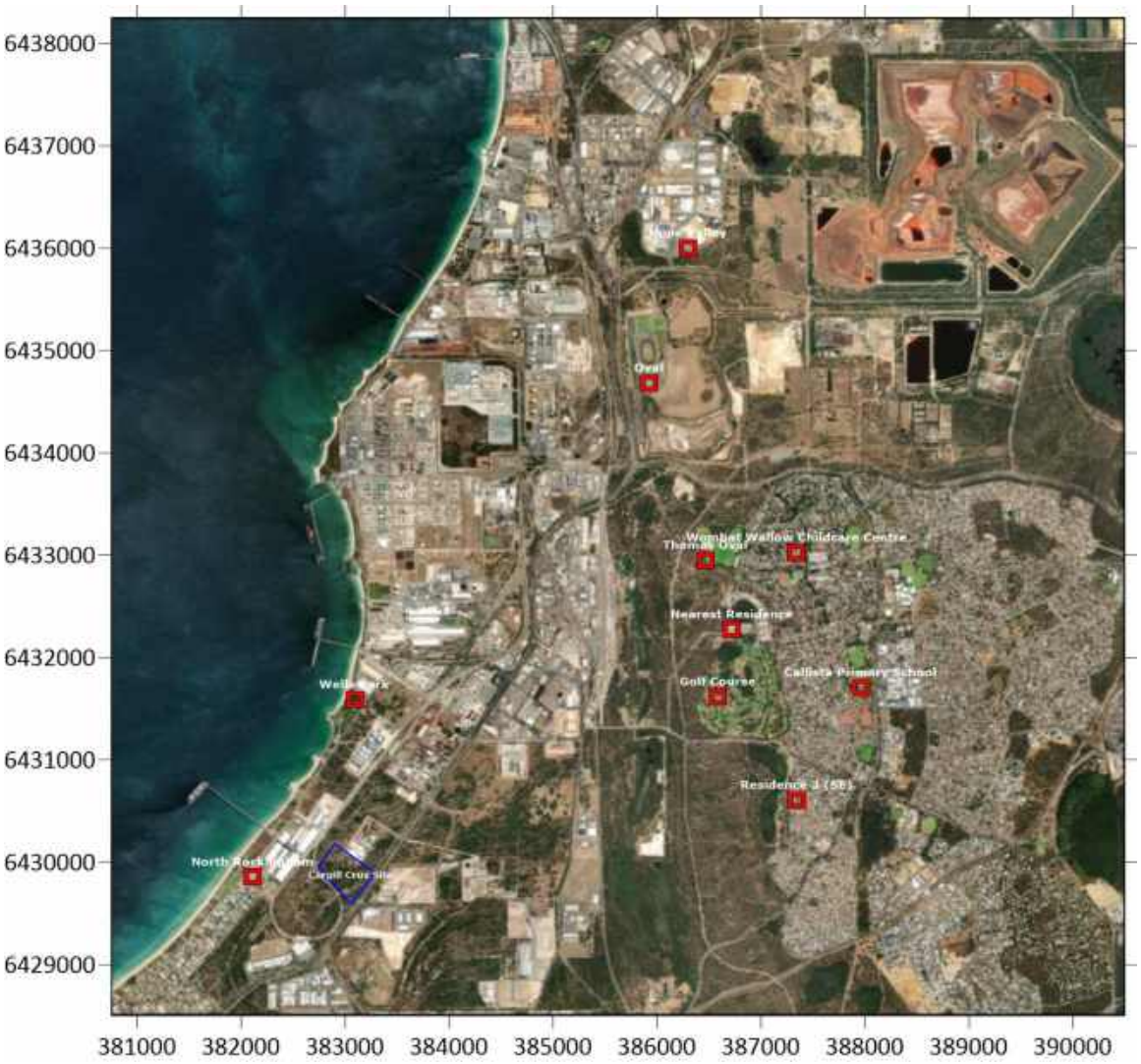


Figure 1: Cargill Crux Site Layout

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3. AMBIENT AIR QUALITY

3.1 Air Quality Criteria

Predicted ground level concentrations (GLCs) for each of the modelled scenarios was compared with the relevant ambient air quality criteria which included consideration to relevant guidance namely the Air Quality Modelling Guidance Notes (Department of Environment, March 2006), the draft Guideline: Air Emissions (DWER, October 2019) and the National Environment Protection Measures (NEPMs). The criteria included in this assessment are presented in Table 1.

It should be noted that on the 18th of May 2021, the National Environment Protection Council (NEPC) modified ambient standards for several pollutants, based on international guidance (NEPC, 2021). Relevant changes to the standards impacting the reporting of NO_2 include significantly strengthening NO_2 reporting standards for 1-hour and annual average NO_2 to 80 ppb and 15 ppb respectively, bringing forward standards initially proposed for 2025.

The EPA established an Environmental Protection Policy (EPP) in Kwinana in 1992 to maintain acceptable air quality. The Kwinana EPP was formally reviewed in 1999 and re-issued unchanged. The 1992 Regulations remain in force and were amended in 1999 to reflect the policy title change. The Policy defines three areas (Areas A, B and C), where:

- Area A is the area of land on which heavy industry is located;
- Area B is outside area A and is zoned for industrial purposes from time to time under a Metropolitan Region Scheme or a town planning scheme;
- Area C is beyond Areas A and B, predominantly rural and residential.

Sulfur dioxide standards and limits were set for the three areas, increasing in stringency from Area A to Area C. The most important of these with respect to controlling air quality are the standards and limits averaged over 1-hour periods. Similarly, ambient standards and limits were established for total suspended particulates.

The EPP provides for a redetermination of these limits as and when required, e.g., to accommodate new industries or variations to existing industry emissions. There have been two redeterminations. The latest redetermination was undertaken in April 2019.

Where applicable, predicted concentrations were compared against the ambient air quality criteria for all pollutants of concern as derived from the NEPM guidelines. In the absence of available data from the NEPM guides, the annual average guideline for SO_2 was sourced from the Kwinana EPP (1999). It is noteworthy that even though the EPP guideline remains applicable in the Kwinana region, its authority is superseded by both DWER and NEPM guidelines. The EPP guideline is invoked absence of the latter guidelines.

Table 1: Ambient Air Quality Criteria

Pollutant	Averaging Period	Criteria µg/m³	Reference
Nitrogen Dioxide (NO_2)	1-hour	151	NEPC (2021)
	Annual	28	
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	23	
	Annual	7	
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	0.0003	DWER (2019)
Sulfur Dioxide (SO_2)	1-hour	262	NEPC (2021)
	24-hours	52	
	Annual	52	DWER (2019)

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Pollutant	Averaging Period	Criteria µg/m³	Reference
Total VOCs (as Benzene)	1-hour	29	
	Annual	9.6	
Arsenic (As) & Compounds	1-hour	0.09	DWER (2019)
	24-hours	0.027	
	Annual	0.0027	
Beryllium (Be) & Compounds	1-hour	0.004	
Cadmium (Cd) & Compounds	1-hour	0.018	
Chromium (III) (Cr-III) Compounds	1-hour	9	
	24-hours	0.46	
Chromium (VI) (Cr-VI) Compounds	1-hour	0.09	
	Annual	0.00018	
Copper (Cu) & Compounds	1-hour	18	
	24-hours	0.92	
Lead (Pb) & Compounds	Annual	0.46	
Mercury (Hg) & Compounds (Inorganic)	1-hour	0.55	
	Annual	0.18	
Nickel (Ni) & Compounds	1-hour	0.18	
	24-hours	0.14	
	Annual	0.003	
Polychlorinated Dioxins and Furans (TEQ)	1-hour	0.000002	

Notes

1. Referenced to 25ºC, and 101.3 kPa.

3.2 Existing Environment

A representative background concentration of pollutants (particulates, ozone (O_3), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2)) in the Kwinana region was required to assess potential cumulative impacts for the purposes of this study.

No specific guidance for selection of an appropriate background level is provided in Western Australia. Accordingly, in Victoria, the State Environment Protection Policy (Ambient Air Quality) (SEPP (AQM)) (EPA VIC, 2001) states that the 70th percentile concentration (concentration which is exceeded by 30% of concentrations for that averaging period) should be adopted as the background level.

The DWER conduct ongoing ambient air quality monitoring within the Kwinana region for criteria pollutants such as O_3, NO_2, CO, SO_2, particles less than 10 micrometres in diameter (PM_{10}) and particles less than 2.5 micrometres in diameter ($PM_{2.5}$), the results of which are reported annually. The DWER reports annually the 75th percentile for 1-hour and 24–hour average concentration at its monitoring stations in Western Australia. Hence, in absence of reported 70th percentile values, the 75th percentile 1-hour and 24-hour average as well as the annual average concentrations for the pollutants of interest were obtained from a number of monitoring stations (DWER 2022) and are presented in Table 2.

The relevant DWER monitoring stations in the region include North Rockingham, South Lake and Wattleup, all of which have been considered for the background monitoring of the various pollutants where data is available. The highest averaging values have been selected as the background concentration values for the various pollutants for the cumulative assessment across the region which can be seen in Table 2.

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Table 2: DWER Background Monitoring Concentrations – Kwinana

Compound	Averaging Period	Concentration (ppm)	Concentration (µg/m³)[1]	Station	Reference
NO_2	75th Percentile 1-hour	0.016	30.1	North Rockingham	NEPC (2021)
	Annual	0.005	9.4		
	75th Percentile 1-hour	0.019	35.8	South Lake	
	Annual	0.006	11.3		
$PM_{2.5}$	75th Percentile 24-hour	-	7.9	South Lake	
	Annual	-	7.0		
SO_2	75th Percentile 1-hour	0.004	10.5	North Rockingham	
	75th Percentile 24-hour	0.003	7.9		
	Annual	0.001	2.6		DWER (2021)
	75th Percentile 1-hour	0.002	5.2	South Lake	NEPC (2021)
	75th Percentile 24-hour	0.001	2.6		
	Annual	0.002	5.2		DWER (2021)
	75th Percentile 1-hour	0.002	5.2	Wattleup	NEPC (2021)
	75th Percentile 24-hour	0.001	2.6		
	Annual	0.001	2.6		DWER (2021)

Notes

1. Referenced to 25ºC, and 101.3 kPa.
2. Shaded values represent the maximum background concentration values for each pollutant and their respective averaging periods which have been adapted for the cumulative assessment.

Table 3 and Table 4 present the emissions of NO_x and SO_2 respectively, as reported to the National Pollutant Inventory for 2022/2023 from facilities within the modelling domain.

Table 3: NPI Emissions Estimates NO_x (kg/year) 2022/2023

Company	Facility Name	2022/2023	%
Alcoa of Australia	Kwinana Alumina Refinery	1,600,000	56%
CSBP Limited	CSBP Kwinana Operations	554,558	19%
Wesfarmers LPG Pty Ltd	Kleenheat Gas, Kwinana Production Facility	257,969	9%
Australian Terminal Operations Management Pty Ltd	Kwinana Terminal	117,084	4%
Tronox Management Pty Ltd	KMK Cogeneration Plant	116,191	4%
Western Energy Pty Ltd	Western Energy Kwinana Swift Power Station	78,860	3%
Tronox Management Pty Ltd	Kwinana Pigment Plant	74,570	3%
DBNGP (WA) Nominees Pty Limited	Compressor Station 10	18,841	<1%
Cockburn Cement Limited	Kwinana Operations	12,454	<1%
Coogee Chemical Pty Ltd	Kwinana Operations	9,627	<1%
Solenis Australia Pty Ltd	Solenis Australia Pty Ltd	3,596	<1%
Puma Energy (Australia) Bitumen Pty Ltd	Kwinana Bitumen Terminal	415	<1%
APT Parmelia Gas Pty Ltd	PGP - Kwinana Supply System (KSS) Meter Station	84	<1%

Table 4: NPI Emissions Estimates SO_x (kg/year) 2022/2023

Company	Facility Name	2022/2023	%
Tronox Management Pty Ltd	Kwinana Pigment Plant	80,573	35%
Alcoa of Australia	Kwinana Alumina Refinery	67,000	29%
Australian Terminal Operations Management Pty Ltd	Kwinana Terminal	56,458	24%
CSBP Limited	CSBP Kwinana Operations	26,746	11%
Wesfarmers LPG Pty Ltd	Kleenheat Gas, Kwinana Production Facility	964	<1%
Tronox Management Pty Ltd	KMK Cogeneration Plant	636	<1%
Western Energy Pty Ltd	Western Energy Kwinana Swift Power Station	257	<1%
Cockburn Cement Limited	Kwinana Operations	207	<1%
Coogee Chemical Pty Ltd	Kwinana Operations	60	<1%
Solenis Australia Pty Ltd	Solenis Australia Pty Ltd	37	<1%
DBNGP (WA) Nominees Pty Limited	Compressor Station 10	30	<1%
Puma Energy (Australia) Bitumen Pty Ltd	Kwinana Bitumen Terminal	9	<1%
APT Parmelia Gas Pty Ltd	PGP - Kwinana Supply System (KSS) Meter Station	1	<1%

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4. AIR DISPERSION MODELLING AND METHODOLOGY

4.1 Air Dispersion Models

The Gaussian dispersion models DISPMOD (Version 2005) and the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) (Version 23132) were both used in this study to predict the air quality impacts from the Facility.

DISPMOD is a Gaussian air dispersion model developed by the DWER, that includes the effects of the Thermal Internal Boundary Layer (TIBL) and Mechanical Internal Boundary Layer (MIBL). The TIBL has been demonstrated to have a significant impact on plume dispersion in the Kwinana region via a process known as shoreline fumigation and therefore its correct parameterisation within the model is a very important component. DISPMOD is considered to be an appropriate model to predict dispersion characteristics from elevated emission sources located on the Kwinana coastline.

AERMOD is one of the current United States Environment Protection Agency (USEPA) recommended air dispersion models and was specially designed to support the USEPA's regulatory modelling programs. AERMOD is a current-generation air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain and was developed to replace the Industrial Source Complex Model-Short Term (ISCST3) as the USEPA's preferred model for most local scale regulatory applications. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) building downwash algorithms, which provide a more realistic handling of downwash effects than previous approaches.

These two models have been chosen in order to ensure the modelling results account for coastal dispersion influences and building wake effects. The DISPMOD air dispersion model has a limited capacity for considering the influence of building wake effects on plume dispersion, while AERMOD can account for building wakes but does not include an algorithm for coastal fumigation. As a general rule, building wake effects are likely to influence plume dispersion if the height of the exhaust stack is less than 2.5 times the height of surrounding buildings. Since there are a number of buildings and structures in the vicinity of the cyanide plants, building wake effects were considered a potential influence on plume dispersion.

4.2 Meteorological Data

A model ready meteorological dataset developed by the DWER using meteorological monitoring data collected at Hope Valley during the 1980, 1995 and 1996 calendar years, was used for input into DISPMOD and then converted into an AERMOD ready file. Hope Valley is located approximately 7 km north-northeast of the Cargill site and is considered generally representative of the meteorology of the area. This is consistent with the meteorological datasets used by DWER to determine maximum permissible quantities of sulphur dioxide for operators in the Kwinana region.

The following parameters were provided as 10-minute averaged data, and were paired with the 10-minute average mixing height data source from the DWER's DISPMOD-ready Hope Valley meteorological dataset:

- wind speed;
- wind direction;
- standard deviation of wind direction;
- temperature;
- temperature difference (between 2 m and 10 m in height);

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- humidity;
- net solar radiation; and
- precipitation.

The annual average wind rose derived from the Hope Valley meteorological dataset (1980, 1995 and 1996) is presented as Figure 2. Moderate easterlies are evident in the dataset, along with strong westerlies through south-westerlies.

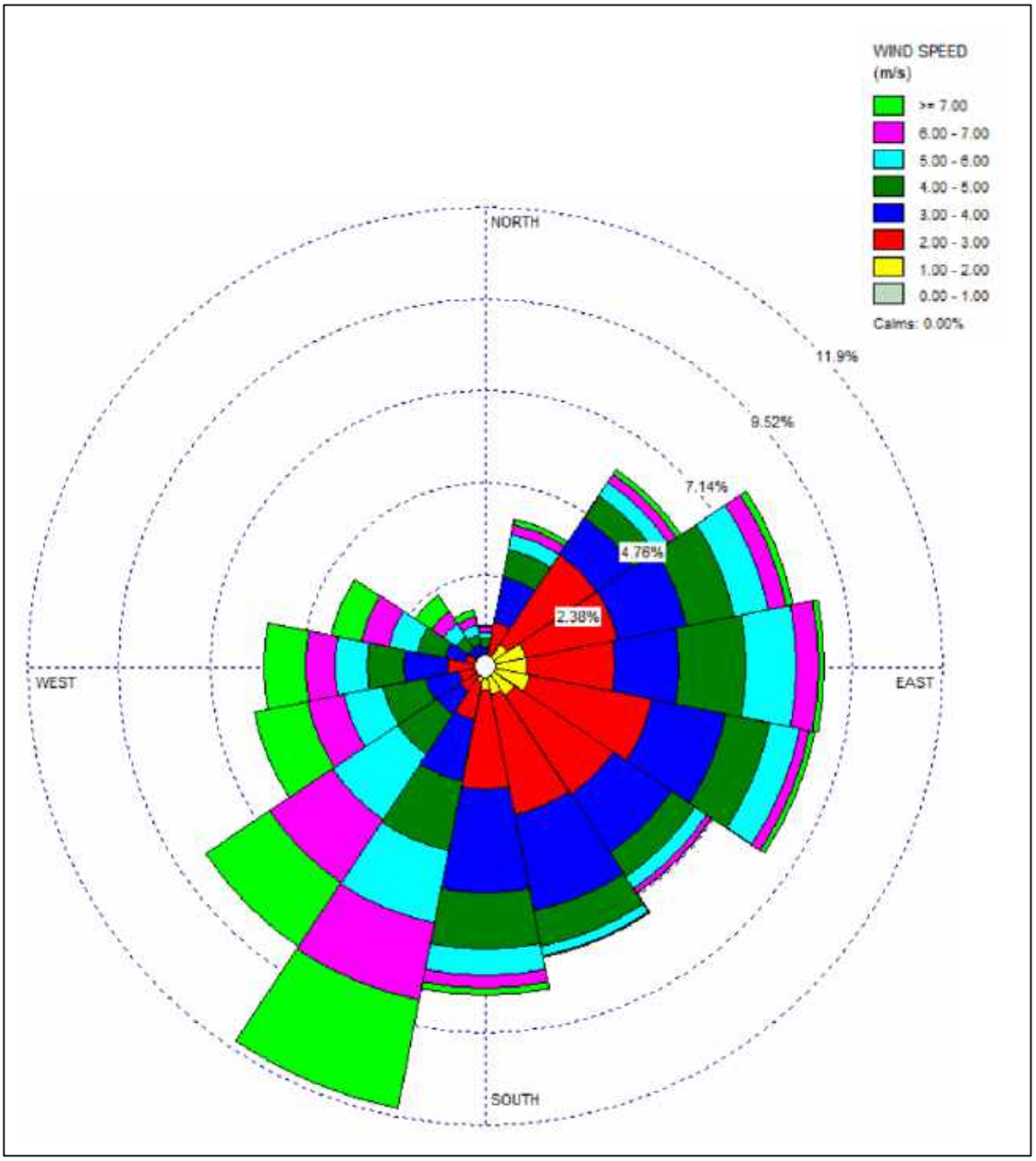


Figure 2: Hope Valley 1980, 1995 & 1996 Annual Average Wind Rose

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4.3 Model Parameterisation

4.3.1 AERMOD

AERMOD was set up with three nested receptor grids centred on the emission sources in order to provide coverage at greater distances from the facility without sacrificing resolution close to the sources. Receptors were also placed along the facility boundary at close intervals. A summary of the receptor grids is presented in Table 5.

Table 5: AERMOD Grid Receptor Parameters

Parameter	Grid 1	Grid 2	Grid 3
Dimensions	9.75 km x 9.75 km	4 km x 4 km	2.5 km x 2.5 km
Spacing	250 m	125 m	125 m
SW Easting[1] (mE)	380,750	382,125	382,685
SW Northing[1] (mN)	6,428,500	6,428,750	6,429,250

Notes

1. MGA94

Terrain elevation data for the model domain were obtained from the US National Aeronautics and Space Administration's (NASA) Shuttle Radar Topography Mission and incorporated into AERMOD using the AERMAP terrain processor.

4.3.1.1 Land Use Classification

The AERMOD model relies upon classifying the surrounding land use as either 'rural' or 'urban' to determine the wind profile exponents used to calculate wind speeds at stack heights. Large urban areas influence the surface roughness due to the presence of paved surfaces, buildings and roads, which change the dispersion characteristics of the atmosphere. Depending on the source characteristics, the choice of urban or rural dispersion parameters can make a difference in the predicted ambient air concentrations.

While the area within 3 km of the Cargill site is primarily classified as rural, there are industrial operations immediately surrounding the Cargill site. Sensitivity analyses were undertaken and the rural setting resulted in higher predicted concentrations across most of the modelled grid. As such, the more conservative rural settings were applied in this assessment.

4.3.1.2 Building Wake Effects

Building wake effects were incorporated into AERMOD using the Building Profile Input Program (BPIP) – Plume Rise Model Enhancements (PRIME) building algorithm. The locations and dimensions of buildings that have the potential to influence plume dispersion were supplied in the form of facility drawings by Cargill.

4.3.2 DISPMOD

DISPMOD was run in non-statistical mode with the standard input configurations as defined in the Instructions for use of DISPMOD and Post Processing Software, previously supplied to Ramboll by the DWER. DISPMOD was set up with a model domain of 6 km by 7 km, with 250 m spacings. The south-west corner of the model domain was located at 381,750 mE and 6,429,500 mE, encompassing both the North Rockingham and Hope Valley receptors.

As the DISPMOD predicted ground level concentrations (GLCs) are referenced to standard temperature and pressure (STP) (i.e. 0ºC), these outputs were corrected to an ambient

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temperature of 25ºC for direct comparison against the AERMOD predicted GLCs and the applicable air quality criteria.

4.3.3 Receptor Locations

In addition to the gridded receptors for AERMOD and DISPMOD, discrete receptors were positioned throughout the modelled domain to represent residential dwellings and recreational locations. These discrete receptors are summarised in Table 6 and are also highlighted in Figure 1.

Table 6: Discrete Receptor Locations

ID	Receptor	Easting (MGA94) (m)	Northing (MGA94) (m)
R1	Wells Park	383,090	6,431,590
R2	Golf Course	386,587	6,431,618
R3	Thomas Oval	386,468	6,432,951
R4	Oval	385,925	6,434,681
R5	Nearest Residence	386,723	6,432,276
R6	North Rockingham	382,112	6,429,858
R7	Residence 3 (SE)	387,347	6,430,608
R8	Hope Valley	386,300	6,436,000
R9	Calista Primary School	387,961	6,431,708
R10	Wombat Wallow Childcare Centre	387,344	6,433,024

4.4 Treatment of Oxides of Nitrogen

Ramboll has applied the Ozone Limiting Method (OLM) to predict ground level concentrations of NO_2 as specified by the USEPA (see Cole and Summerhays 1979; Tikvart 1996) and NSW Environment Protection Authority (NSW EPA, 2016). This method assumes that all the available ozone in the atmosphere will react with nitrogen oxide (NO) in the plume until either all the available ozone or all the NO is used up. This approach is conservative in that it assumes that the atmospheric reaction is instant when in reality, the reaction takes place over a number of hours.

A summary of the regional ambient ozone concentrations as measured by DWER at the Rockingham and South Lake monitoring stations (as published in the annual DWER WA Air Monitoring Reports) is presented in Table 7. These data indicate similar concentrations of ozone have been measured at the Rockingham and South Lake monitoring stations between 2008 and 2020. The highest monitored 95th percentile 1-hour average concentration of 0.054 ppm (recorded at the South Lake site in 2013) was selected as the background ozone concentration applied in the OLM.

Table 7: Summary of Monitored Ozone Concentrations within the Kwinana Region

Year	Maximum and Percentile 1-hour Average Ozone Concentration (ppm)							
	Rockingham				South Lake			
	Max.	99th	95th	90th	Max.	99th	95th	90th
2008	0.077	0.063	0.045	0.038	0.082	0.061	0.044	0.037
2009	0.078	0.064	0.048	0.041	0.065	0.057	0.045	0.039
2010	0.067	0.060	0.052	0.044	0.070	0.067	0.052	0.045

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Year	Maximum and Percentile 1-hour Average Ozone Concentration (ppm)							
	Rockingham				South Lake			
	Max.	99th	95th	90th	Max.	99th	95th	90th
2011	0.065	0.062	0.048	0.043	0.076	0.064	0.050	0.044
2012	0.095	0.073	0.053	0.044	0.085	0.065	0.051	0.041
2013	0.084	0.068	0.052	0.044	0.087	0.074	**0.054**	0.043
2014	0.076	0.060	0.047	0.039	0.065	0.059	0.046	0.041
2015	0.069	0.062	0.052	0.045	0.067	0.063	0.051	0.042
2016	0.087	0.064	0.051	0.044	0.091	0.065	0.050	0.043
2017	0.069	0.060	0.051	0.042	0.074	0.061	0.050	0.043
2018	0.061	0.049	0.042	0.038	0.061	0.048	0.039	0.035
2019	0.107	0.059	0.029	0.025	0.036	0.031	0.030	0.026
2020	0.070	0.056	0.044	0.040	0.061	0.054	0.042	0.038

4.5 Emission Estimates and Stack Parameters

A summary of the stack parameters and emissions data used in the modelling assessment is presented in Table 9 (Cargill Sources). The physical stack parameters, exhaust characteristics and emission estimates for each emission source was provided by Cargill. The operating parameters for the KIA sources are presented in Table 11 through to Table 15. The reference for each of the sources explicitly modelled as part of this assessment have been tabulated in Table 8. A list of normalised concentrations for each of the pollutants of concern associated with the biomass boiler have also been provided in Table 10.

Table 8: Summary of Reference Data for Source Emission Estimates (KIA)

Source/Location	Reference Source
Ammonia Plant	CSBP Ammonia Expansion Project Air Quality Impact Assessment (2022) | Ramboll (2022)
Kwinana Waste to Energy Plant	Kwinana Waste to Energy Report | Ramboll (2019)
East Rockingham Waste to Energy Plant	EPA Proposal Search | Aurora Environmental (2017)
Covalent Lithium Plant	EPA Proposal Search | GHD (2020) & DWER (2021)
Tianqi Lithium Plant	Tianqi Supplied Data via Email | CSBP Supplied to Ramboll

Table 9: Summary of Source Parameters

Parameter	Units	Emission Point	Emission Point
		Stack #1 - Gas Boiler Stack	Stack #2 - Biomass Stack
Location	mE	383,192	383,192
	mN	6,429,880	6,429,880
Stack Height	m	20	18
Stack Diameter	m	1	1
Exhaust Temperature	^{0}C	124	170
Volumetric Flowrate	Am^3/s	11	21
Exit Velocity	m/s	13	27

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Parameter	Units	Emission Point	Emission Point
		Stack #1 - Gas Boiler Stack	Stack #2 - Biomass Stack
Biomass Boiler Emission Rates			
Nitrogen Dioxide (NO_2)		-	3.51E+00
Particulate Matter < 2.5 ($PM_{2.5}$)		-	6.59E-01
Polycyclic Aromatic Hydrocarbons (B[a]Peq)		-	3.96E-04
Sulfur Dioxide (SO_2)		-	2.96E-01
Total VOCs (as Benzene)		-	2.09E-01
Arsenic (As) & Compounds		-	7.43E-05
Beryllium (Be) & Compounds		-	2.85E-07
Cadmium (Cd) & Compounds		-	1.84E-05
Chromium (III) (Cr-III) Compounds		-	1.36E-04
Chromium (VI) (Cr-VI) Compounds		-	4.00E-05
Copper & Compounds		-	3.25E-04
Lead & Compounds		-	3.88E-04
Mercury & Compounds (Inorganic)		-	4.49E-06
Nickel & Compounds		-	6.00E-05
Polychlorinated Dioxins and Furans (TEQ)		-	9.21E-10
Gas Boiler Emission Rates			
Nitrogen Dioxide (NO_2)		1.57E+00	-

Notes

1. All Gas Boiler Stack Parameters and Emission Rates were taken from vendor provided specifications.
2. Volume Flowrate for Gas Boiler taken as the actual wet volumetric flowrate.

Table 10: Normalised Emission Inputs for Biomass Boiler

Pollutant	Units	Emission Point
Nitrogen Dioxide (NO_2)	mg/Nm^3	2.66E+02
Particulate Matter < 2.5 ($PM_{2.5}$)		5.00E+01
Polycyclic Aromatic Hydrocarbons (B[a]Peq)		3.00E-02
Sulfur Dioxide (SO_2)		2.24E+01
Total VOCs (as Benzene)		1.58E+01
Arsenic (As) & Compounds		5.64E-03
Beryllium (Be) & Compounds		2.16E-05
Cadmium (Cd) & Compounds		1.40E-03
Chromium (III) (Cr-III) Compounds		1.03E-02
Chromium (VI) (Cr-VI) Compounds		3.04E-03
Copper & Compounds		2.47E-02
Lead & Compounds		2.94E-02
Mercury & Compounds (Inorganic)		3.41E-04
Nickel & Compounds		4.55E-03
Polychlorinated Dioxins and Furans (TEQ)		6.98E-08

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Table 11: Summary of Source Parameters – CSBP Ammonia Plant

Source			Proposed Ammonia Plant - AP3	
			Primary Reformer - AP3	Auxiliary Boiler - AP3
Parameter		Units	PR_UPA	AB_UPA
Location		mE	383,907	383,909
		mN	6,432,857	6,432,870
Stack Height		m	30	30
Stack Diameter		m	2.09	1.21
Exhaust Temperature		deg C	160	160
		K	433.15	433.15
Volumetric Flowrate		Am^3/s	56.61	4.25
Exit Velocity		m/s	16.5	3.7
Emission Rate Estimates (Normal Operations)				
NO_2	Limit	g/s	4.85	0.35

Table 12: Summary of Source Parameters – Kwinana Waste to Energy Plant

Source			Kwinana WtE (MS1182)
			Multi-Flue Stack
Parameter		Units	MFS
Location		mE	384,959
		mN	6,435,601
Stack Height		m	87.5
Stack Diameter		m	3.18
Exhaust Temperature		deg C	135
		K	408
Volumetric Flowrate		Am^3/s	157.65
Exit Velocity		m/s	19.8
Emission Rate Estimates (Normal Operations)			
NO_2	Limit	g/s	8.3

Table 13: Summary of Source Parameters – East Rockingham Waste to Energy Plant

Source			East Rockingham - WtE (MS1090)
			Main Stack
Parameter		Units	MS
Location		mE	384,580
		mN	6,430,979
Stack Height		m	60
Stack Diameter		m	2.5
Exhaust Temperature		deg C	140
		K	413
Volumetric Flowrate		Am^3/s	90.59
Exit Velocity		m/s	18.5
Emission Rate Estimates (Normal Operations)			
NO_2	Limit	g/s	14

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Table 14: Summary of Source Parameters – Covalent Lithium Plant

Source			Covalent Lithium (MS1170)					
			Cal Stack 1	Cal Stack 2	Acid Roast 1	Acid Roast 2	Boiler	Dryer
Parameter		Units	CS1	CS2	ARS1	ARS2	BOIL	DRY
Location		mE	384,145	384,146	384,108	384,109	383,293	384,466
		mN	6,434,773	6,434,709	6,434,801	6,434,737	6,434,727	6,434,704
Stack Height		m	48.5	48.5	26.2	26.2	15	10
Stack Diameter		m	0.85	0.85	0.7	0.7	0.55	0.55
Exhaust Temperature		deg C	117	117	365	365	200	90
		K	390	390	638	638	473	363
Volumetric Flowrate		Am^3/s	14.53	14.53	9.81	9.81	5.35	8.79
Exit Velocity		m/s	25.6	25.6	25.5	25.5	22.5	37
Emission Rate Estimates (Normal Operations)								
NO_2	Limit	g/s	3.21	3.21	0.4	0.4	0.7	0.08

Table 15: Summary of Source Parameters – Tianqi Lithium Plant

Source			Tianqi Lithium Plant		
			Calciner Fan Stack	Acid Roast Stack	Sodium Sulphate Stack
Parameter		Units	CFS	ARS	SSS
Location		mE	384,897	384,878	384,905
		mN	6,435,153	6,435,094	6,434,863
Stack Height		m	40	50	30
Stack Diameter		m	1.1	0.76	0.18
Exhaust Temperature		deg C	160	458	90
		K	433	731	363
Volumetric Flowrate		Am^3/s	18.8	4	0.4
Exit Velocity		m/s	19.8	8.8	15.3
Emission Rate Estimates (Normal Operations)					
NO_2	Limit	g/s	4.9	0.02	0.23

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5. MODELLING RESULTS

A summary of the scenario notation used in describing the scenarios is provided in Table 16.

Table 16: Overview of Modelled Scenarios

SC ID	Boiler Configuration	Description
SC1	Biomass	Biomass Boiler
SC2		Biomass Boiler and Future Approved KIA Sources
SC3	Gas	Gas Boiler
SC4		Gas Boiler and Future Approved KIA Sources

Results are presented both in isolation and cumulatively with other existing background sources as represented by background monitoring data for pollutants of concern where regional monitoring data was available, including NO_2, $PM_{2.5}$ and SO_2. Contour plots of the predicted GLCs for each of the pollutants of concern with various averaging periods are presented in Figure 3 to Figure 35 in Appendix 1 for both the biomass and gas boiler configurations.

Biomass Boiler

A summary of the maximum off-site GLCs predicted for each of the pollutants of concern for the proposed biomass boiler operating in both isolation and cumulatively (as applicable) for all operational scenarios (scenario #1 & #2), is presented in Table 17 through to Table 20. A summary of findings as predicted by the modelling has been presented as follows for each pollutant of concern.

NO_2

- No exceedances of the maximum 1-hour average NO_2 criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 142.8 µg/m^3, approximately 95% of the 1-hour average NO_2 criteria.
- Exceedances of the maximum 1-hour average NO_2 criteria were predicted offsite for the cumulative assessment for both scenarios (#1 & #2), however, predicted cumulative concentrations were below the relevant 1-hour average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the site. The maximum offsite predicted GLC (cumulative) was 178.5 µg/m^3, approximately 118% of the 1-hour average NO_2 criteria.
- No exceedances of the annual average NO_2 criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 19.9 µg/m^3, approximately 71% of the annual average NO_2 criteria.

$PM_{2.5}$

- Exceedances of the maximum 24-hour average $PM_{2.5}$ criteria were predicted for both of the biomass boiler scenarios (#1 & #2) in isolation and cumulatively, where the maximum predicted GLC (cumulative) was 24.02 µg/m^3, approximately 104% of the 24-hour average $PM_{2.5}$ criteria. Although exceedances were predicted against the 24-hour $PM_{2.5}$ criteria, based on the contour plots, it can be seen that these predicted GLCs will occur only at/close to the boundary of the site, with predicted GLCs at sensitive receptors remaining well below the 24-hour $PM_{2.5}$ criteria.
- Exceedances of the annual average $PM_{2.5}$ criteria were predicted offsite and at sensitive receptor locations for both of the biomass boiler scenarios (#1 & #2) both in isolation and cumulatively, where the maximum predicted GLC (cumulative) was 8.53 µg/m^3, approximately 122% of the annual average $PM_{2.5}$ criteria. Although exceedances are predicted across the modelling domain for the cumulative assessment, the model predicted results in isolation show

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that Cargill's contribution of $PM_{2.5}$ at each of the sensitive receptor locations is no more than 2% of the annual average $PM_{2.5}$ criteria, and that the exceedance is most associated with elevated monitored background concentrations of $PM_{2.5}$.

PAH

- Exceedances of the maximum annual average PAH criteria were predicted offsite for the cumulative assessment for both scenarios (#1 & #2), however, predicted cumulative concentrations were below the relevant annual average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the boundary of the site. The maximum offsite predicted GLC (cumulative) was 9.39E-04 µg/m^3, approximately 313% of the annual average PAH criteria.

SO_2

- No exceedances of the maximum 1-hour average SO_2 criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 42.41 µg/m^3, approximately 16% of the 1-hour average SO_2 criteria.
- No exceedances of the maximum 24-hour average SO_2 criteria were for either of the biomass boiler scenarios (#1 & #2) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 15.10 µg/m^3, approximately 29% of the 24-hour average SO_2 criteria.
- No exceedances of the annual average SO_2 criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 5.94 µg/m^3, approximately 11% of the annual average SO_2 criteria.

Total VOCs (as Benzene)

- No exceedances of the maximum 1-hour average VOC (Benzene) criteria were predicted for both of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 22.54 µg/m^3, approximately 78% of the 1-hour average VOC (Benzene) criteria.
- No exceedances of the annual average VOC (Benzene) criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 0.50 µg/m^3, approximately 5% of the annual average VOC (Benzene) criteria.

As

- No exceedances of the maximum 1-hour average As criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 8.02E-03 µg/m^3, approximately 9% of the 1-hour average As criteria.
- No exceedances of the maximum 24-hour average As criteria were for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.82E-03 µg/m^3, approximately 7% of the 24-hour average As criteria.
- No exceedances of the annual average As criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.76E-04 µg/m^3, approximately 7% of the annual average As criteria.

Be

- No exceedances of the maximum 1-hour average Be criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 3.08E-05 µg/m^3, approximately 1% of the 1-hour average Be criteria.

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Cd

- No exceedances of the maximum 1-hour average Cd criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.99E-03 µg/m^3, approximately 11% of the 1-hour average Cd criteria.

Cr-III

- No exceedances of the maximum 1-hour average Cr-III criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.46E-02 µg/m^3, approximately <1% of the 1-hour average Cr-III criteria.
- No exceedances of the maximum 24-hour average Cr-III criteria were for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 3.32E-03 µg/m^3, approximately 11% of the 24-hour average Cr-III criteria.

Cr-VI

- No exceedances of the maximum 1-hour average Cr-VI criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 4.32E-03 µg/m^3, approximately 5% of the 1-hour average Cr-VI criteria.
- No exceedances of the annual average Cr-VI criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 9.50E-05 µg/m^3, approximately 53% of the annual average Cr-VI criteria.

Cu

- No exceedances of the maximum 1-hour average Cu criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 3.51E-02 µg/m^3, approximately <1% of the 1-hour average Cu criteria.
- No exceedances of the maximum 24-hour average Cu criteria were for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 7.97E-03 µg/m^3, approximately 1% of the 24-hour average Cu criteria.

Pb

- No exceedances of the annual average Pb criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 9.21E-04 µg/m^3, approximately <1% of the annual average Pb criteria.

Hg

- No exceedances of the maximum 1-hour average Hg criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 4.85E-04 µg/m^3, approximately <1% of the 1-hour average Hg criteria.
- No exceedances of the annual average Hg criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.70E-05 µg/m^3, approximately <1% of the annual average Hg criteria.

Ni

- No exceedances of the maximum 1-hour average Ni criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 6.48E-03 µg/m^3, approximately 4% of the 1-hour average Ni criteria.
- No exceedances of the maximum 24-hour average Ni criteria were for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.47E-03 µg/m^3, approximately 1% of the 24-hour average Ni criteria.

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- No exceedances of the annual average Ni criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 1.42E-04 µg/m^3, approximately 5% of the annual average Ni criteria.

Polychlorinated Dioxins and Furans (TEQ)

- No exceedances of the maximum 1-hour average TEQ criteria were predicted for either of the biomass boiler scenarios (#1 & #2) in isolation, where the maximum predicted GLC was 9.94E-08 µg/m^3, approximately 5% of the 1-hour average TEQ criteria.

Gas Boiler

A summary of the maximum off-site GLCs predicted for NO_2 as the only pollutant of concern for the proposed gas boiler operating in both isolation and cumulatively for all operational scenarios (#3 & #4), is presented in Table 21 and Table 22. A summary of findings as predicted by the modelling has been presented as follows for NO_2.

NO_2

- No exceedances of the maximum 1-hour average NO_2 criteria were predicted for either of the biomass boiler scenarios (#3 & #4) in isolation, where the maximum predicted GLC was 134 µg/m^3, approximately 89% of the 1-hour average NO_2 criteria.
- Exceedances of the maximum 1-hour average NO_2 criteria were predicted offsite for the cumulative assessment for both scenarios (#3 & #4), however, predicted cumulative concentrations were below the relevant 1-hour average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the site boundary. The maximum offsite predicted GLC (cumulative) was 170 µg/m^3, approximately 112% of the 1-hour average NO_2 criteria.
- No exceedances of the annual average NO_2 criteria were predicted for either of the biomass boiler scenarios (#3 & #4) both in isolation or cumulatively, where the maximum predicted GLC (cumulative) was 18.3 µg/m^3, approximately 66% of the annual average NO_2 criteria.

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Table 17: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations in Isolation – Scenario #1 (Biomass Boiler Emissions Excluding KIA Sources)

Scenario #1: Biomass Stack Excluding Future Approved KIA Sources												
Pollutant	Averaging Period	Criteria µg/m³	Maximum Predicted GLCs in Isolation (µg/m³)										
			Max Offsite	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	1.43E+02	1.89E+01	1.47E+01	1.21E+01	1.20E+01	1.01E+01	7.22E+01	7.54E+00	8.24E+00	9.16E+00	1.15E+01
	Annual	2.80E+01	8.25E+00	2.59E-01	7.53E-02	5.84E-02	6.75E-02	6.08E-02	4.42E-01	7.35E-02	6.30E-02	5.13E-02	4.85E-02
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	1.61E+01	5.95E-01	2.92E-01	1.80E-01	1.37E-01	1.80E-01	1.06E+00	2.38E-01	1.29E-01	1.80E-01	1.43E-01
	Annual	7.00E+00	1.56E+00	4.87E-02	1.41E-02	1.10E-02	1.27E-02	1.14E-02	8.30E-02	1.38E-02	1.19E-02	9.65E-03	9.12E-03
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	3.00E-04	9.39E-04	2.92E-05	8.49E-06	6.59E-06	7.61E-06	6.86E-06	4.98E-05	8.29E-06	7.11E-06	5.79E-06	5.47E-06
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	3.19E+01	1.60E+00	1.24E+00	1.02E+00	1.01E+00	8.51E-01	6.09E+00	6.36E-01	6.95E-01	7.73E-01	9.74E-01
	24-hours	5.20E+01	7.24E+00	2.67E-01	1.31E-01	8.10E-02	6.14E-02	8.09E-02	4.77E-01	1.07E-01	5.77E-02	8.07E-02	6.43E-02
	Annual	5.20E+01	7.02E-01	2.19E-02	6.35E-03	4.93E-03	5.69E-03	5.13E-03	3.73E-02	6.20E-03	5.32E-03	4.33E-03	4.09E-03
Total VOCs (as Benzene)	1-hour	2.90E+01	2.25E+01	1.13E+00	8.73E-01	7.18E-01	7.12E-01	6.01E-01	4.30E+00	4.49E-01	4.91E-01	5.46E-01	6.88E-01
	Annual	9.60E+00	4.96E-01	1.54E-02	4.48E-03	3.48E-03	4.02E-03	3.62E-03	2.63E-02	4.38E-03	3.75E-03	3.06E-03	2.89E-03
Arsenic (As) & Compounds	1-hour	9.00E-02	8.02E-03	4.01E-04	3.11E-04	2.56E-04	2.53E-04	2.14E-04	1.53E-03	1.60E-04	1.75E-04	1.94E-04	2.45E-04
	24-hours	2.70E-02	1.82E-03	6.71E-05	3.29E-05	2.03E-05	1.54E-05	2.03E-05	1.20E-04	2.68E-05	1.45E-05	2.03E-05	1.61E-05
	Annual	2.70E-03	1.76E-04	5.49E-06	1.60E-06	1.24E-06	1.43E-06	1.29E-06	9.36E-06	1.56E-06	1.34E-06	1.09E-06	1.03E-06
Beryllium (Be) & Compounds	1-hour	4.00E-03	3.08E-05	1.54E-06	1.19E-06	9.82E-07	9.73E-07	8.21E-07	5.88E-06	6.14E-07	6.71E-07	7.46E-07	9.40E-07
Cadmium (Cd) & Compounds	1-hour	1.80E-02	1.99E-03	9.95E-05	7.72E-05	6.35E-05	6.29E-05	5.31E-05	3.80E-04	3.97E-05	4.34E-05	4.82E-05	6.08E-05
Chromium (III) (Cr-III) Compounds	1-hour	9.00E+00	1.46E-02	7.32E-04	5.68E-04	4.67E-04	4.63E-04	3.91E-04	2.79E-03	2.92E-04	3.19E-04	3.55E-04	4.47E-04
	24-hours	4.60E-01	3.32E-03	1.23E-04	6.01E-05	3.71E-05	2.82E-05	3.71E-05	2.19E-04	4.90E-05	2.65E-05	3.70E-05	2.95E-05
Chromium (VI) (Cr-VI) Compounds	1-hour	9.00E-02	4.32E-03	2.16E-04	1.67E-04	1.38E-04	1.37E-04	1.15E-04	8.24E-04	8.61E-05	9.41E-05	1.05E-04	1.32E-04
	Annual	1.80E-04	9.50E-05	2.96E-06	8.59E-07	6.67E-07	7.70E-07	6.94E-07	5.04E-06	8.39E-07	7.20E-07	5.86E-07	5.54E-07
Copper & Compounds	1-hour	1.80E+01	3.51E-02	1.76E-03	1.36E-03	1.12E-03	1.11E-03	9.37E-04	6.70E-03	7.00E-04	7.65E-04	8.50E-04	1.07E-03
	24-hours	9.20E-01	7.97E-03	2.94E-04	1.44E-04	8.91E-05	6.75E-05	8.91E-05	5.24E-04	1.18E-04	6.35E-05	8.87E-05	7.07E-05
Lead & Compounds	Annual	4.60E-01	9.21E-04	2.87E-05	8.33E-06	6.46E-06	7.47E-06	6.73E-06	4.89E-05	8.14E-06	6.98E-06	5.68E-06	5.37E-06
Mercury & Compounds (Inorganic)	1-hour	5.50E-01	4.85E-04	2.42E-05	1.88E-05	1.54E-05	1.53E-05	1.29E-05	9.25E-05	9.65E-06	1.06E-05	1.17E-05	1.48E-05
	Annual	1.80E-01	1.07E-05	3.32E-07	9.64E-08	7.48E-08	8.64E-08	7.79E-08	5.66E-07	9.42E-08	8.07E-08	6.57E-08	6.21E-08
Nickel & Compounds	1-hour	1.80E-01	6.48E-03	3.24E-04	2.51E-04	2.07E-04	2.05E-04	1.73E-04	1.24E-03	1.29E-04	1.41E-04	1.57E-04	1.98E-04
	24-hours	1.40E-01	1.47E-03	5.42E-05	2.66E-05	1.64E-05	1.25E-05	1.64E-05	9.68E-05	2.17E-05	1.17E-05	1.64E-05	1.30E-05
	Annual	3.00E-03	1.42E-04	4.44E-06	1.29E-06	1.00E-06	1.16E-06	1.04E-06	7.56E-06	1.26E-06	1.08E-06	8.79E-07	8.30E-07
Polychlorinated Dioxins and Furans (TEQ)	1-hour	2.00E-06	9.94E-08	4.97E-09	3.85E-09	3.17E-09	3.14E-09	2.65E-09	1.90E-08	1.98E-09	2.16E-09	2.41E-09	3.03E-09

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Pollutant	Averaging Period	Criteria µg/m³	Maximum Predicted GLC as % of Criteria										
			Max Offsite	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	95%	13%	10%	8%	8%	7%	48%	5%	5%	6%	8%
	Annual	2.80E+01	29%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	70%	3%	1%	1%	1%	1%	5%	1%	1%	1%	1%
	Annual	7.00E+00	22%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	3.00E-04	313%	10%	3%	2%	3%	2%	17%	3%	2%	2%	2%
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	12%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%
	24-hours	5.20E+01	14%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	Annual	5.20E+01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total VOCs (as Benzene)	1-hour	2.90E+01	78%	4%	3%	2%	2%	2%	15%	2%	2%	2%	2%
	Annual	9.60E+00	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Arsenic (As) & Compounds	1-hour	9.00E-02	9%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%
	24-hours	2.70E-02	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	2.70E-03	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Beryllium (Be) & Compounds	1-hour	4.00E-03	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cadmium (Cd) & Compounds	1-hour	1.80E-02	11%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Chromium (III) (Cr-III) Compounds	1-hour	9.00E+00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	24-hours	4.60E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chromium (VI) (Cr-VI) Compounds	1-hour	9.00E-02	5%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	Annual	1.80E-04	53%	2%	0%	0%	0%	0%	3%	0%	0%	0%	0%
Copper & Compounds	1-hour	1.80E+01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	24-hours	9.20E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lead & Compounds	Annual	4.60E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mercury & Compounds (Inorganic)	1-hour	5.50E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	1.80E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nickel & Compounds	1-hour	1.80E-01	4%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	24-hours	1.40E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	3.00E-03	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Polychlorinated Dioxins and Furans (TEQ)	1-hour	2.00E-06	5%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%

Notes
1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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Table 18: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations with Background – Scenario #1 (Biomass Boiler Emissions Excluding KIA Sources)

Scenario #1: Biomass Stack Excluding Future Approved KIA Sources												
Pollutant	**Averaging Period**	**Criteria µg/m³**	**Background Concentration (µg/m³)**	**Cumulative Maximum Predicted GLCs (µg/m³)**										
				Max Offsite	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	3.58E+01	1.79E+02	5.47E+01	5.04E+01	4.78E+01	4.77E+01	4.58E+01	1.08E+02	4.33E+01	4.40E+01	4.49E+01	4.73E+01
	Annual	2.80E+01	1.13E+01	1.95E+01	1.15E+01	1.14E+01	1.13E+01	1.14E+01	1.14E+01	1.17E+01	1.14E+01	1.14E+01	1.13E+01	1.13E+01
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	7.88E+00	2.40E+01	8.47E+00	8.17E+00	8.06E+00	8.02E+00	8.06E+00	8.94E+00	8.12E+00	8.01E+00	8.06E+00	8.02E+00
	Annual	7.00E+00	6.96E+00	8.53E+00	7.01E+00	6.98E+00	6.97E+00	6.98E+00	6.97E+00	7.05E+00	6.98E+00	6.97E+00	6.97E+00	6.97E+00
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	1.05E+01	4.24E+01	1.21E+01	1.17E+01	1.15E+01	1.15E+01	1.13E+01	1.66E+01	1.11E+01	1.12E+01	1.13E+01	1.15E+01
	24-hours	5.20E+01	7.86E+00	1.51E+01	8.13E+00	7.99E+00	7.94E+00	7.92E+00	7.94E+00	8.34E+00	7.97E+00	7.92E+00	7.94E+00	7.92E+00
	Annual	5.20E+01	5.24E+00	5.94E+00	5.26E+00	5.25E+00	5.25E+00	5.25E+00	5.25E+00	5.28E+00	5.25E+00	5.25E+00	5.24E+00	5.24E+00
Pollutant	**Averaging Period**	**Criteria µg/m³**	**Background Concentration (µg/m³)**	**Cumulative Maximum Predicted GLC as % of Criteria**										
				Max Offsite	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	3.58E+01	118%	36%	33%	32%	32%	30%	71%	29%	29%	30%	31%
	Annual	2.80E+01	1.13E+01	70%	41%	41%	41%	41%	41%	42%	41%	41%	41%	40%
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	7.88E+00	104%	37%	36%	35%	35%	35%	39%	35%	35%	35%	35%
	Annual	7.00E+00	6.96E+00	122%	100%	100%	100%	100%	100%	101%	100%	100%	100%	100%
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	1.05E+01	16%	5%	4%	4%	4%	4%	6%	4%	4%	4%	4%
	24-hours	5.20E+01	7.86E+00	29%	16%	15%	15%	15%	15%	16%	15%	15%	15%	15%
	Annual	5.20E+01	5.24E+00	11%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Notes

1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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Table 19: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations in Isolation – Scenario #2 (Biomass Boiler Emissions Including KIA Sources)

Scenario #2: Biomass Stack Including Future Approved KIA Sources												
Pollutant	Averaging Period	Criteria µg/m³	Maximum Predicted GLCs in Isolation (µg/m³)										
			Max Offsite	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	1.43E+02	4.19E+01	3.74E+01	2.57E+01	5.79E+01	3.18E+01	7.22E+01	2.64E+01	4.40E+01	1.78E+01	2.50E+01
	Annual	2.80E+01	8.65E+00	9.46E-01	5.77E-01	8.04E-01	1.33E+00	5.84E-01	8.85E-01	3.64E-01	1.25E+00	3.51E-01	6.32E-01
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	1.61E+01	5.95E-01	2.92E-01	1.80E-01	1.37E-01	1.80E-01	1.06E+00	2.38E-01	1.29E-01	1.80E-01	1.43E-01
	Annual	7.00E+00	1.56E+00	4.87E-02	1.41E-02	1.10E-02	1.27E-02	1.14E-02	8.30E-02	1.38E-02	1.19E-02	9.65E-03	9.12E-03
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	3.00E-04	9.39E-04	2.92E-05	8.49E-06	6.59E-06	7.61E-06	6.86E-06	4.98E-05	8.29E-06	7.11E-06	5.79E-06	5.47E-06
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	3.19E+01	1.60E+00	1.24E+00	1.02E+00	1.01E+00	8.51E-01	6.09E+00	6.36E-01	6.95E-01	7.73E-01	9.74E-01
	24-hours	5.20E+01	7.24E+00	2.67E-01	1.31E-01	8.10E-02	6.14E-02	8.09E-02	4.77E-01	1.07E-01	5.77E-02	8.07E-02	6.43E-02
	Annual	5.20E+01	7.02E-01	2.19E-02	6.35E-03	4.93E-03	5.69E-03	5.13E-03	3.73E-02	6.20E-03	5.32E-03	4.33E-03	4.09E-03
Total VOCs (as Benzene)	1-hour	2.90E+01	2.25E+01	1.13E+00	8.73E-01	7.18E-01	7.12E-01	6.01E-01	4.30E+00	4.49E-01	4.91E-01	5.46E-01	6.88E-01
	Annual	9.60E+00	4.96E-01	1.54E-02	4.48E-03	3.48E-03	4.02E-03	3.62E-03	2.63E-02	4.38E-03	3.75E-03	3.06E-03	2.89E-03
Arsenic (As) & Compounds	1-hour	9.00E-02	8.02E-03	4.01E-04	3.11E-04	2.56E-04	2.53E-04	2.14E-04	1.53E-03	1.60E-04	1.75E-04	1.94E-04	2.45E-04
	24-hours	2.70E-02	1.82E-03	6.71E-05	3.29E-05	2.03E-05	1.54E-05	2.03E-05	1.20E-04	2.68E-05	1.45E-05	2.03E-05	1.61E-05
	Annual	2.70E-03	1.76E-04	5.49E-06	1.60E-06	1.24E-06	1.43E-06	1.29E-06	9.36E-06	1.56E-06	1.34E-06	1.09E-06	1.03E-06
Beryllium (Be) & Compounds	1-hour	4.00E-03	3.08E-05	1.54E-06	1.19E-06	9.82E-07	9.73E-07	8.21E-07	5.88E-06	6.14E-07	6.71E-07	7.46E-07	9.40E-07
Cadmium (Cd) & Compounds	1-hour	1.80E-02	1.99E-03	9.95E-05	7.72E-05	6.35E-05	6.29E-05	5.31E-05	3.80E-04	3.97E-05	4.34E-05	4.82E-05	6.08E-05
Chromium (III) (Cr-III) Compounds	1-hour	9.00E+00	1.46E-02	7.32E-04	5.68E-04	4.67E-04	4.63E-04	3.91E-04	2.79E-03	2.92E-04	3.19E-04	3.55E-04	4.47E-04
	24-hours	4.60E-01	3.32E-03	1.23E-04	6.01E-05	3.71E-05	2.82E-05	3.71E-05	2.19E-04	4.90E-05	2.65E-05	3.70E-05	2.95E-05
Chromium (VI) (Cr-VI) Compounds	1-hour	9.00E-02	4.32E-03	2.16E-04	1.67E-04	1.38E-04	1.37E-04	1.15E-04	8.24E-04	8.61E-05	9.41E-05	1.05E-04	1.32E-04
	Annual	1.80E-04	9.50E-05	2.96E-06	8.59E-07	6.67E-07	7.70E-07	6.94E-07	5.04E-06	8.39E-07	7.20E-07	5.86E-07	5.54E-07
Copper & Compounds	1-hour	1.80E+01	3.51E-02	1.76E-03	1.36E-03	1.12E-03	1.11E-03	9.37E-04	6.70E-03	7.00E-04	7.65E-04	8.50E-04	1.07E-03
	24-hours	9.20E-01	7.97E-03	2.94E-04	1.44E-04	8.91E-05	6.75E-05	8.91E-05	5.24E-04	1.18E-04	6.35E-05	8.87E-05	7.07E-05
Lead & Compounds	Annual	4.60E-01	9.21E-04	2.87E-05	8.33E-06	6.46E-06	7.47E-06	6.73E-06	4.89E-05	8.14E-06	6.98E-06	5.68E-06	5.37E-06
Mercury & Compounds (Inorganic)	1-hour	5.50E-01	4.85E-04	2.42E-05	1.88E-05	1.54E-05	1.53E-05	1.29E-05	9.25E-05	9.65E-06	1.06E-05	1.17E-05	1.48E-05
	Annual	1.80E-01	1.07E-05	3.32E-07	9.64E-08	7.48E-08	8.64E-08	7.79E-08	5.66E-07	9.42E-08	8.07E-08	6.57E-08	6.21E-08
Nickel & Compounds	1-hour	1.80E-01	6.48E-03	3.24E-04	2.51E-04	2.07E-04	2.05E-04	1.73E-04	1.24E-03	1.29E-04	1.41E-04	1.57E-04	1.98E-04
	24-hours	1.40E-01	1.47E-03	5.42E-05	2.66E-05	1.64E-05	1.25E-05	1.64E-05	9.68E-05	2.17E-05	1.17E-05	1.64E-05	1.30E-05
	Annual	3.00E-03	1.42E-04	4.44E-06	1.29E-06	1.00E-06	1.16E-06	1.04E-06	7.56E-06	1.26E-06	1.08E-06	8.79E-07	8.30E-07
Polychlorinated Dioxins and Furans (TEQ)	1-hour	2.00E-06	9.94E-08	4.97E-09	3.85E-09	3.17E-09	3.14E-09	2.65E-09	1.90E-08	1.98E-09	2.16E-09	2.41E-09	3.03E-09

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Pollutant	Averaging Period	Criteria µg/m³	Maximum Predicted GLC as % of Criteria										
			Max Offsite	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	95%	28%	25%	17%	38%	21%	48%	17%	29%	12%	17%
	Annual	2.80E+01	31%	3%	2%	3%	5%	2%	3%	1%	4%	1%	2%
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	70%	3%	1%	1%	1%	1%	5%	1%	1%	1%	1%
	Annual	7.00E+00	22%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Polycyclic Aromatic Hydrocarbons (B[a]Peq)	Annual	3.00E-04	313%	10%	3%	2%	3%	2%	17%	3%	2%	2%	2%
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	12%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%
	24-hours	5.20E+01	14%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	Annual	5.20E+01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total VOCs (as Benzene)	1-hour	2.90E+01	78%	4%	3%	2%	2%	2%	15%	2%	2%	2%	2%
	Annual	9.60E+00	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Arsenic (As) & Compounds	1-hour	9.00E-02	9%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%
	24-hours	2.70E-02	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	2.70E-03	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Beryllium (Be) & Compounds	1-hour	4.00E-03	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cadmium (Cd) & Compounds	1-hour	1.80E-02	11%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Chromium (III) (Cr-III) Compounds	1-hour	9.00E+00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	24-hours	4.60E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chromium (VI) (Cr-VI) Compounds	1-hour	9.00E-02	5%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	Annual	1.80E-04	53%	2%	0%	0%	0%	0%	3%	0%	0%	0%	0%
Copper & Compounds	1-hour	1.80E+01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	24-hours	9.20E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lead & Compounds	Annual	4.60E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mercury & Compounds (Inorganic)	1-hour	5.50E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	1.80E-01	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nickel & Compounds	1-hour	1.80E-01	4%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	24-hours	1.40E-01	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Annual	3.00E-03	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Polychlorinated Dioxins and Furans (TEQ)	1-hour	2.00E-06	5%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%

Notes
1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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Table 20: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations with Background – Scenario #2 (Biomass Boiler Emissions Including KIA Sources)

Scenario #2: Biomass Stack Including Future Approved KIA Sources												
Pollutant	**Averaging Period**	**Criteria µg/m³**	**Background Concentration (µg/m³)**	**Cumulative Maximum Predicted GLCs (µg/m³)**										
				Max Offsite	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	3.58E+01	1.79E+02	7.76E+01	7.32E+01	6.14E+01	9.37E+01	6.76E+01	1.08E+02	6.22E+01	7.98E+01	5.36E+01	6.08E+01
	Annual	2.80E+01	1.13E+01	1.99E+01	1.22E+01	1.19E+01	1.21E+01	1.26E+01	1.19E+01	1.22E+01	1.17E+01	1.25E+01	1.16E+01	1.19E+01
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	7.88E+00	2.40E+01	8.47E+00	8.17E+00	8.06E+00	8.02E+00	8.06E+00	8.94E+00	8.12E+00	8.01E+00	8.06E+00	8.02E+00
	Annual	7.00E+00	6.96E+00	8.53E+00	7.01E+00	6.98E+00	6.97E+00	6.98E+00	6.97E+00	7.05E+00	6.98E+00	6.97E+00	6.97E+00	6.97E+00
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	1.05E+01	4.24E+01	1.21E+01	1.17E+01	1.15E+01	1.15E+01	1.13E+01	1.66E+01	1.11E+01	1.12E+01	1.13E+01	1.15E+01
	24-hours	5.20E+01	7.86E+00	1.51E+01	8.13E+00	7.99E+00	7.94E+00	7.92E+00	7.94E+00	8.34E+00	7.97E+00	7.92E+00	7.94E+00	7.92E+00
	Annual	5.20E+01	5.24E+00	5.94E+00	5.26E+00	5.25E+00	5.25E+00	5.25E+00	5.25E+00	5.28E+00	5.25E+00	5.25E+00	5.24E+00	5.24E+00
Pollutant	**Averaging Period**	**Criteria µg/m³**	**Background Concentration (µg/m³)**	**Cumulative Maximum Predicted GLC as % of Criteria**										
				Max Offsite	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**
Nitrogen Dioxide (NO_2)	1-hour	1.51E+02	3.58E+01	118%	51%	48%	41%	62%	45%	71%	41%	53%	35%	40%
	Annual	2.80E+01	1.13E+01	71%	44%	42%	43%	45%	42%	43%	42%	45%	42%	43%
Particulate Matter < 2.5 ($PM_{2.5}$)	24-hours	2.30E+01	7.88E+00	104%	37%	36%	35%	35%	35%	39%	35%	35%	35%	35%
	Annual	7.00E+00	6.96E+00	122%	100%	100%	100%	100%	100%	101%	100%	100%	100%	100%
Sulfur Dioxide (SO_2)	1-hour	2.62E+02	1.05E+01	16%	5%	4%	4%	4%	4%	6%	4%	4%	4%	4%
	24-hours	5.20E+01	7.86E+00	29%	16%	15%	15%	15%	15%	16%	15%	15%	15%	15%
	Annual	5.20E+01	5.24E+00	11%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Notes

1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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Table 21: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations – Scenario #3 (Gas Boiler Emissions Excluding KIA Sources)

Max 1-hour Average Model Predicted NO_2 GLCs							
Receptor		Guideline (µg/m³)	GLC Isolation (µg/m³)[1]	% of Criteria	Background (µg/m³)	Cumulative GLC (µg/m³)[1]	% of Criteria
Max Offsite		1.51E+02	1.34E+02	89%	3.58E+01	1.70E+02	112%
Rec_001	Wells Park		1.26E+01	8%		4.84E+01	32%
Rec_002	Golf Course		9.73E+00	6%		4.55E+01	30%
Rec_003	Thomas Oval		5.59E+00	4%		4.13E+01	27%
Rec_004	Oval		7.70E+00	5%		4.35E+01	29%
Rec_005	Nearest Residence		5.82E+00	4%		4.16E+01	28%
Rec_006	North Rockingham		4.46E+01	30%		8.03E+01	53%
Rec_007	Residence 3 (SE)		7.04E+00	5%		4.28E+01	28%
Rec_008	Hope Valley		4.30E+00	3%		4.01E+01	27%
Rec_009	Callista Primary School		4.70E+00	3%		4.05E+01	27%
Rec_010	Wombat Wallow Childcare Centre		6.09E+00	4%		4.18E+01	28%
Annual Average Model Predicted NO_2 GLCs							
Receptor		Guideline (µg/m³)	GLC Isolation (µg/m³)[1]	% of Criteria	Background (µg/m³)	Cumulative GLC (µg/m³)[1]	% of Criteria
Max Offsite		2.80E+01	7.06E+00	25%	1.13E+01	1.83E+01	66%
Rec_001	Wells Park		2.17E-01	1%		1.15E+01	41%
Rec_002	Golf Course		4.14E-02	0%		1.13E+01	40%
Rec_003	Thomas Oval		3.12E-02	0%		1.13E+01	40%
Rec_004	Oval		3.58E-02	0%		1.13E+01	40%
Rec_005	Nearest Residence		3.30E-02	0%		1.13E+01	40%
Rec_006	North Rockingham		3.17E-01	1%		1.16E+01	41%
Rec_007	Residence 3 (SE)		4.13E-02	0%		1.13E+01	40%
Rec_008	Hope Valley		3.33E-02	0%		1.13E+01	40%
Rec_009	Callista Primary School		2.76E-02	0%		1.13E+01	40%
Rec_010	Wombat Wallow Childcare Centre		2.59E-02	0%		1.13E+01	40%

Notes
1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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Table 22: Summary of Maximum Predicted GLCs Offsite & at Sensitive Receptor Locations – Scenario #4 (Gas Boiler Emissions Including KIA Sources)

Max 1-hour Average Model Predicted NO_2 GLCs							
Receptor		Guideline (µg/m³)	GLC Isolation (µg/m³)[1]	% of Criteria	Background (µg/m³)	Cumulative GLC (µg/m³)[1]	% of Criteria
Max Offsite		1.51E+02	1.34E+02	89%	3.58E+01	1.70E+02	112%
Rec_001	Wells Park		4.19E+01	28%		7.76E+01	51%
Rec_002	Golf Course		3.68E+01	24%		7.25E+01	48%
Rec_003	Thomas Oval		2.54E+01	17%		6.11E+01	40%
Rec_004	Oval		5.79E+01	38%		9.37E+01	62%
Rec_005	Nearest Residence		2.99E+01	20%		6.57E+01	43%
Rec_006	North Rockingham		4.46E+01	30%		8.03E+01	53%
Rec_007	Residence 3 (SE)		2.64E+01	17%		6.22E+01	41%
Rec_008	Hope Valley		4.40E+01	29%		7.98E+01	53%
Rec_009	Callista Primary School		1.50E+01	10%		5.07E+01	34%
Rec_010	Wombat Wallow Childcare Centre		2.50E+01	17%		6.08E+01	40%
Operations with All KIA Approved Sources - Annual							
Receptor		Guideline (µg/m³)	GLC Isolation (µg/m³)[1]	% of Criteria	Background (µg/m³)	Cumulative GLC (µg/m³)[1]	% of Criteria
Max Offsite		2.80E+01	7.46E+00	27%	1.13E+01	1.87E+01	67%
Rec_001	Wells Park		9.04E-01	3%		1.22E+01	44%
Rec_002	Golf Course		5.47E-01	2%		1.18E+01	42%
Rec_003	Thomas Oval		7.76E-01	3%		1.21E+01	43%
Rec_004	Oval		1.30E+00	5%		1.26E+01	45%
Rec_005	Nearest Residence		5.60E-01	2%		1.19E+01	42%
Rec_006	North Rockingham		7.61E-01	3%		1.21E+01	43%
Rec_007	Residence 3 (SE)		3.30E-01	1%		1.16E+01	42%
Rec_008	Hope Valley		1.22E+00	4%		1.25E+01	45%
Rec_009	Callista Primary School		3.27E-01	1%		1.16E+01	41%
Rec_010	Wombat Wallow Childcare Centre		6.12E-01	2%		1.19E+01	43%

Notes
1. Concentrations (µg/m³) referenced to 25°C, 101.3 kPa.

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6. SUMMARY

The Cargill Crux Project seeks to build a canola crush plant adjacent to the CBH Kwinana Grain Terminal with the capacity of up to 3000 tonnes per day (tpd). The project would receive oilseeds by rail and some truck movements. Significant storage capacity of vegetable oil and protein meal will be required on site. The processing facility will include a solvent extraction plant.

Cargill has identified a potential site in the Rockingham Strategic Industrial Area (RSIA). The identified potential site is a subset of Lot 108 and is up to 13Ha in size. Other industries in the precinct include chemical and fuel storage, mineral processing, wastewater treatment and a proposed green hydrogen facility. Cargill is aiming to assess the feasibility between a biomass boiler or a gas boiler for their plant, where if a biomass boiler is to be used, various pollutants would be of concern, and if a gas boiler was to be used, NO_2 would be the only pollutant of concern.

Cargill engaged Ramboll to undertake an air quality study with the intent of assessing how emissions from the newly proposed site boiler (biomass or gas boiler) configurations location will impact local and regional air quality.

Air dispersion modelling has been completed to assess the potential air quality impacts associated with various pollutants of concern emissions from the proposed operations of Cargill's Crux project in Kwinana. Predicted GLCs for the pollutant(s) of concern have been estimated using the AERMOD and DISPMOD model and meteorological data has been adapted from the nearest BoM monitoring station, Hope Valley. A total of four (4) scenarios were modelled, which have been summarised as below:

SC ID	Boiler Configuration	Description
SC1	Biomass	Biomass Boiler
SC2		Biomass Boiler and Future KIA Sources
SC3	Gas	Gas Boiler
SC4		Gas Boiler and Future KIA Sources

A summary of the findings is as follows:

Biomass Boiler

- No exceedances were predicted for the maximum 1-hour average NO_2 GLCs in isolation, however, exceedances were predicted offsite for the cumulative assessment for both scenarios (#1 & #2), where the maximum cumulative offsite predicted GLC was 178.5 µg/m^3, approximately 118% of the 1-hour average NO_2 criteria. Although the exceedances were predicted, the contours showed that these occurred only at/near the boundary of the facility;
- No exceedances were predicted at any of the sensitive receptor locations for the maximum 1-hour average NO_2 criteria and across the modelling domain for the annual average NO_2 criteria;
- Exceedances of the maximum 24-hour average $PM_{2.5}$ criteria were predicted for both of the applicable operating scenarios (#1 & #2) in isolation and cumulatively, where the maximum predicted GLC (cumulative) was 24.05 µg/m^3, approximately 104% of the 24-hour average $PM_{2.5}$ criteria. Although exceedances were predicted against the 24-hour $PM_{2.5}$ criteria, based on the contour plots, it can be seen that these predicted GLCs will occur only at/close to the boundary of the site, with predicted GLCs at all sensitive receptors remaining below the 24-hour $PM_{2.5}$ criteria.

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- Exceedances of the annual average $PM_{2.5}$ criteria were predicted offsite and at sensitive receptor locations for both of the biomass boiler (#1 & #2) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 8.53 µg/m^3, approximately 122% of the annual average $PM_{2.5}$ criteria. Although exceedances are predicted across the modelling domain for the cumulative assessment, the predicted results in isolation show that Cargill's contribution of $PM_{2.5}$ at each of the sensitive receptor locations is no more than 2% of the annual average $PM_{2.5}$ criteria, and that the annual average monitored background concentration of $PM_{2.5}$ is attributable to majority of the contribution to the exceedances (background representing 99% of the criteria);
- Exceedances of the maximum annual average PAH criteria were predicted offsite for the cumulative assessment for both scenarios (#1 & #2), however, predicted cumulative concentrations were below the relevant annual average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the site as per the contour plots. The maximum offsite predicted GLC (cumulative) was 9.39E-04 µg/m^3, approximately 313% of the annual average PAH criteria; and
- All other pollutants remained below their respective short- and long-term ambient air quality criteria.

Gas Boiler

- No exceedances of the maximum 1-hour average NO_2 criteria were predicted for either of the biomass boiler scenarios (#3 & #4) in isolation, where the maximum predicted GLC was 134 µg/m^3, approximately 89% of the 1-hour average NO_2 criteria;
- Exceedances of the maximum 1-hour average NO_2 criteria were predicted offsite for the cumulative assessment for both scenarios (#3 & #4), however, predicted cumulative concentrations were below the relevant 1-hour average criteria at each of the sensitive receptors within the modelling domain, and the offsite predicted GLCs were in close proximity to the site as per the contour plots. The maximum offsite predicted GLC (cumulative) was 170 µg/m^3, approximately 112% of the 1-hour average NO_2 criteria; and
- No exceedances of the annual average NO_2 criteria were predicted for either of the biomass boiler scenarios (#3 & #4) in either isolation or cumulatively, where the maximum predicted GLC (cumulative) was 18.3 µg/m^3, approximately 66% of the annual average NO_2 criteria.

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7. LIMITATIONS

Ramboll prepared this report in accordance with the scope of work as outlined in our proposal to Cargill Australia Limited dated 2nd October 2023 and in accordance with our understanding and interpretation of current regulatory standards.

The conclusions presented in this report represent Ramboll's professional judgement based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

7.1 User Reliance

This report has been prepared for Cargill Australia Limited and may not be relied upon by any other person or entity without Ramboll's express written permission.

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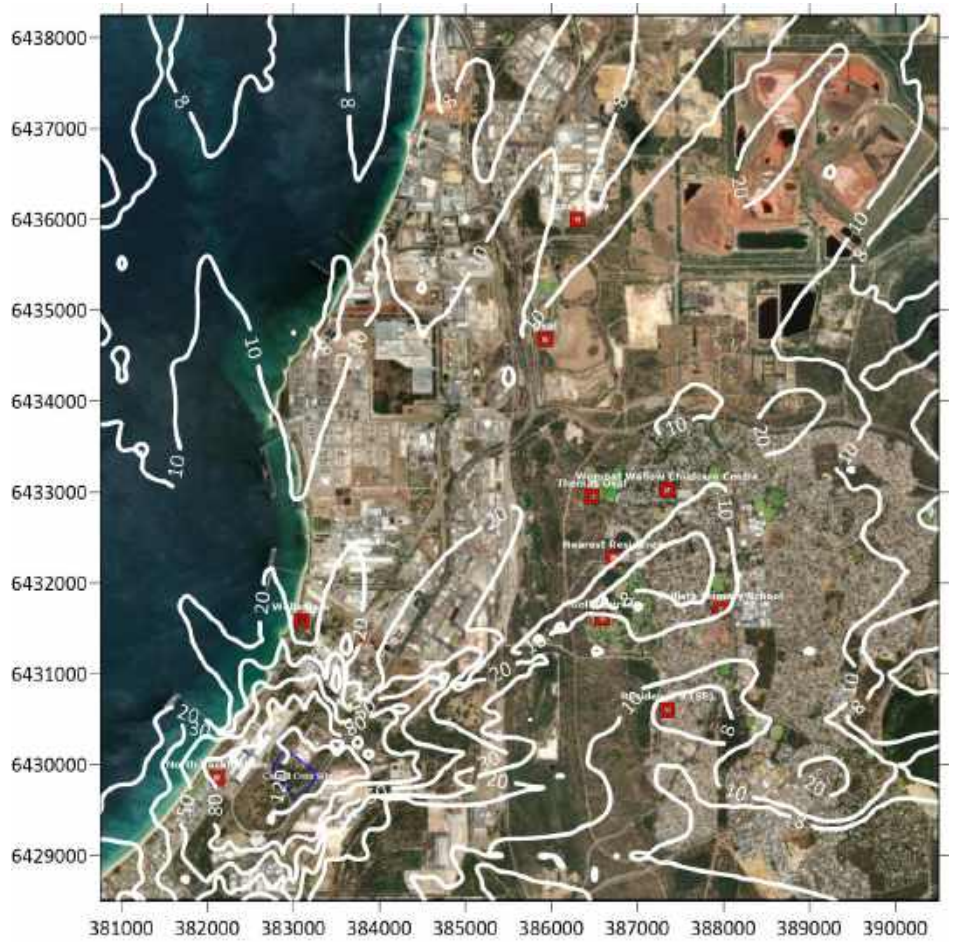
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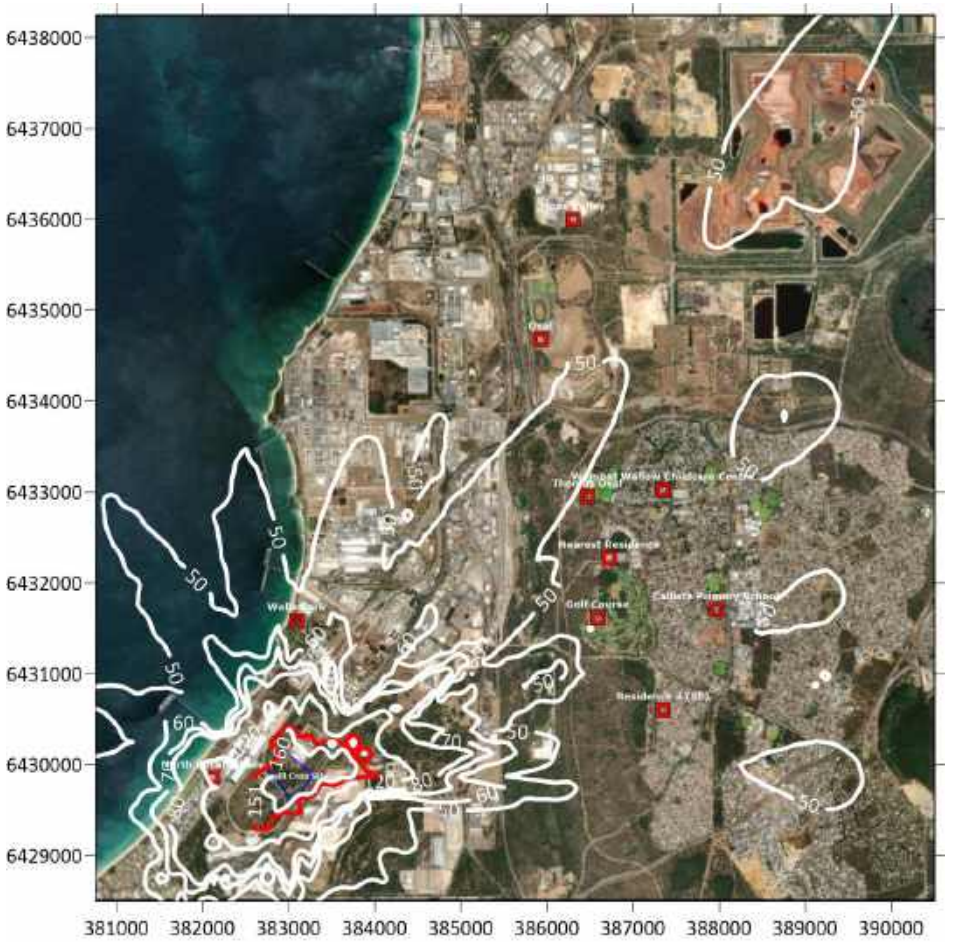
APPENDIX 1
CONTOUR PLOTS

Confidential

Isolation



Cumulative

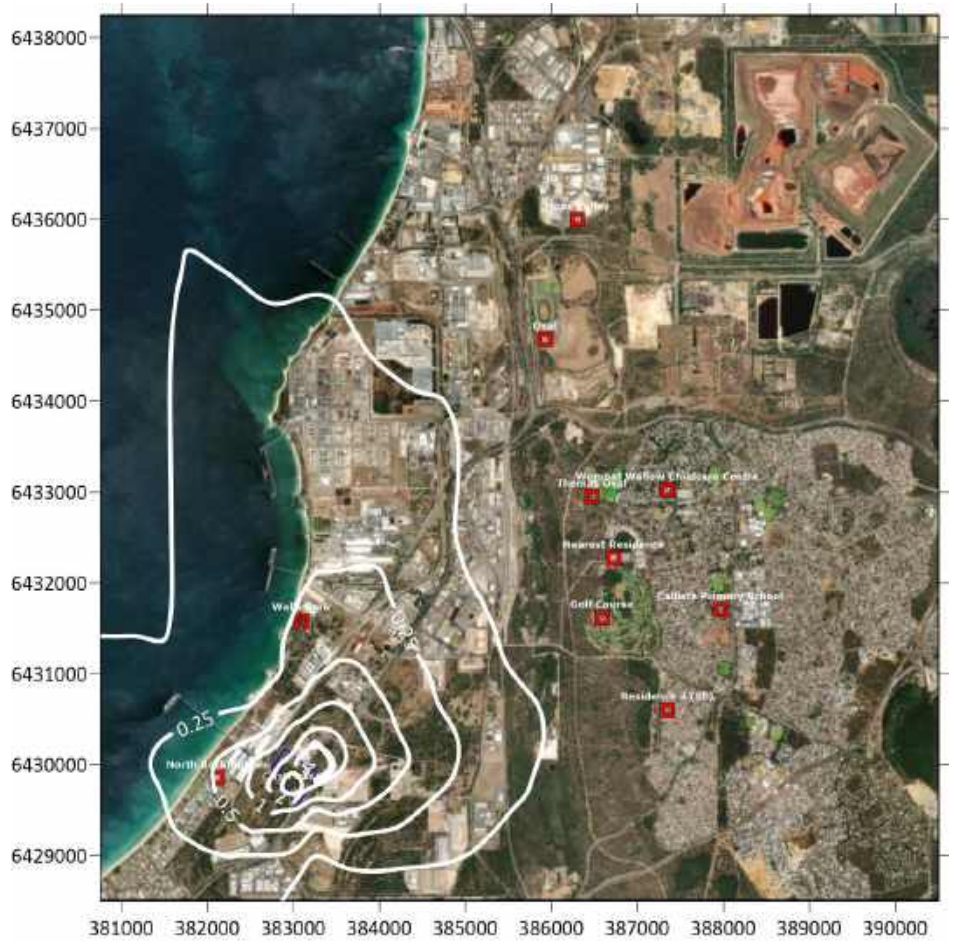


Scenario #1 (Biomass Boiler Emissions):
Maximum 1-hour Average Predicted NO_2 GLCs (µg/m^3)

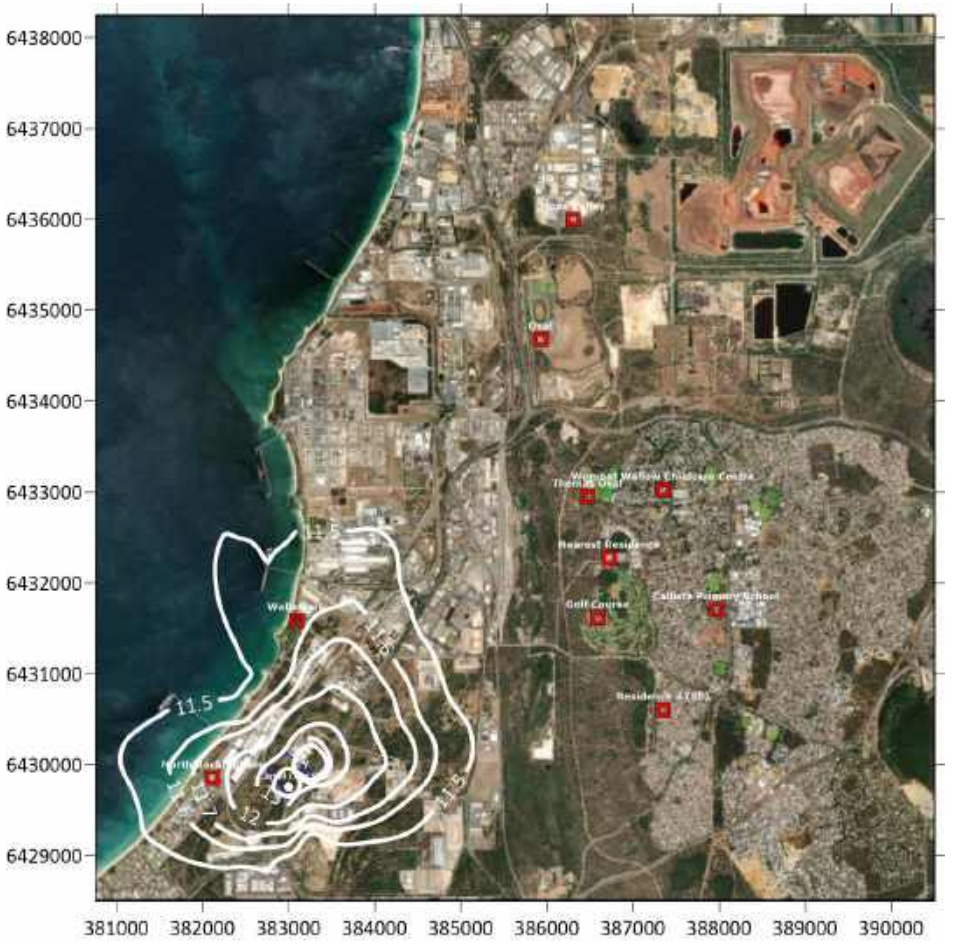
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Figure 3

Isolation



Cumulative

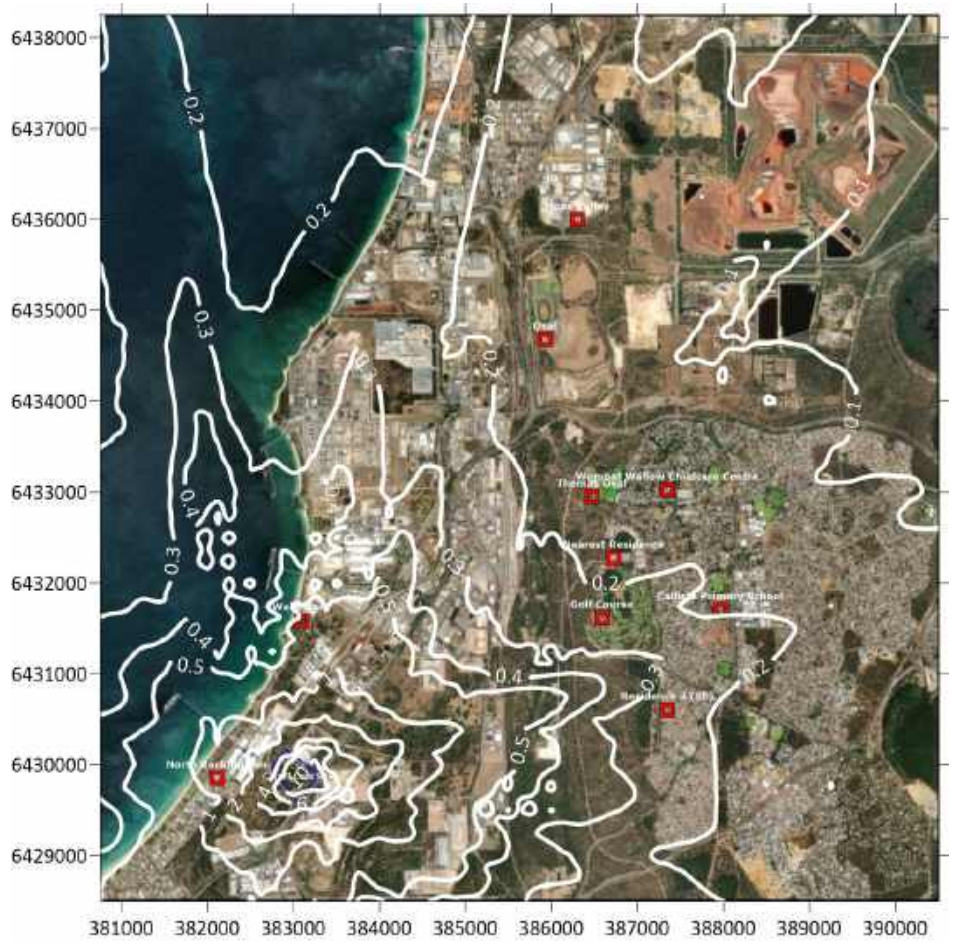


Scenario #1 (Biomass Boiler Emissions):
Annual Average Predicted NO_2 GLCs (µg/m^3)

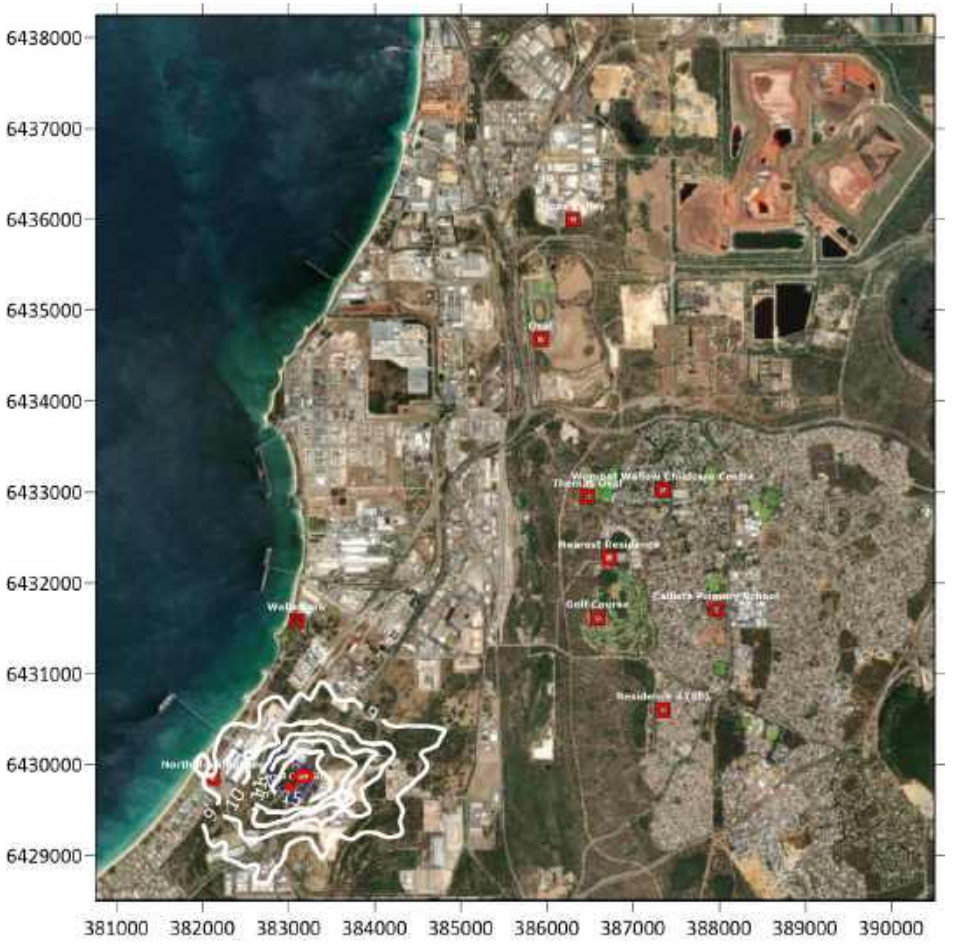
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Figure 4

Isolation



Cumulative

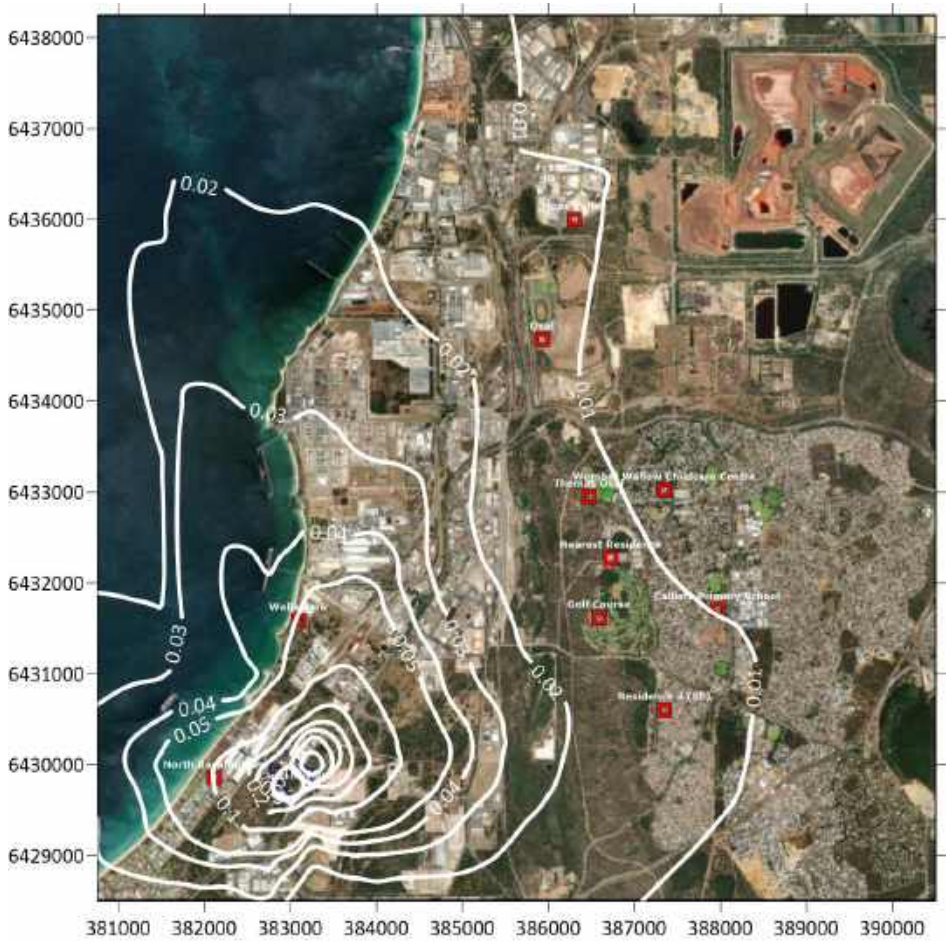


Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted $PM_{2.5}$ GLCs ($\mu g/m^3$)

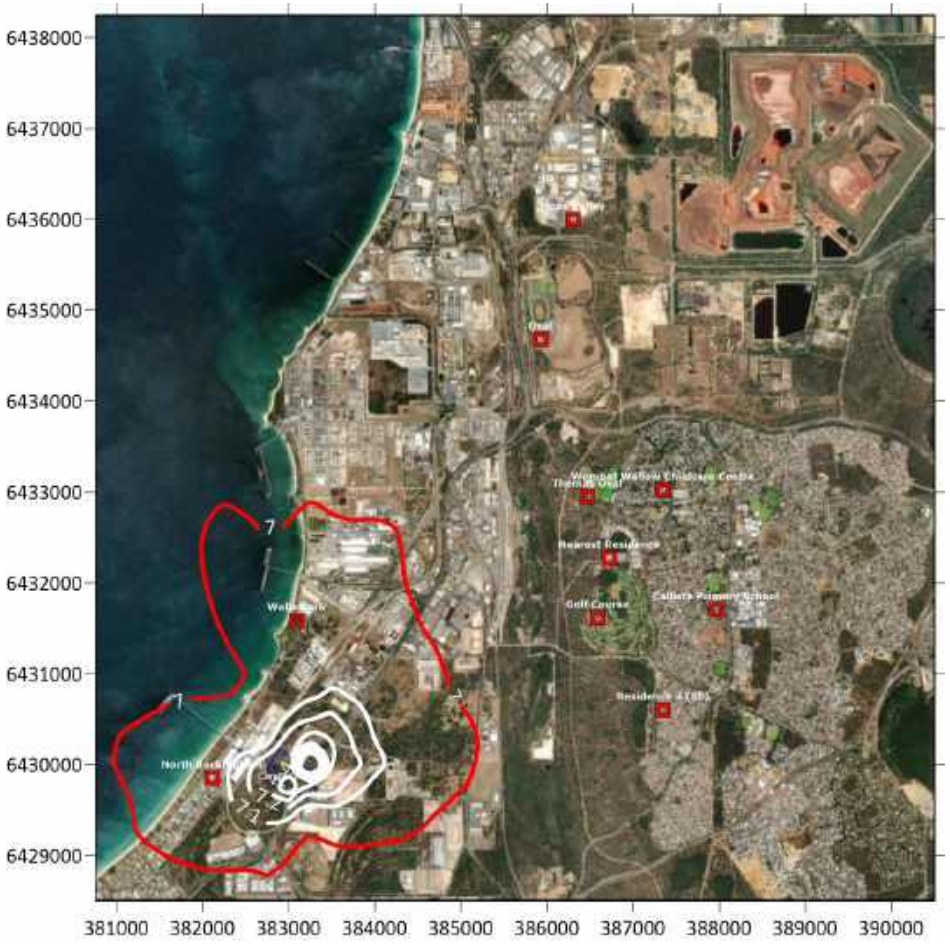
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Figure 5

Isolation



Cumulative

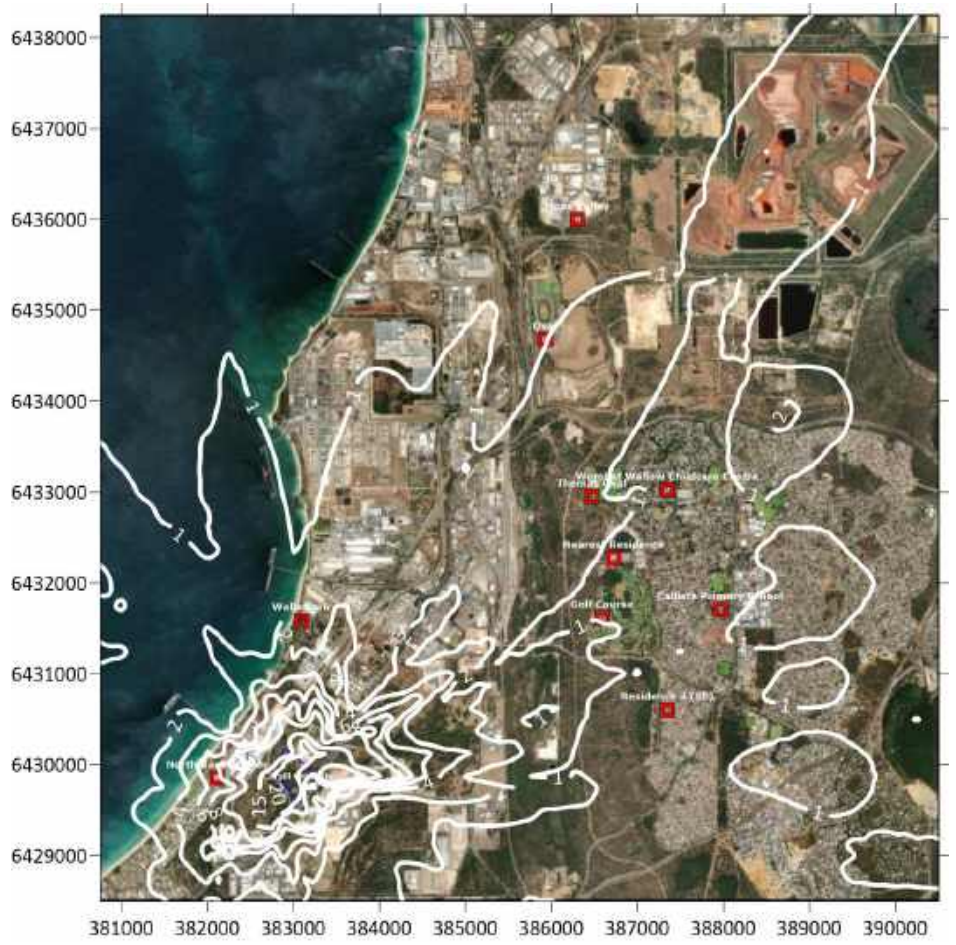


Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted $PM_{2.5}$ GLCs (µg/m^3)

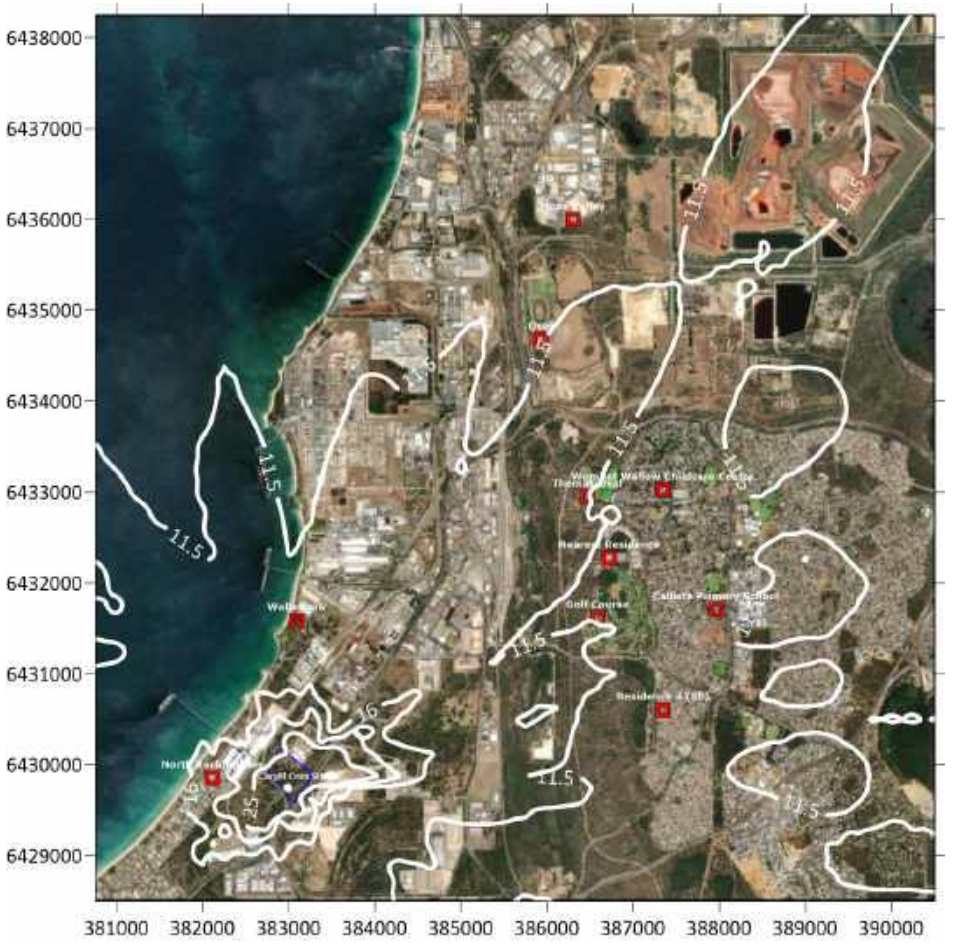
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Figure 6

Isolation



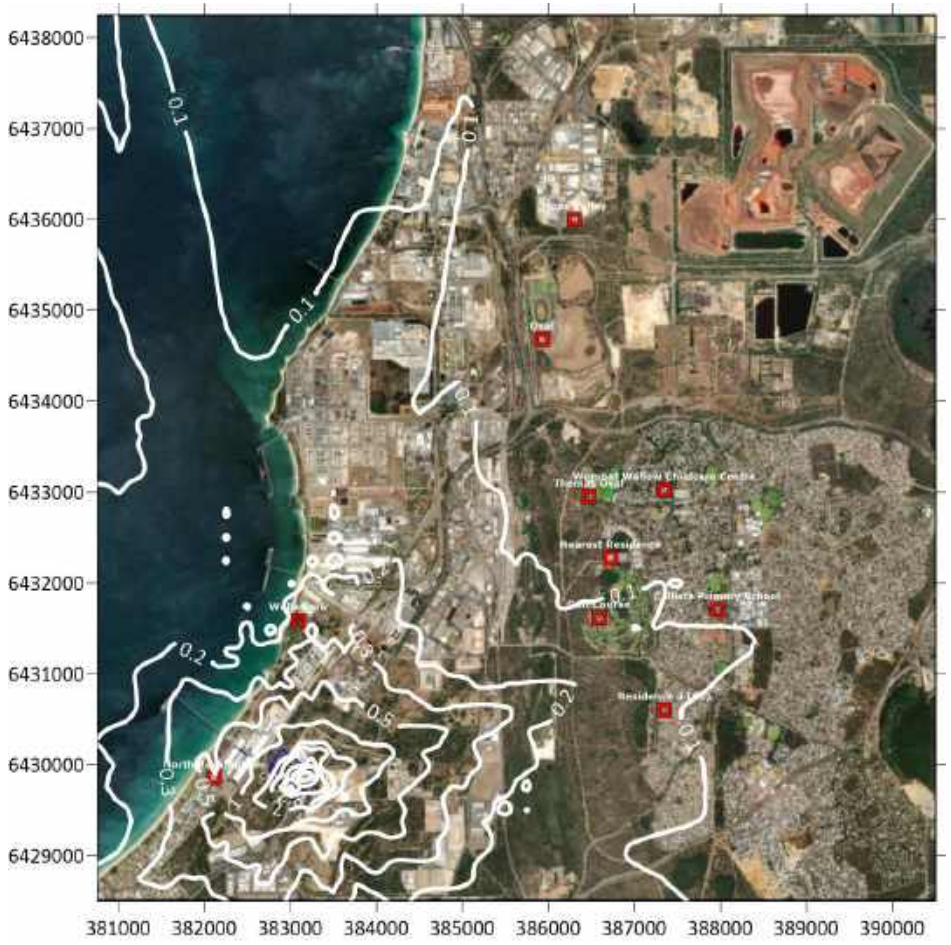
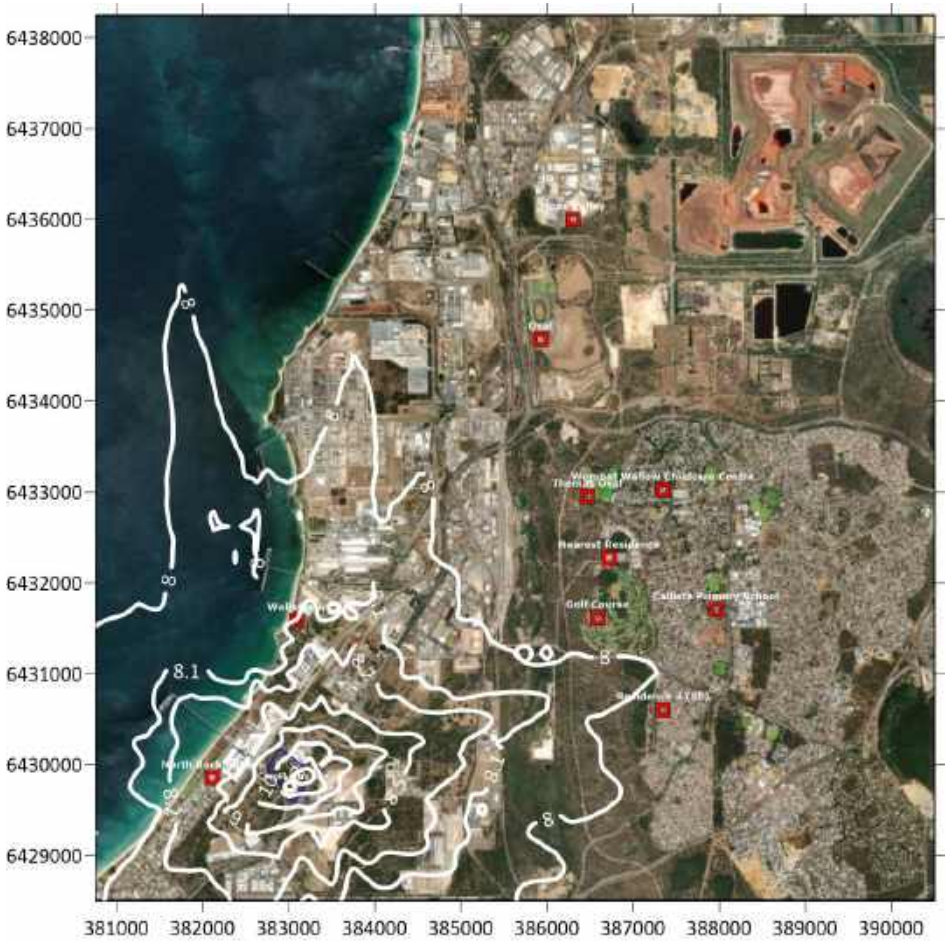
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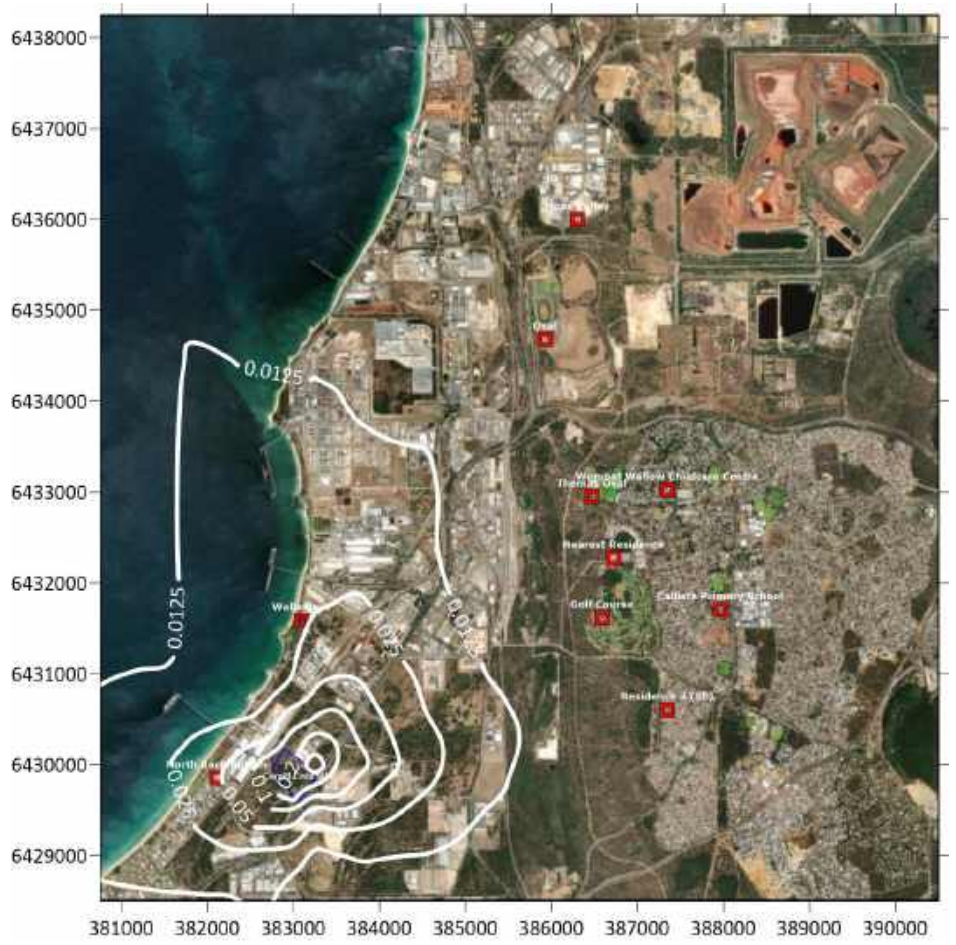
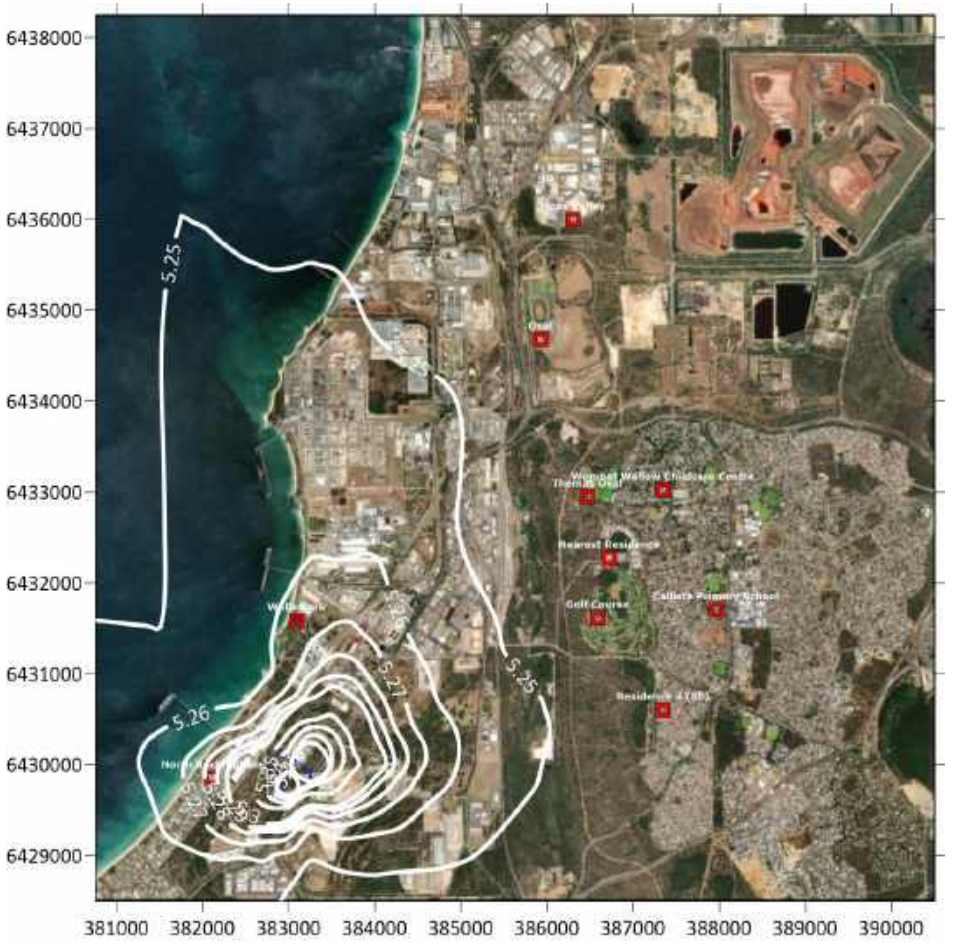


Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted SO_2 GLCs (µg/m^3)

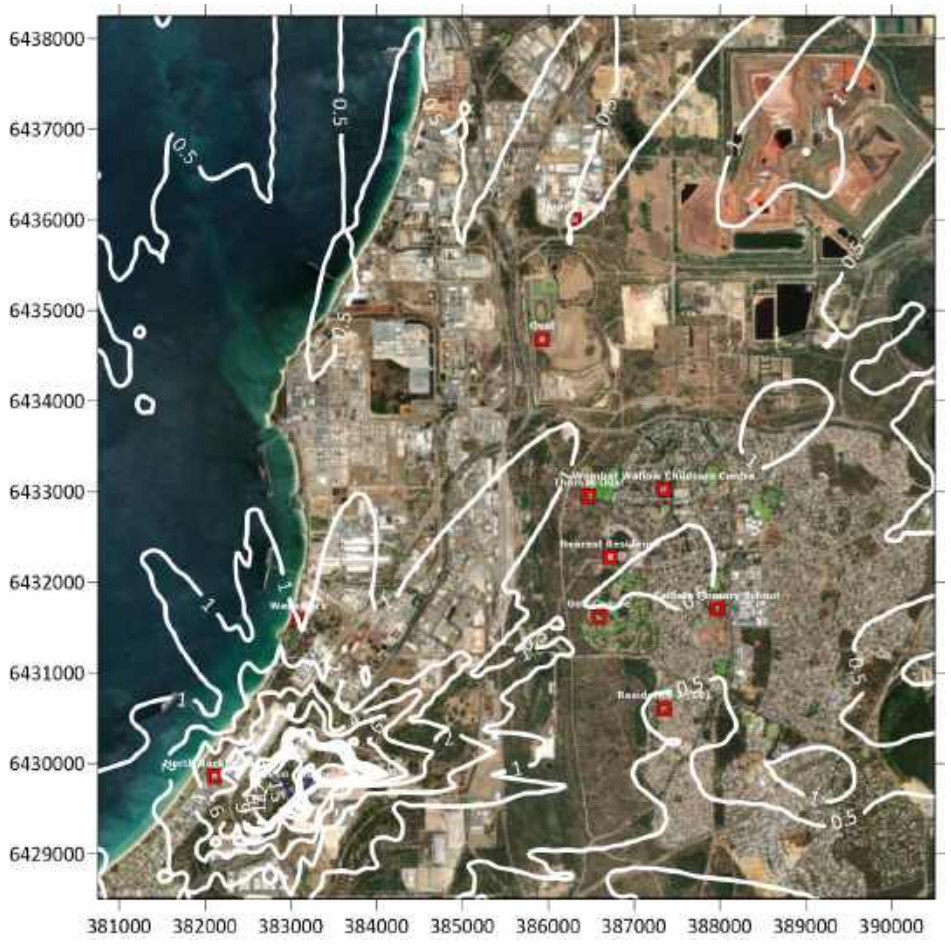
Date: July 2024

Figure 7

Isolation	Cumulative
	
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted SO_2 GLCs (µg/m^3)
Date: July 2024	Figure 8

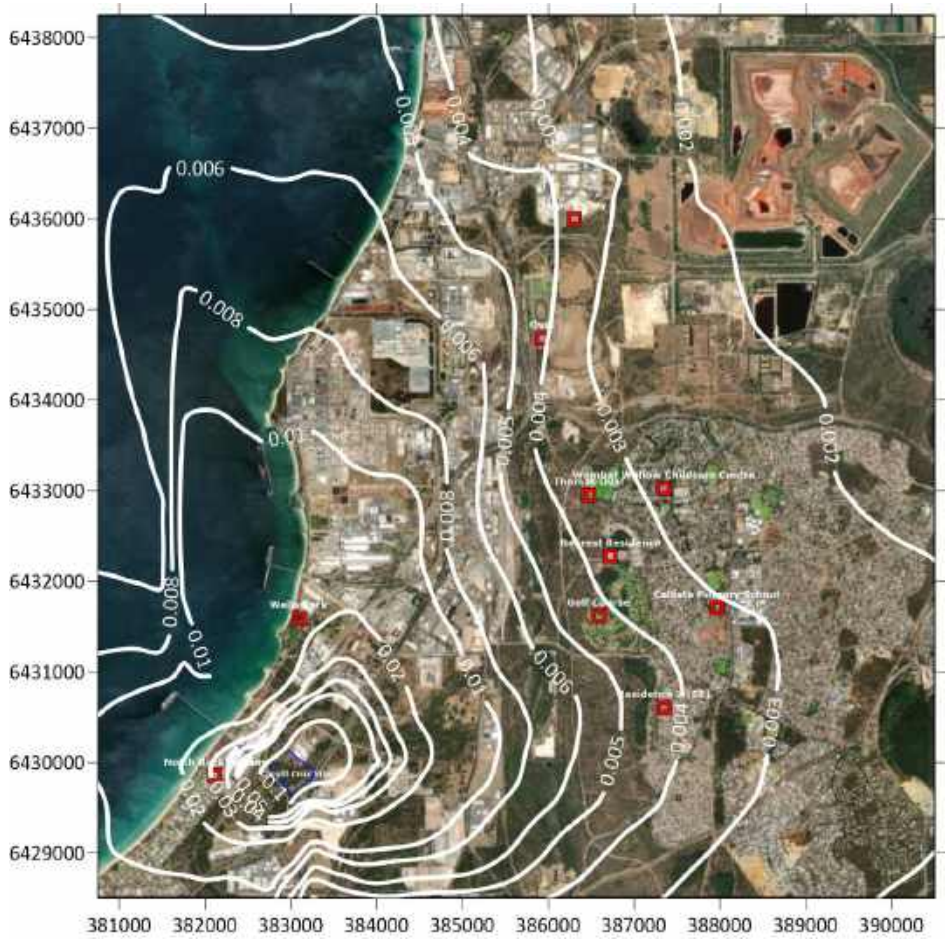
Isolation	Cumulative
	
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted SO_2 GLCs (µg/m^3)
Date: July 2024	Figure 9

Isolation



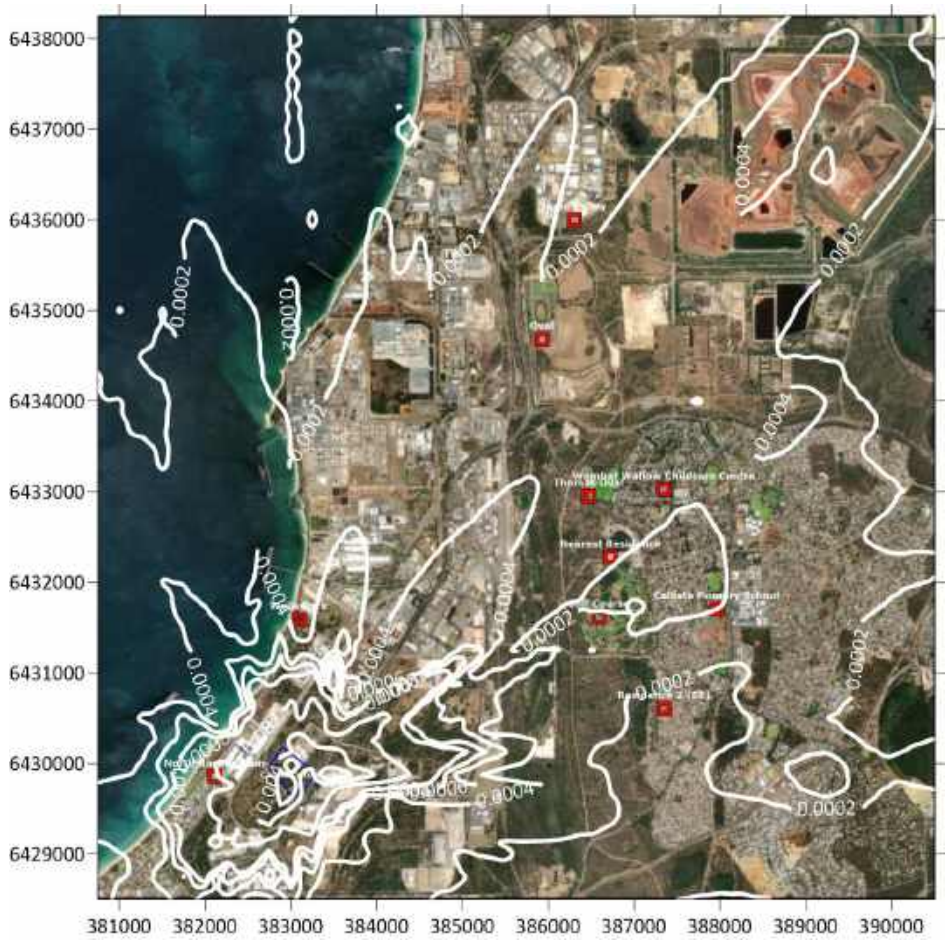
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted VOC (as Benzene) GLCs (µg/m^3)
Date: July 2024	Figure 10

Isolation



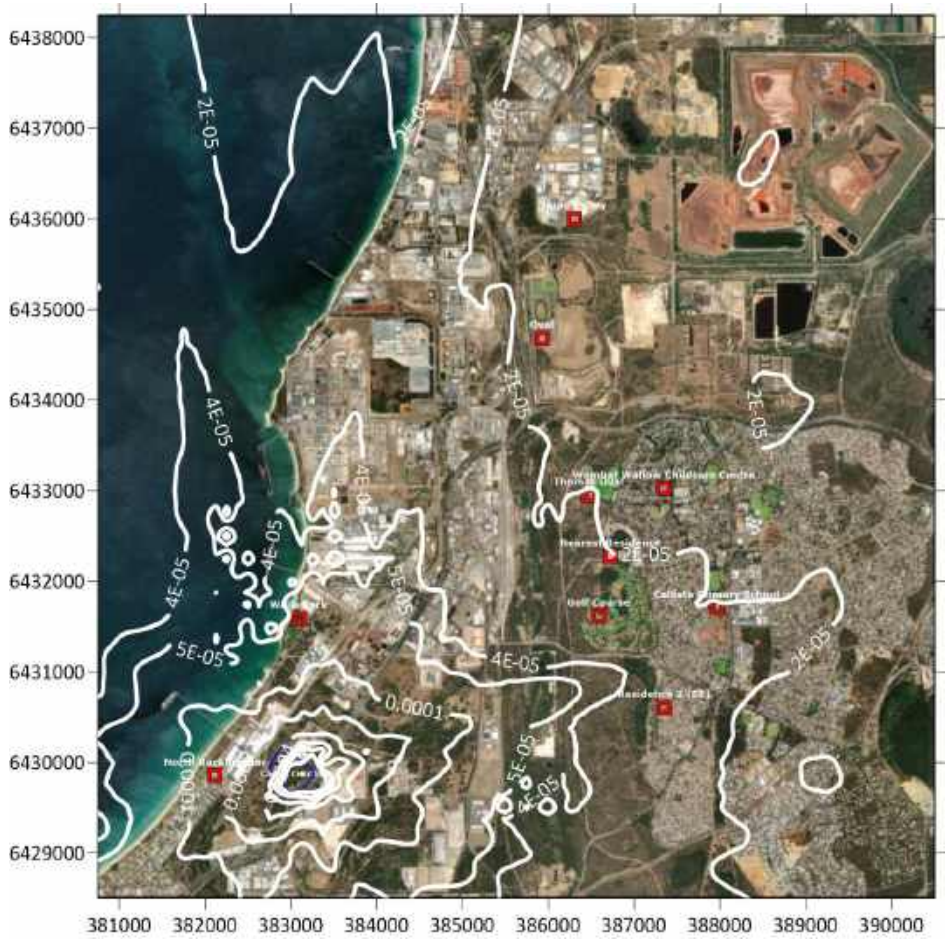
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted VOC (as Benzene) GLCs (µg/m^3)
Date: July 2024	Figure 11

Isolation



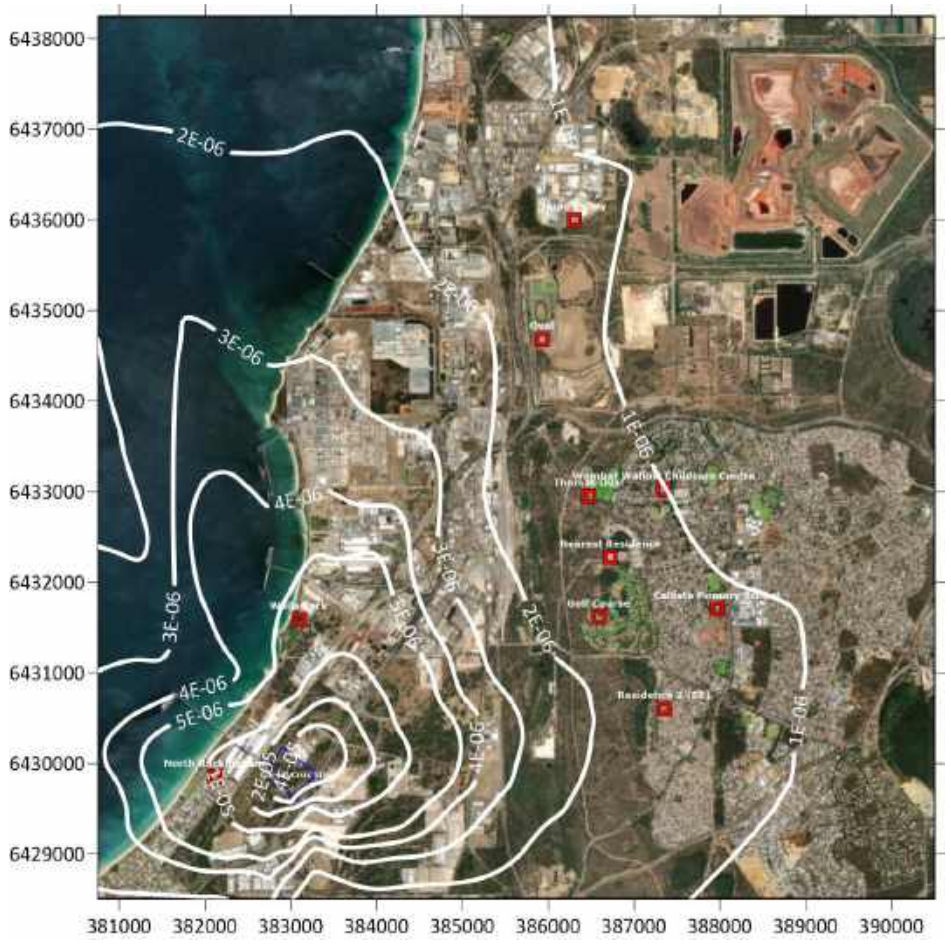
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted As GLCs (µg/m^3)
Date: July 2024	Figure 12

Isolation



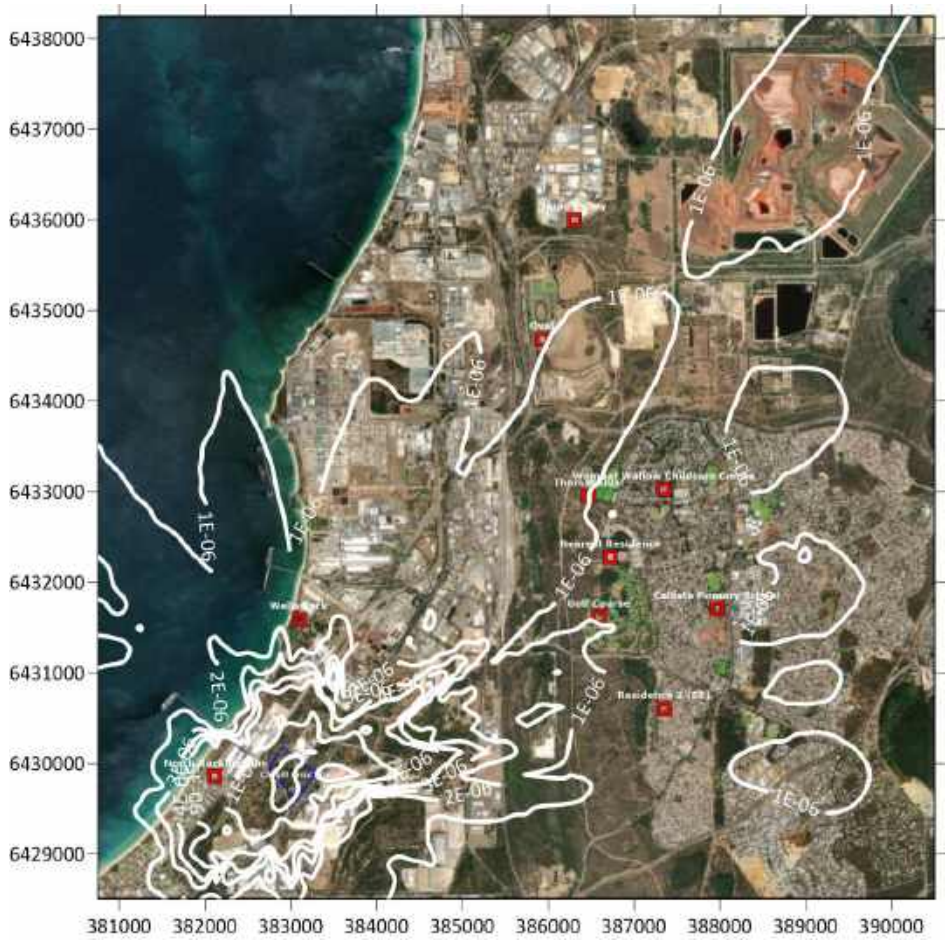
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted As GLCs (µg/m^3)
Date: July 2024	Figure 13

Isolation



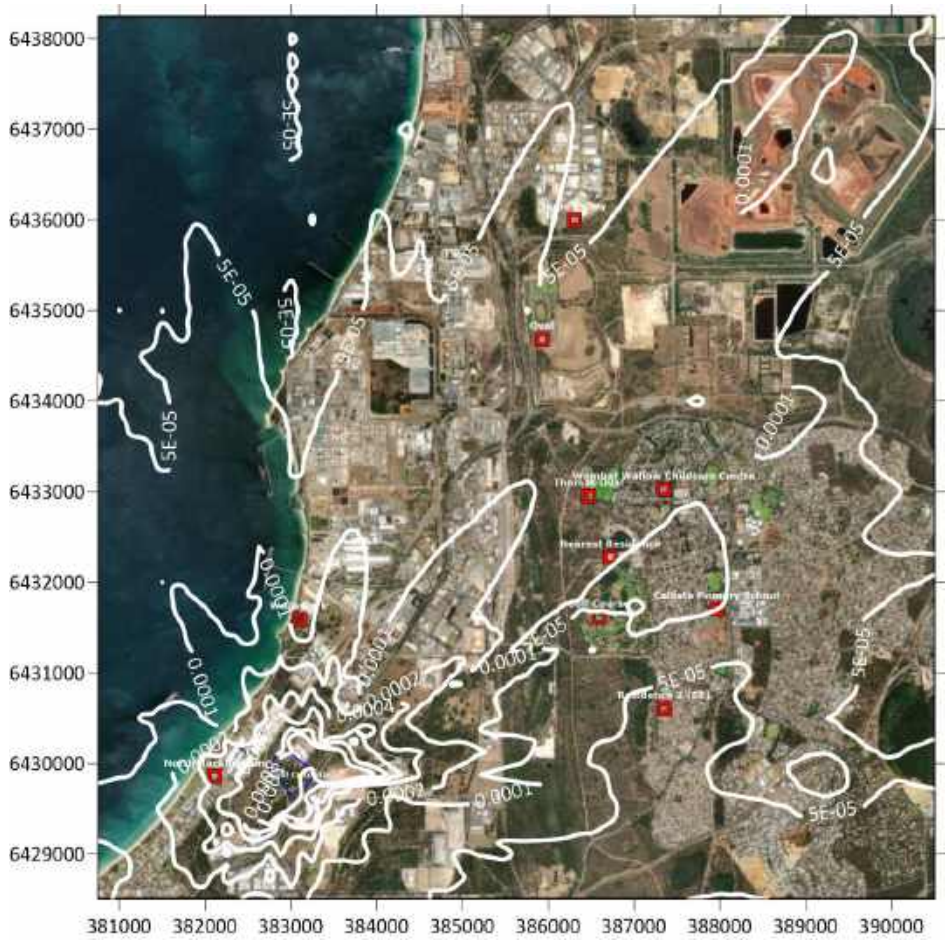
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted As GLCs (µg/m^3)
Date: July 2024	Figure 14

Isolation



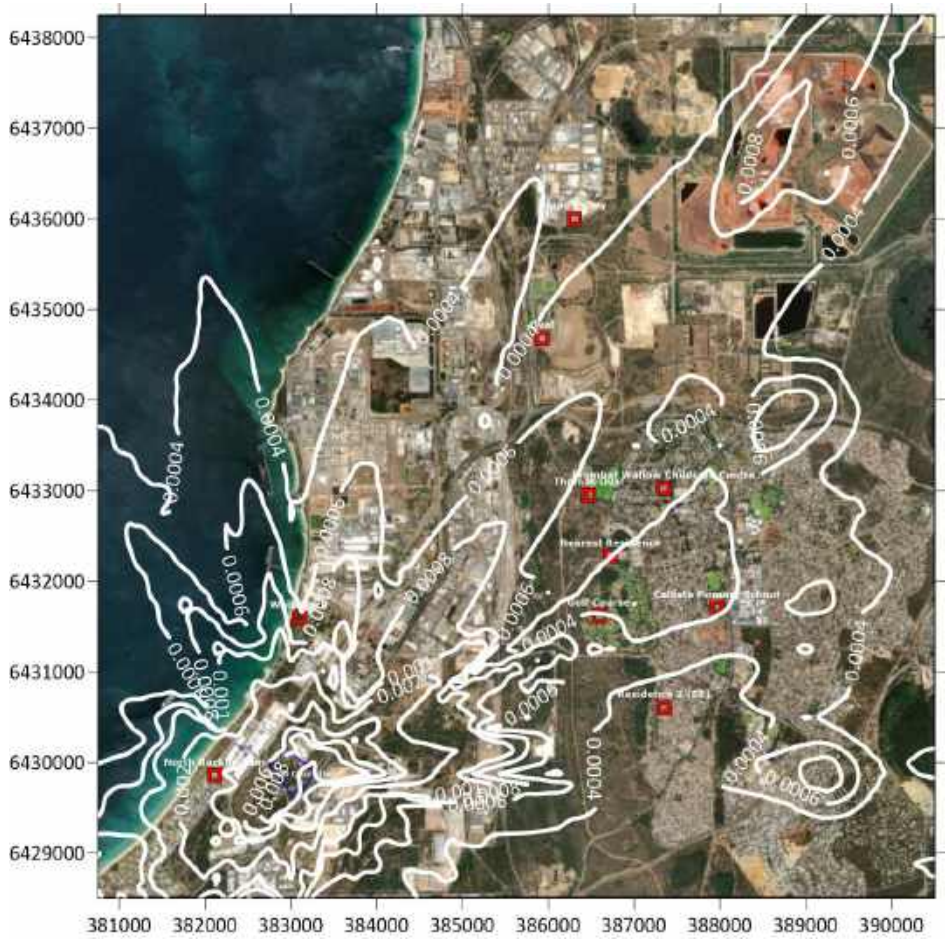
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Be GLCs (µg/m^3)
Date: July 2024	Figure 15

Isolation



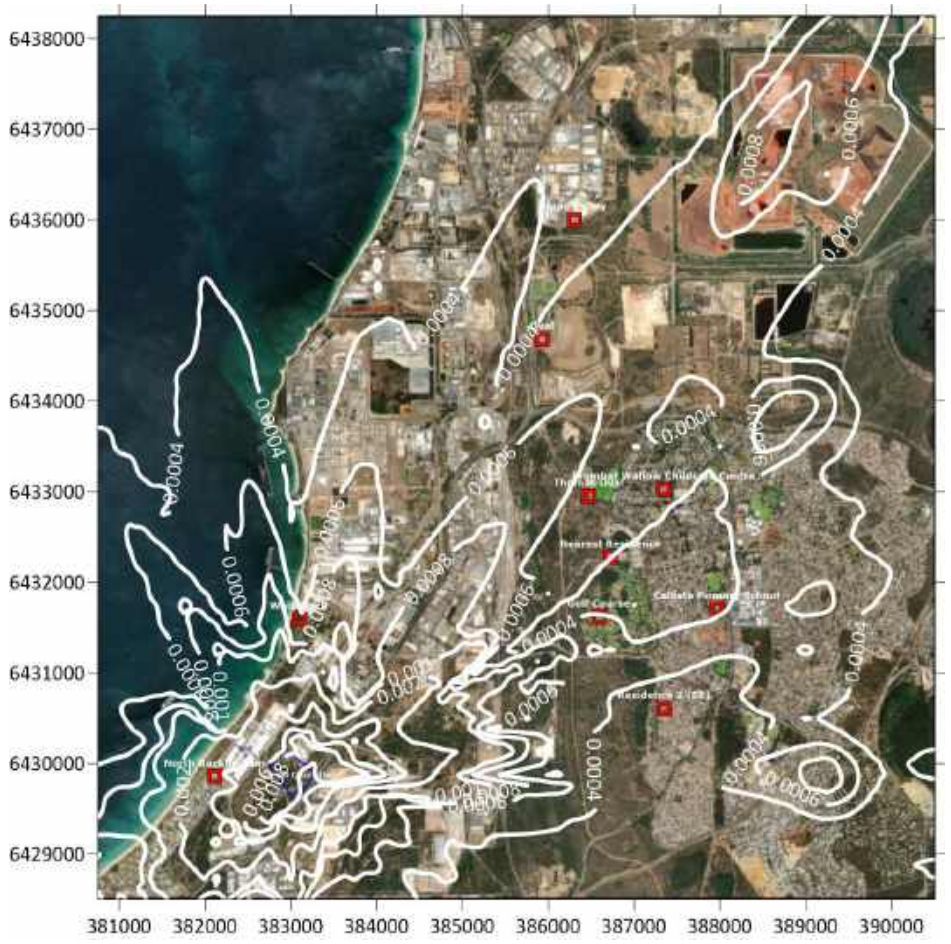
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Cd GLCs (µg/m^3)
Date: July 2024	Figure 16

Isolation



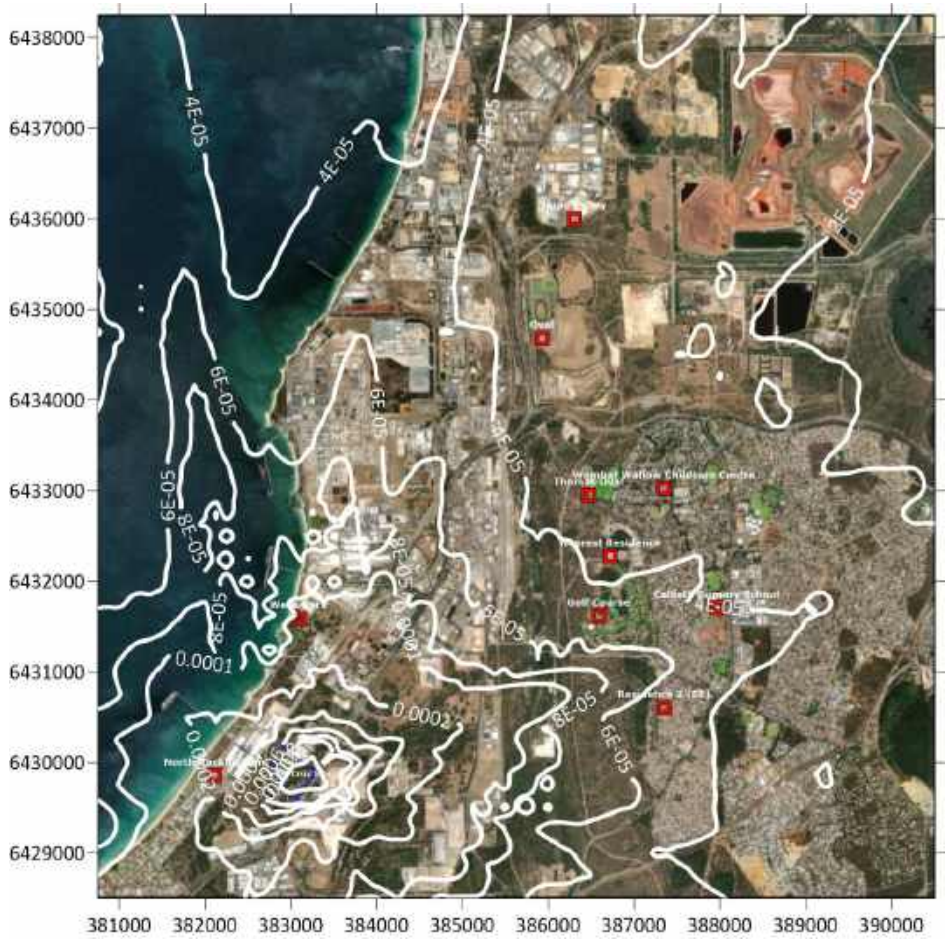
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Cr-III GLCs (µg/m^3)
Date: July 2024	Figure 17

Isolation



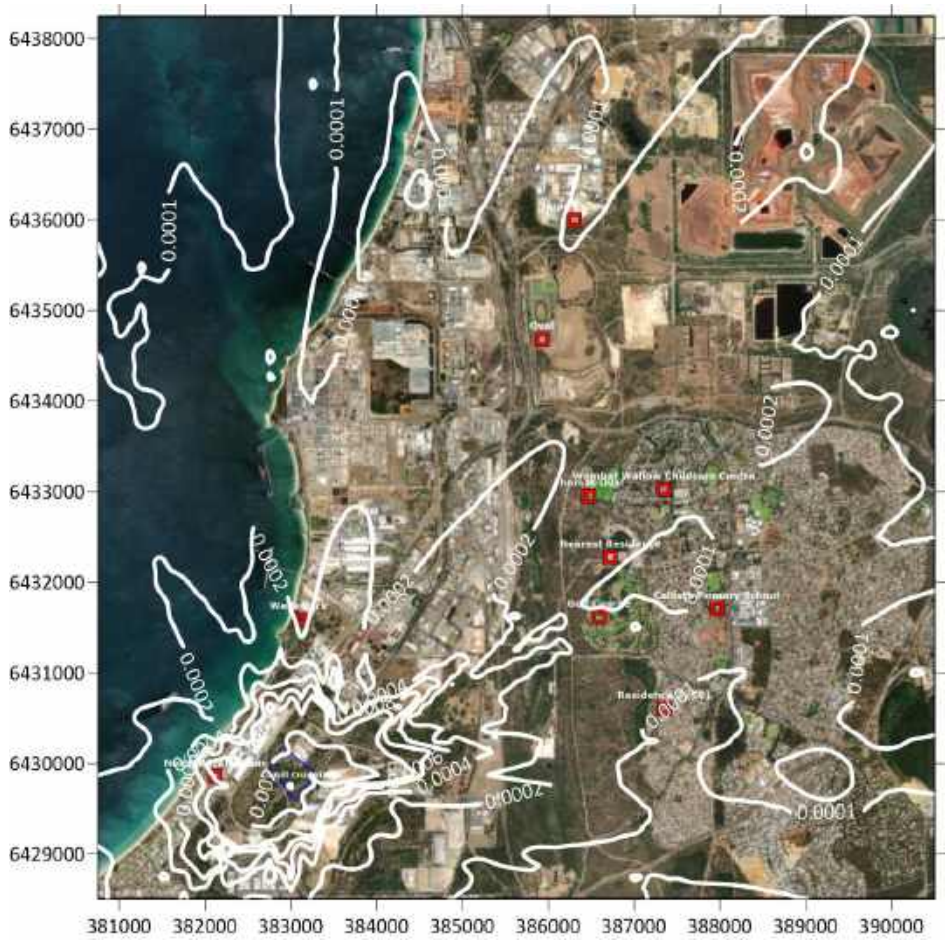
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Cr-III GLCs (µg/m^3)
Date: July 2024	Figure 18

Isolation



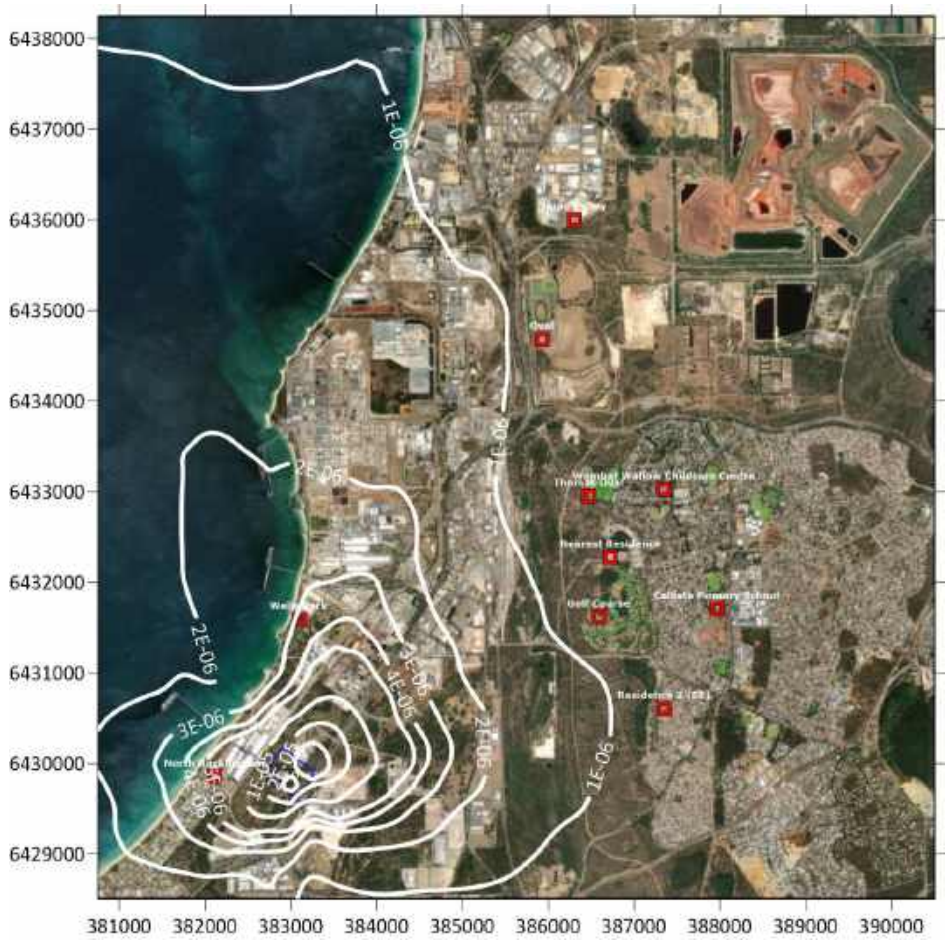
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted Cr-III GLCs (µg/m^3)
Date: July 2024	Figure 19

Isolation



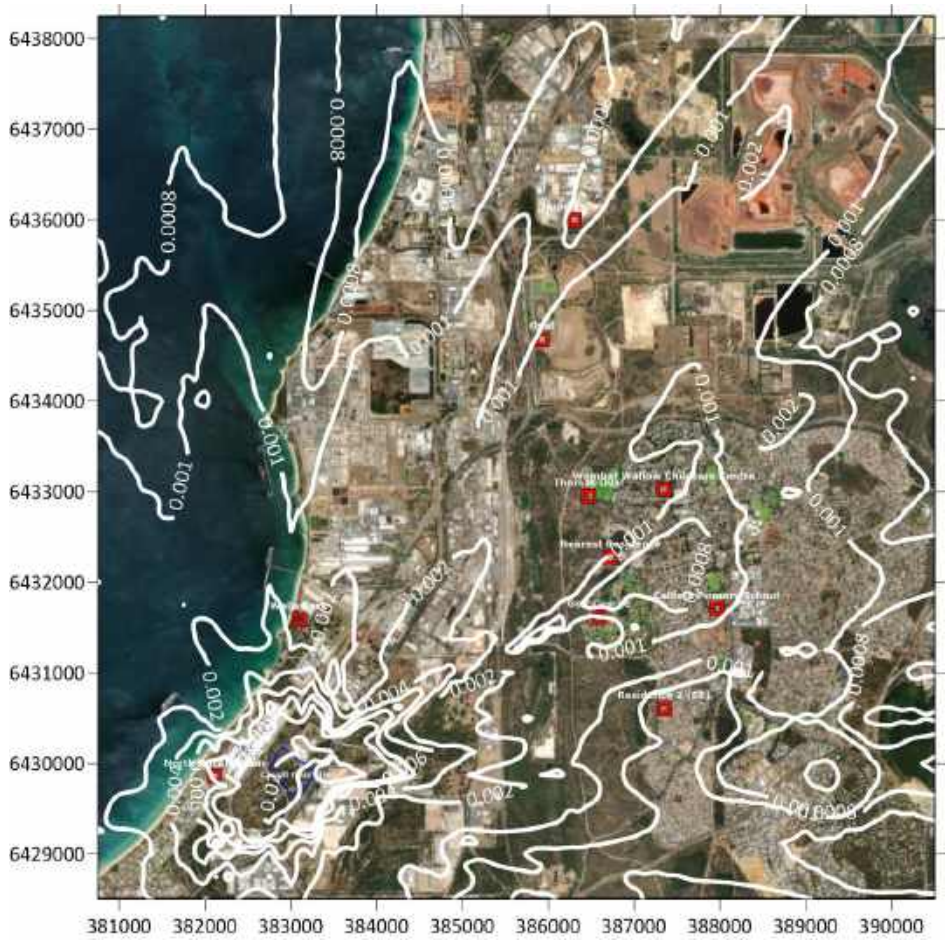
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Cr-VI GLCs (µg/m^3)
Date: July 2024	Figure 20

Isolation



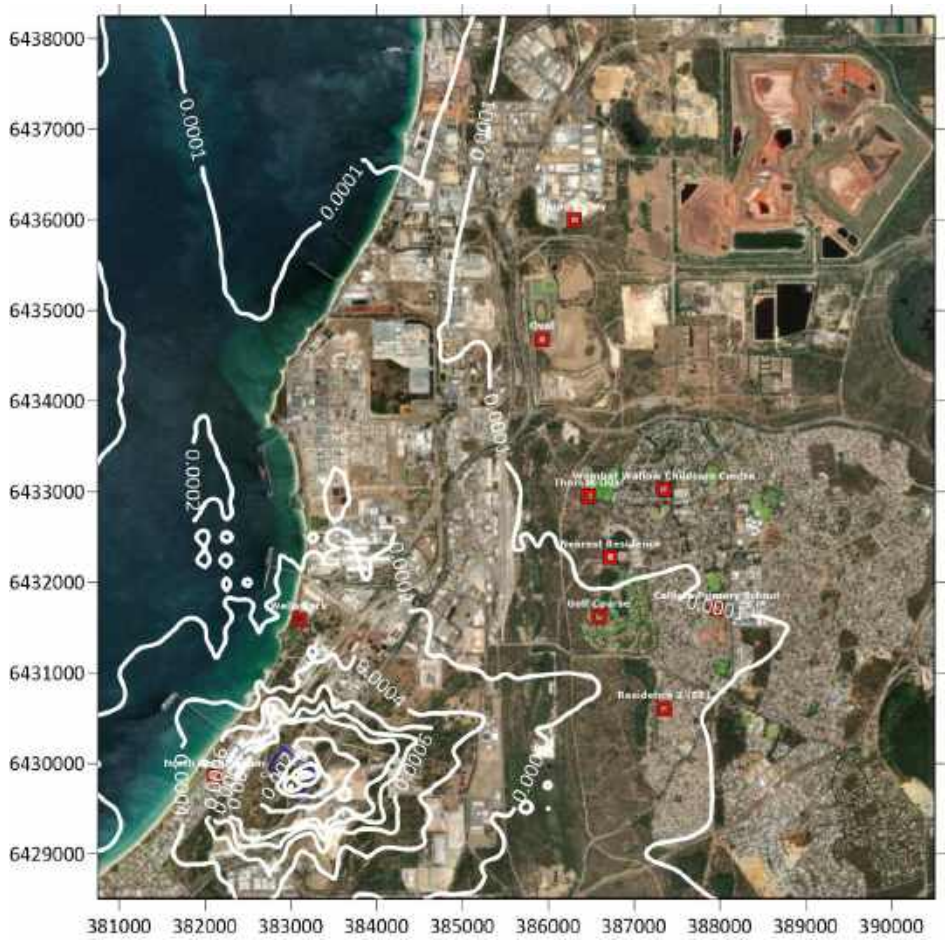
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted Cr-VI GLCs (µg/m^3)
Date: July 2024	Figure 21

Isolation



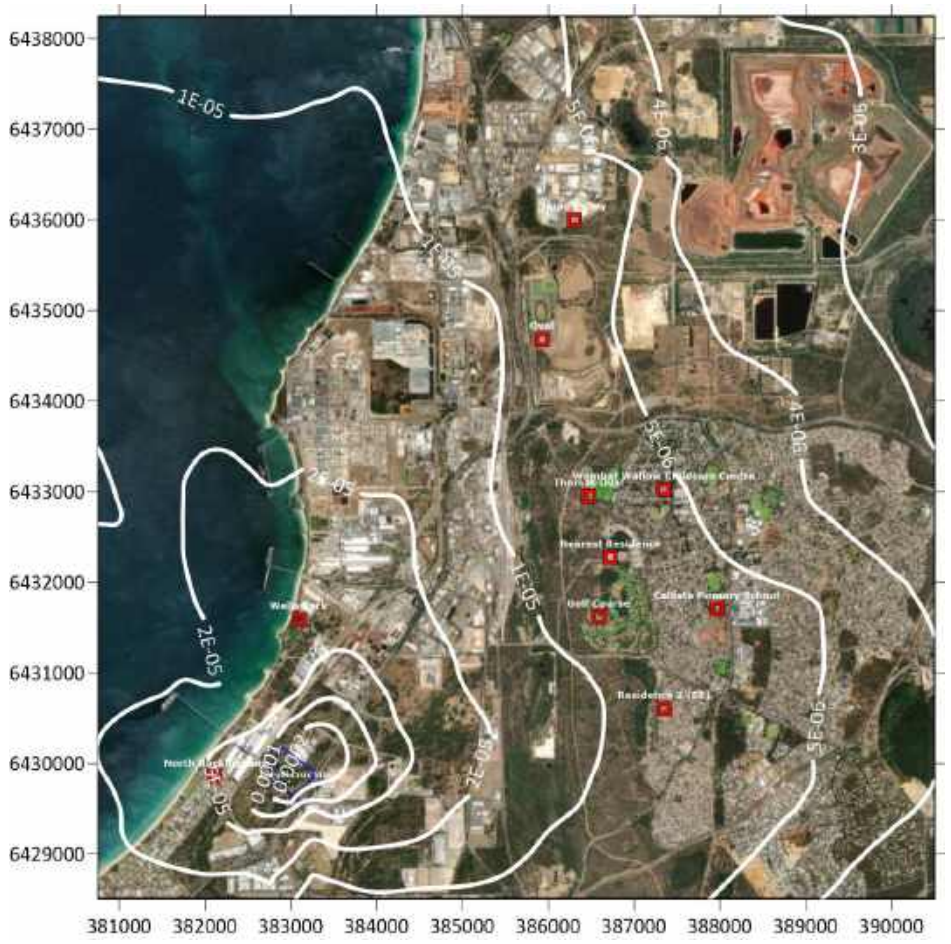
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Cu GLCs (µg/m^3)
Date: July 2024	Figure 22

Isolation



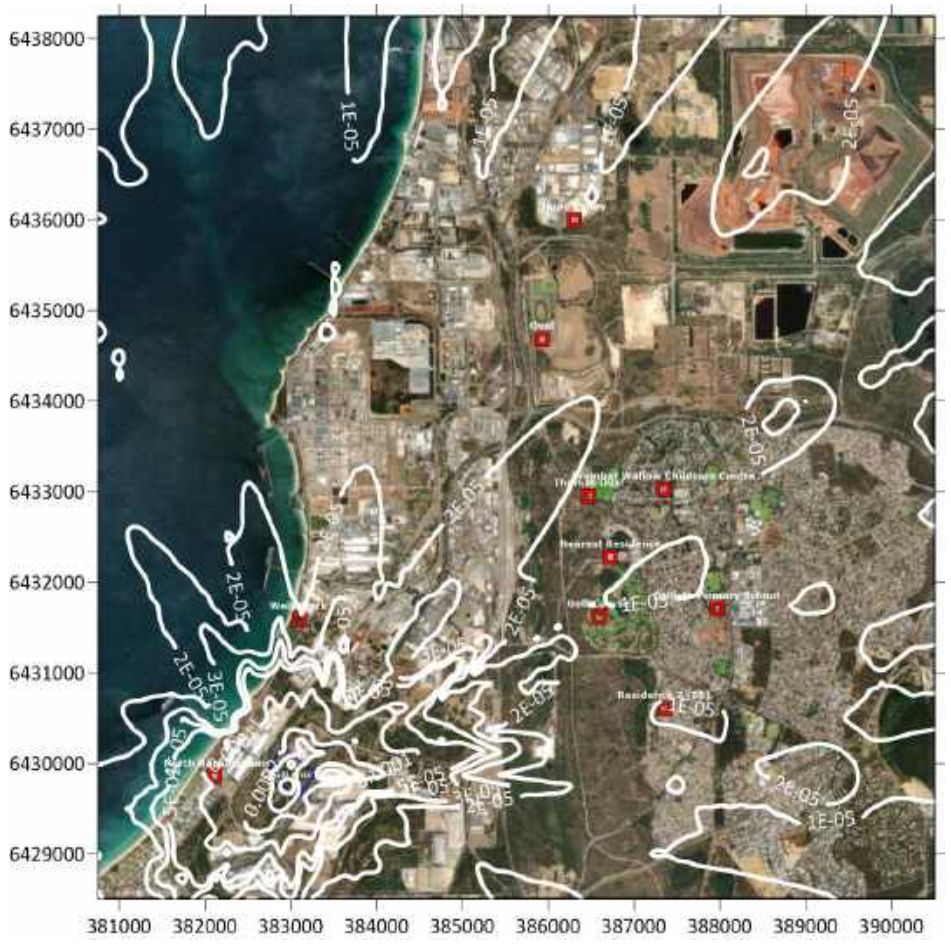
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted Cu GLCs (µg/m^3)
Date: July 2024	Figure 23

Isolation



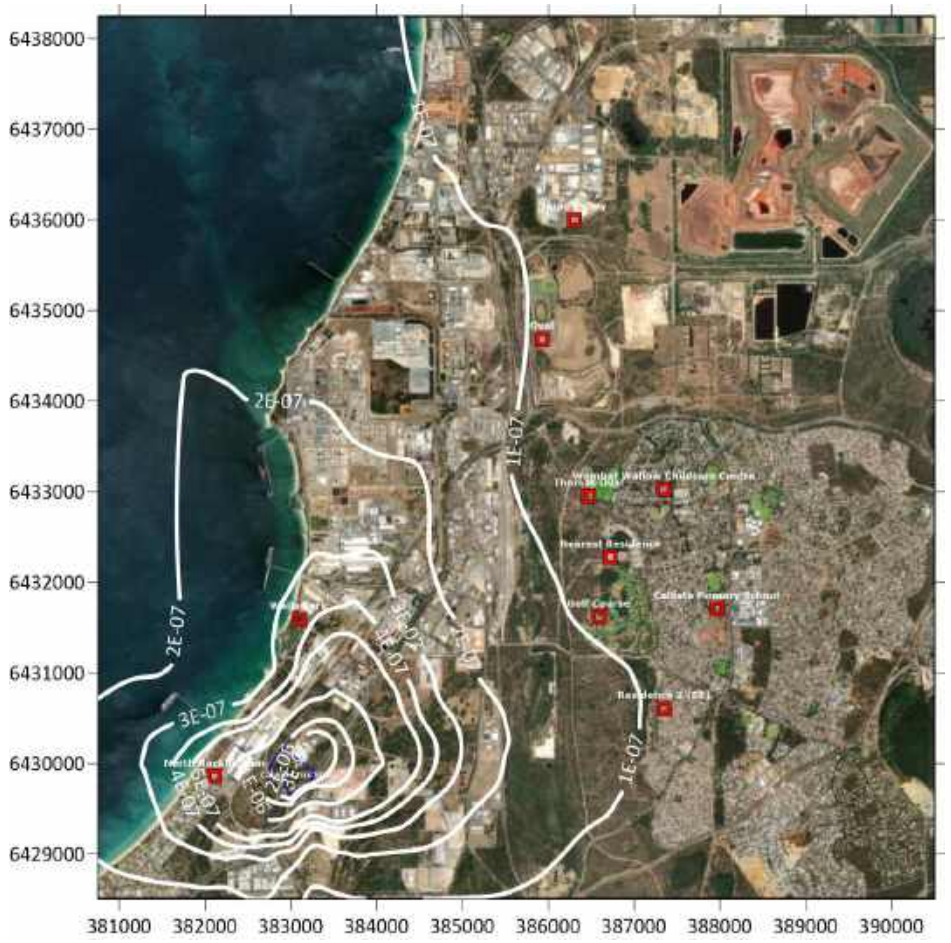
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted Pb GLCs (µg/m^3)
Date: July 2024	Figure 24

Isolation



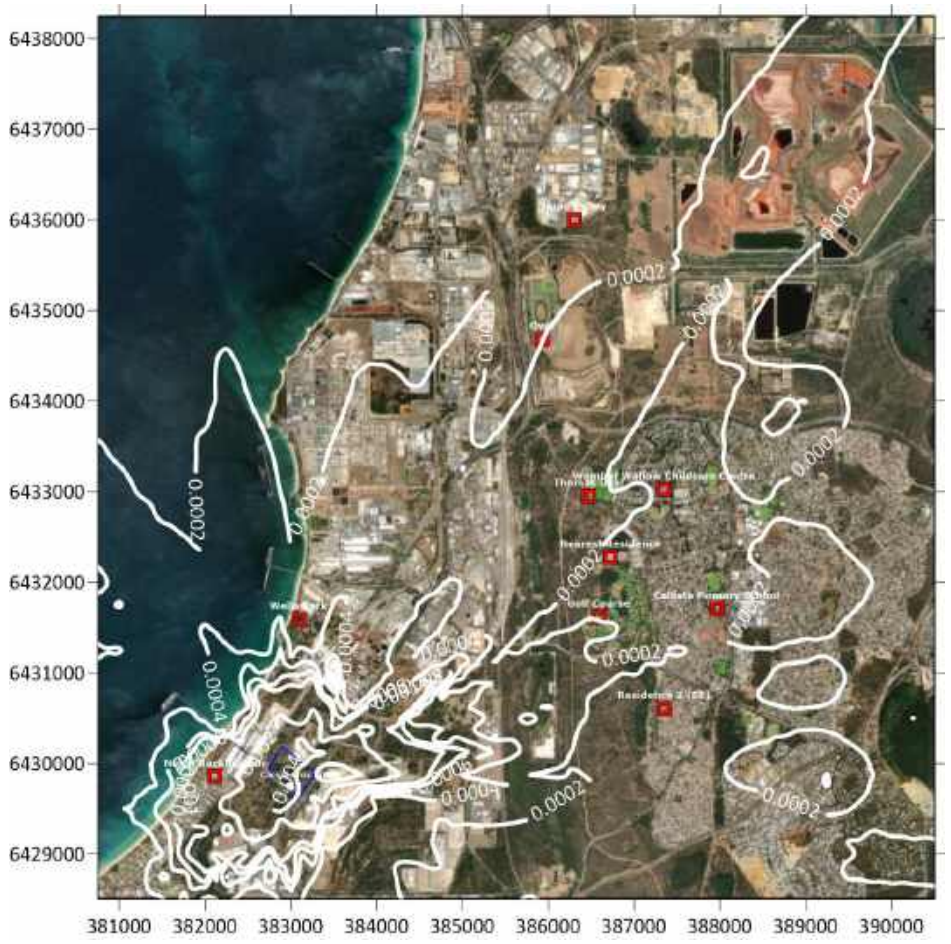
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Hg GLCs (µg/m^3)
Date: July 2024	Figure 25

Isolation



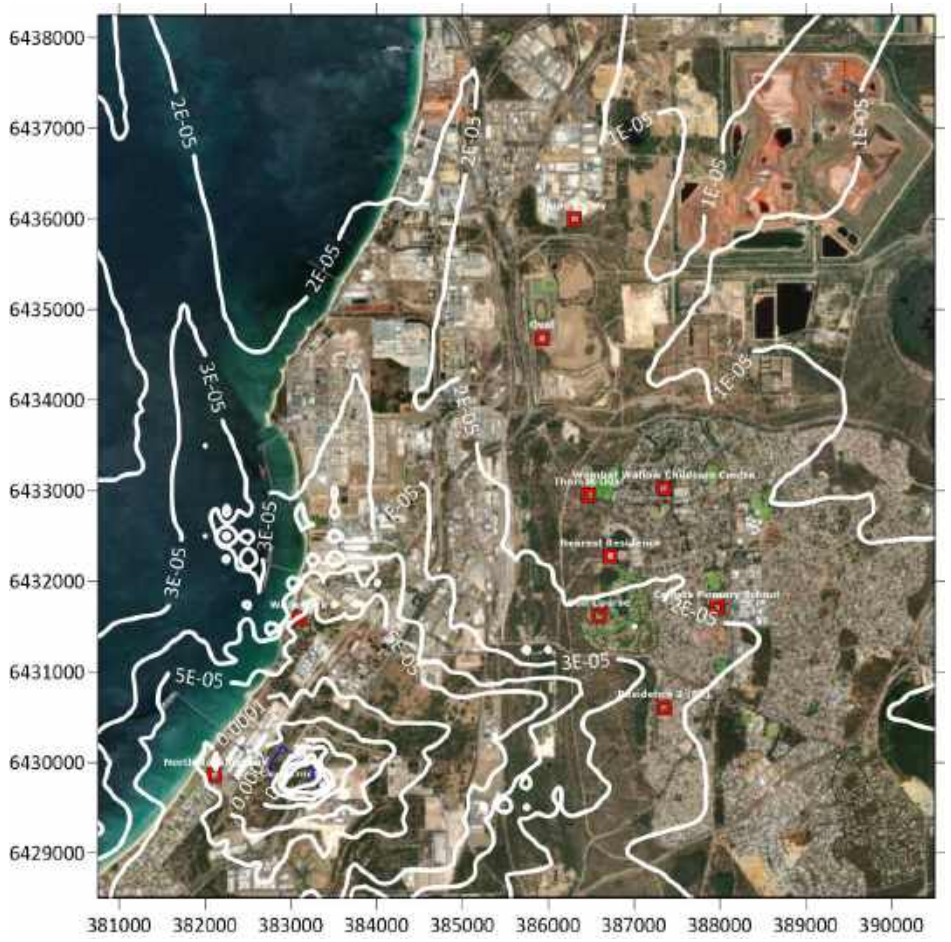
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted Hg GLCs (µg/m^3)
Date: July 2024	Figure 26

Isolation



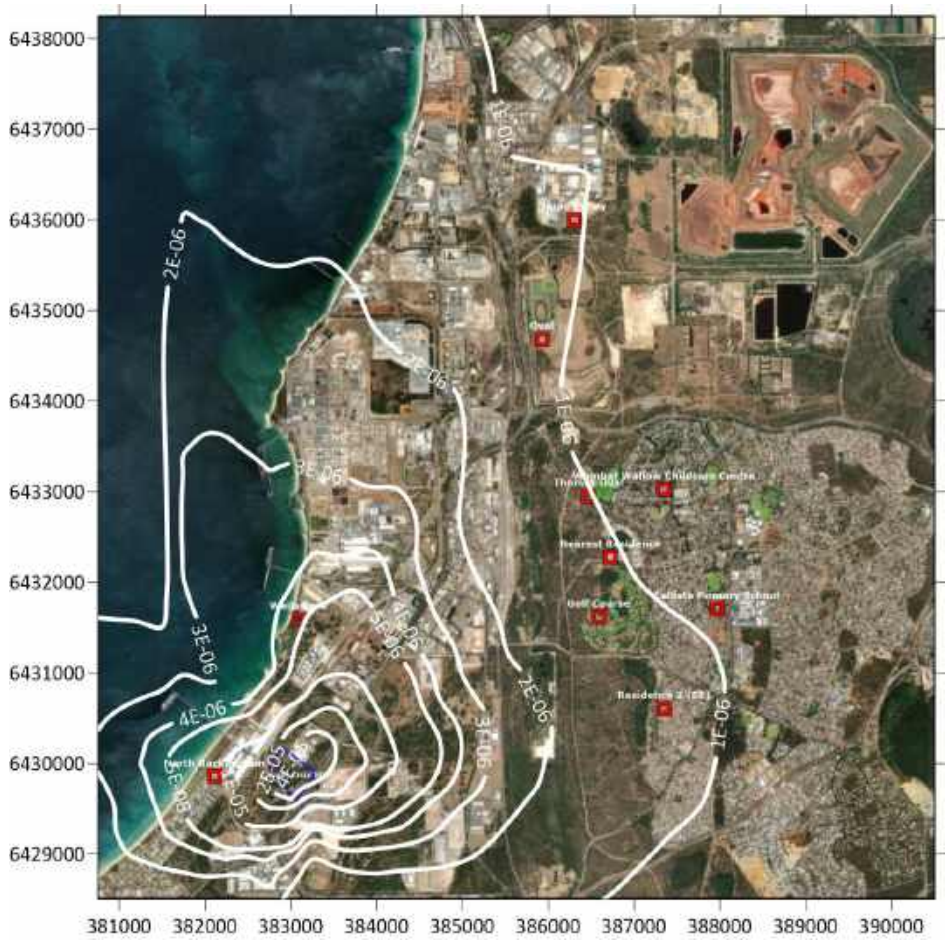
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 1-hour Average Predicted Ni GLCs (µg/m^3)
Date: July 2024	Figure 27

Isolation



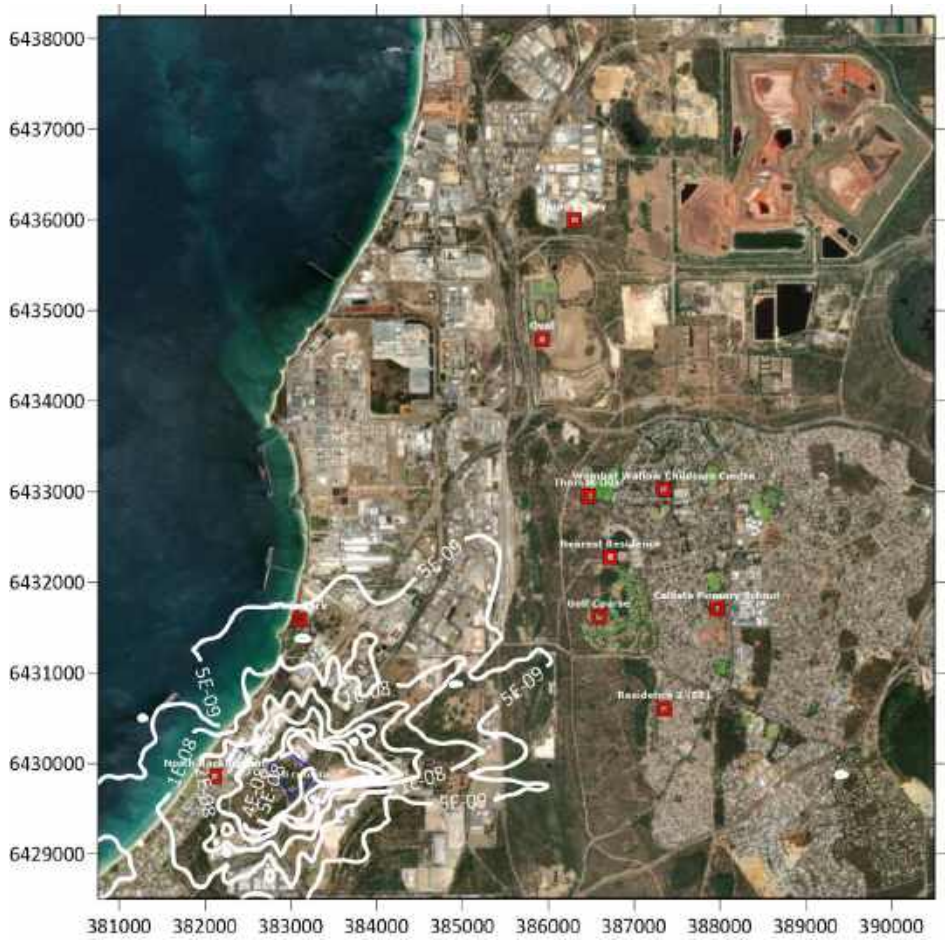
	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Maximum 24-hour Average Predicted Ni GLCs (µg/m^3)
Date: July 2024	Figure 28

Isolation

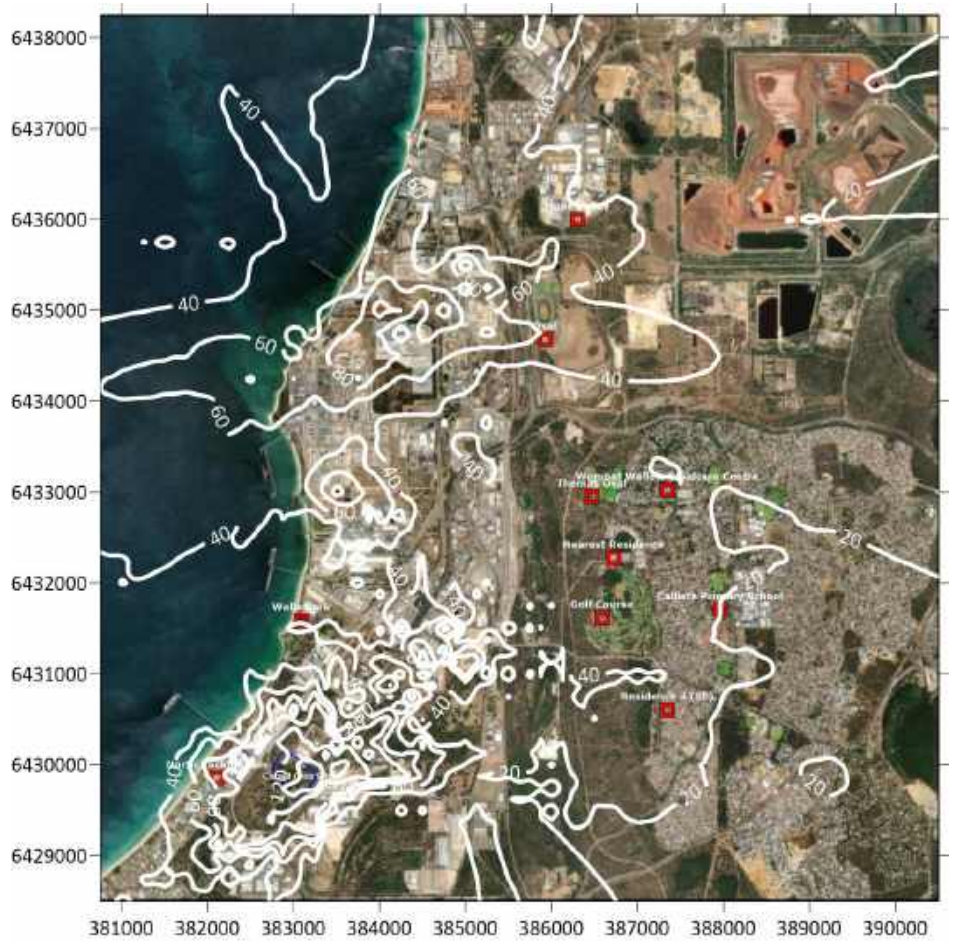


	Scenario #1 (Biomass Boiler Emissions) &#2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted Ni GLCs (µg/m^3)
Date: July 2024	Figure 29

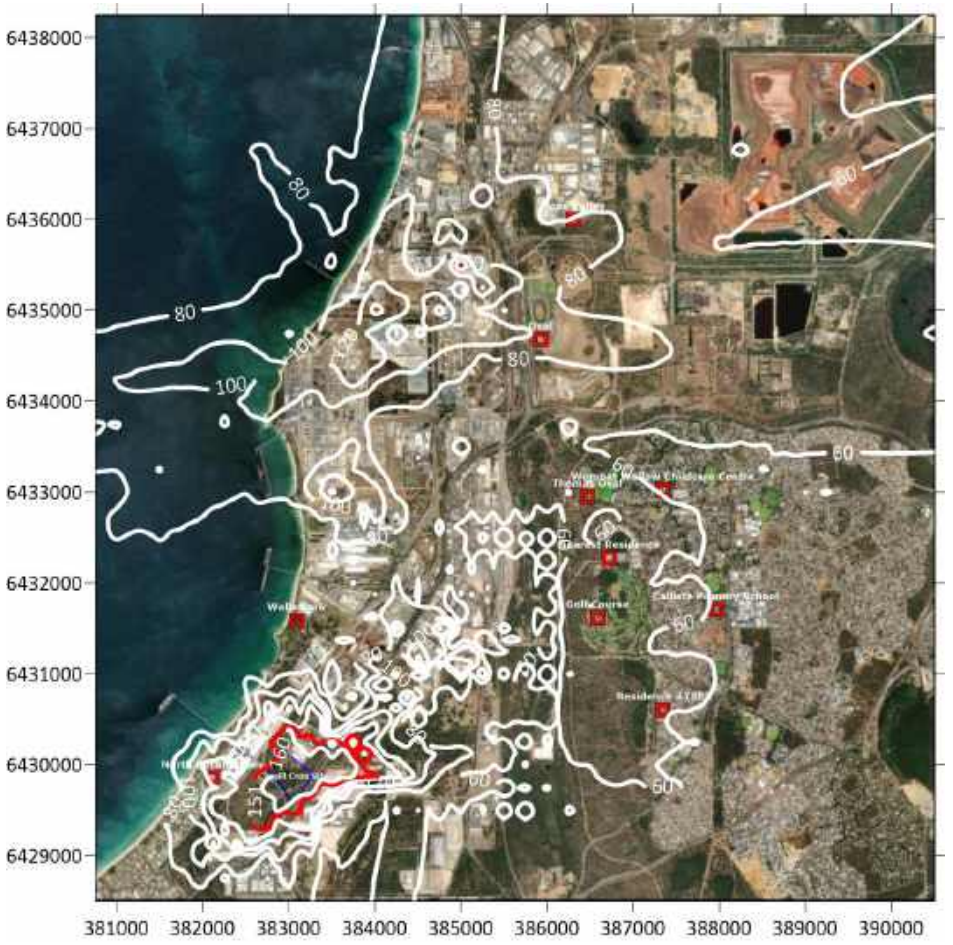
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Isolation



Cumulative

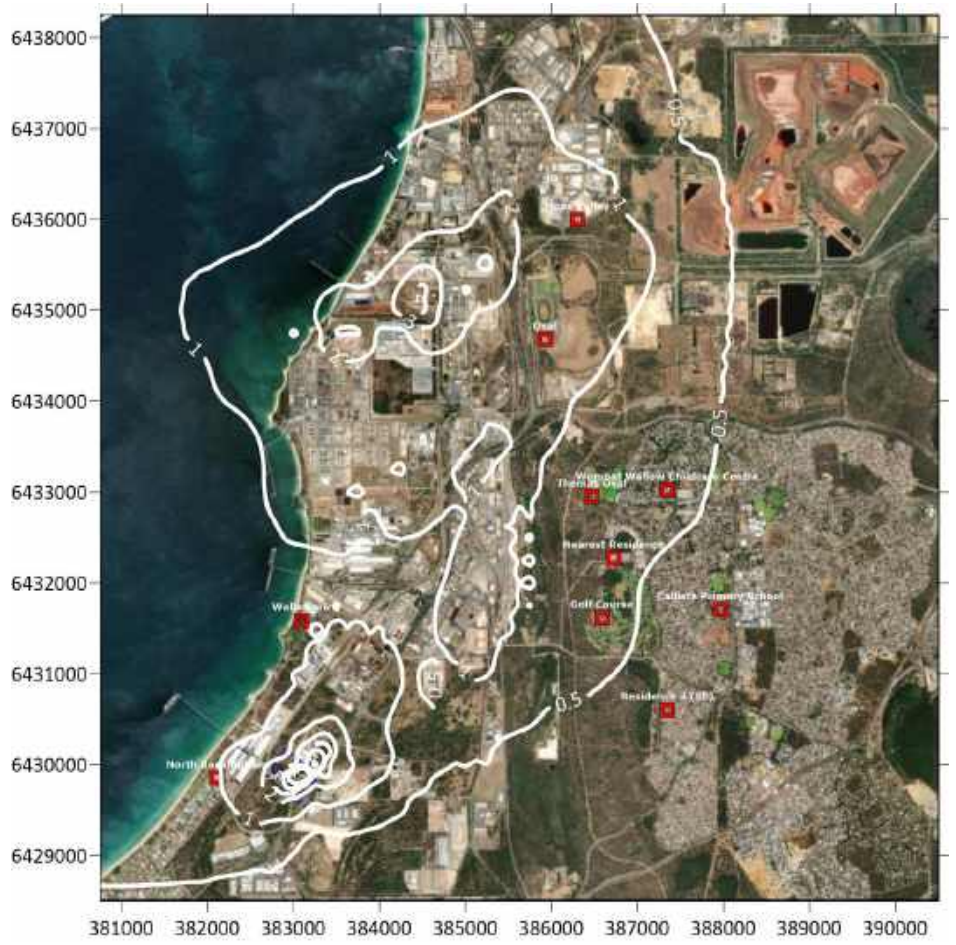


Scenario #2 (Biomass Boiler Emissions with Future KIA Sources):
Maximum 1-hour Average Predicted NO_2 GLCs ($\mu g/m^3$)

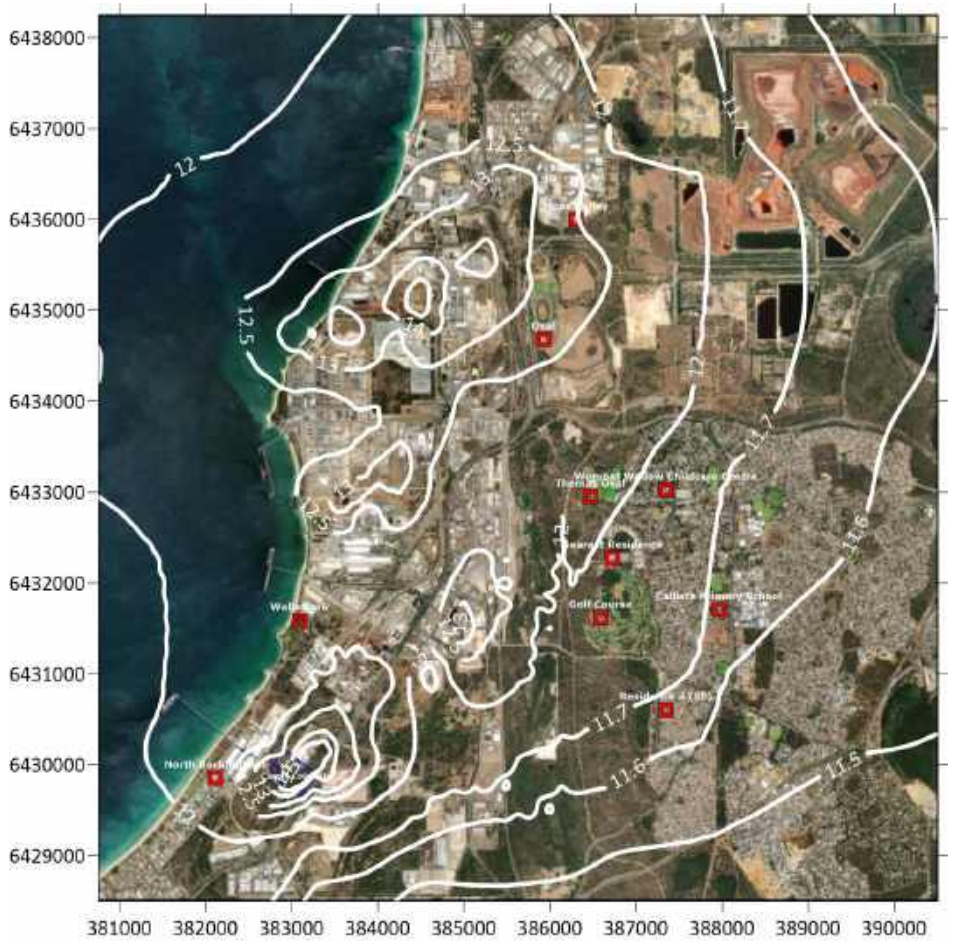
Date: July 2024

Figure 31

Isolation



Cumulative

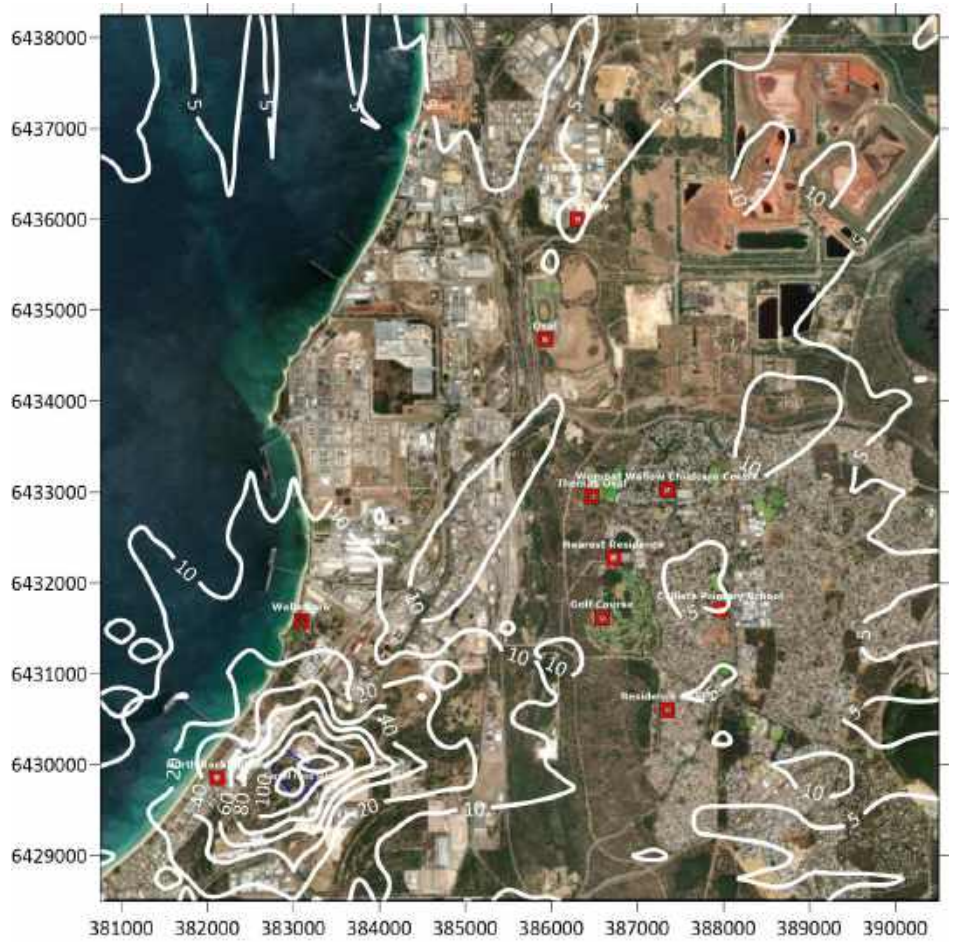


Scenario #2 (Biomass Boiler Emissions with Future KIA Sources): Annual Average Predicted NO_2 GLCs (µg/m^3)

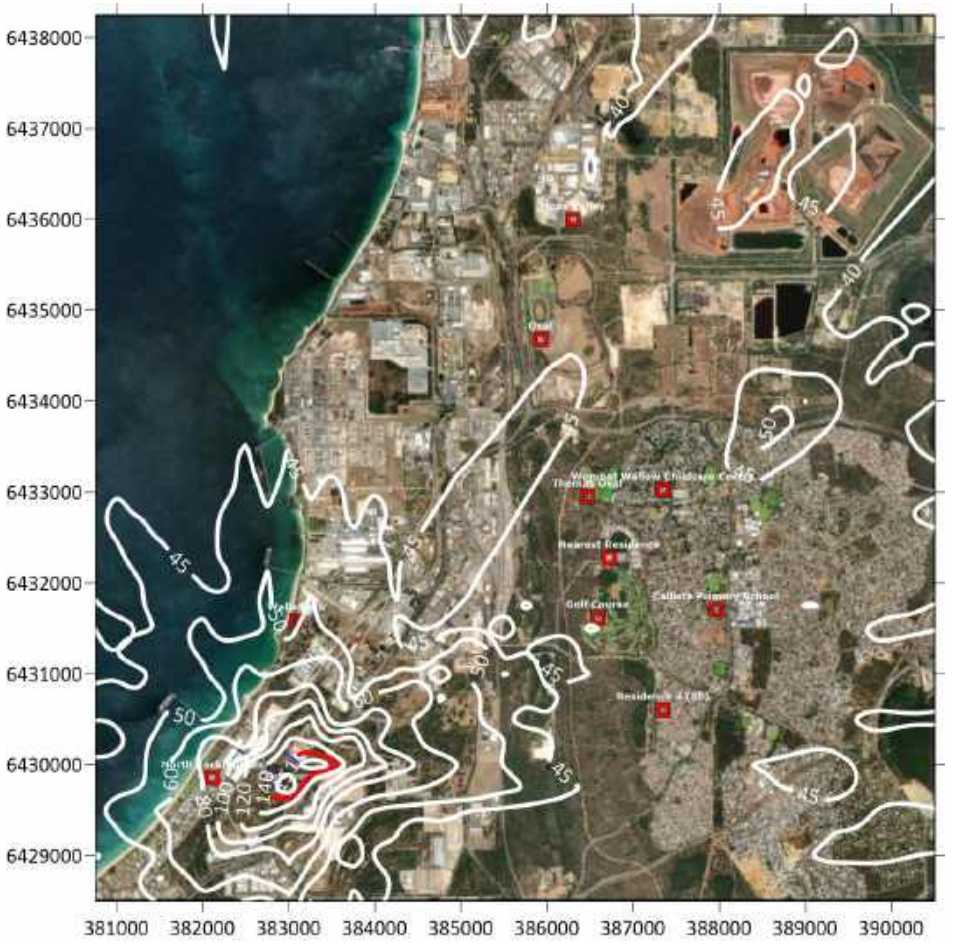
Date: July 2024

Figure 32

Isolation



Cumulative

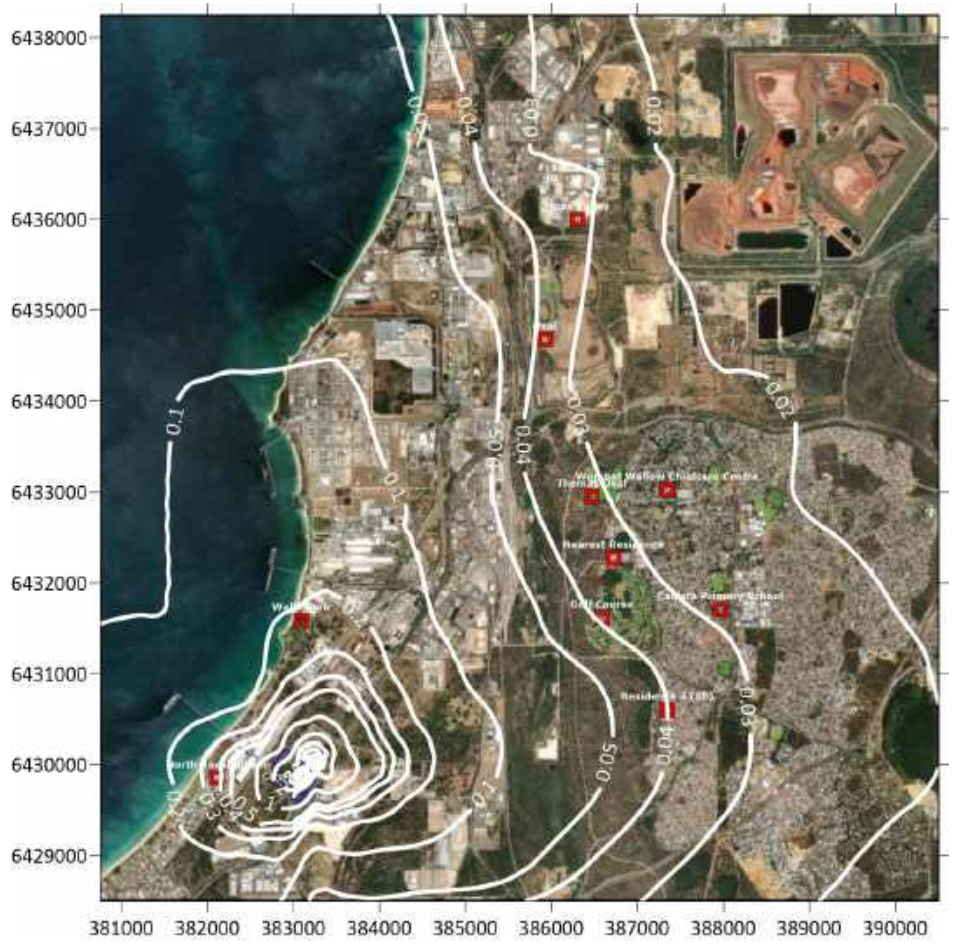


Scenario #3 (Gas Boiler Emissions):
Maximum 1-hour Average Predicted NO_2 GLCs ($\mu g/m^3$)

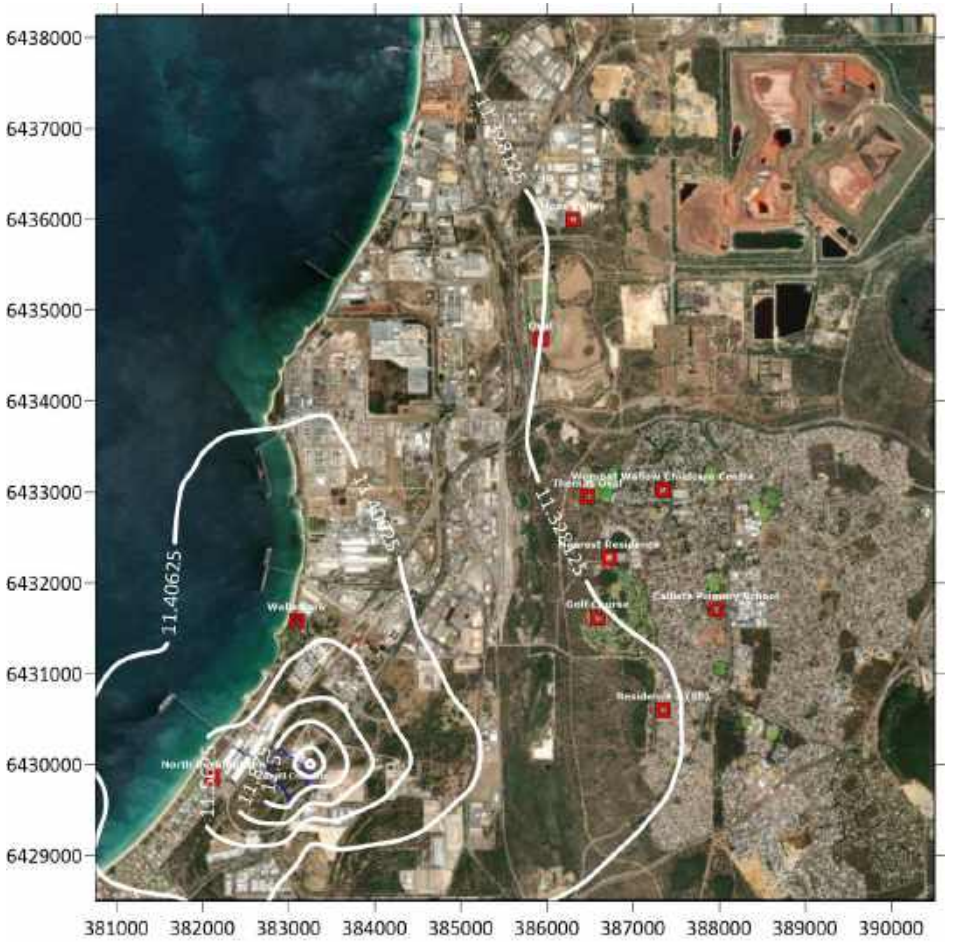
Date: July 2024

Figure 33

Isolation



Cumulative

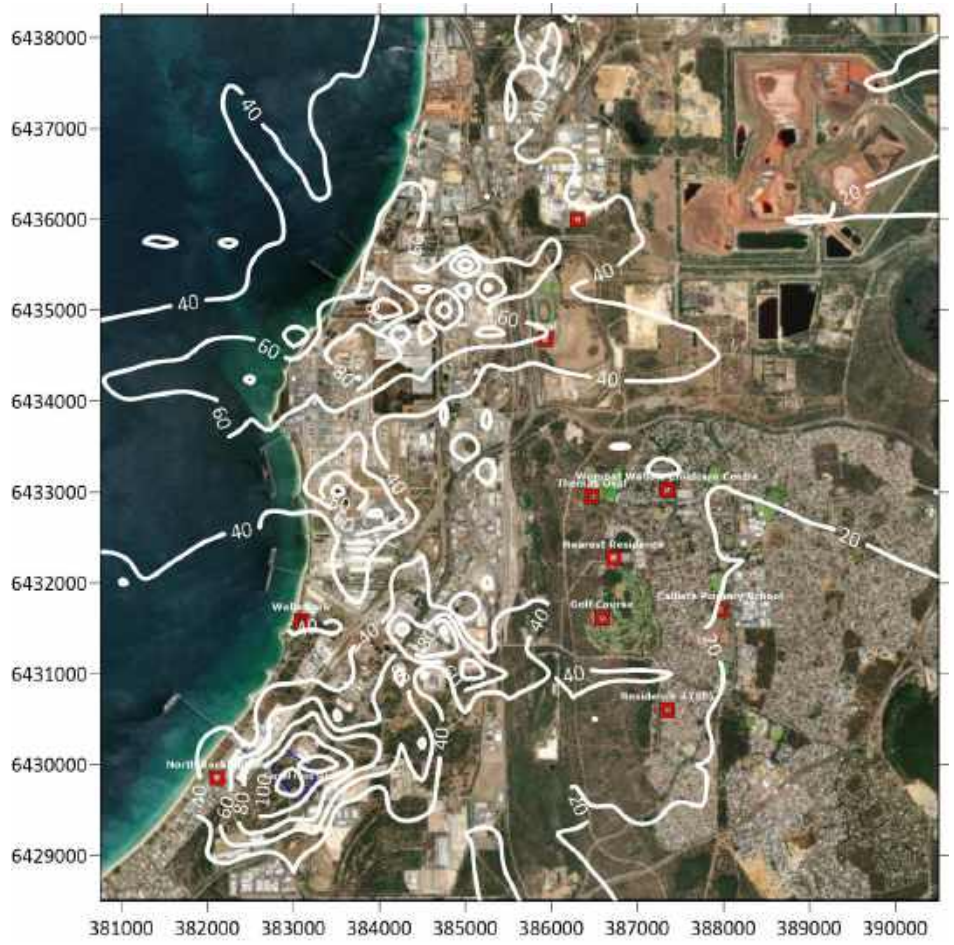


Scenario #3 (Gas Boiler Emissions):
Annual Average Predicted NO_2 GLCs (µg/m^3)

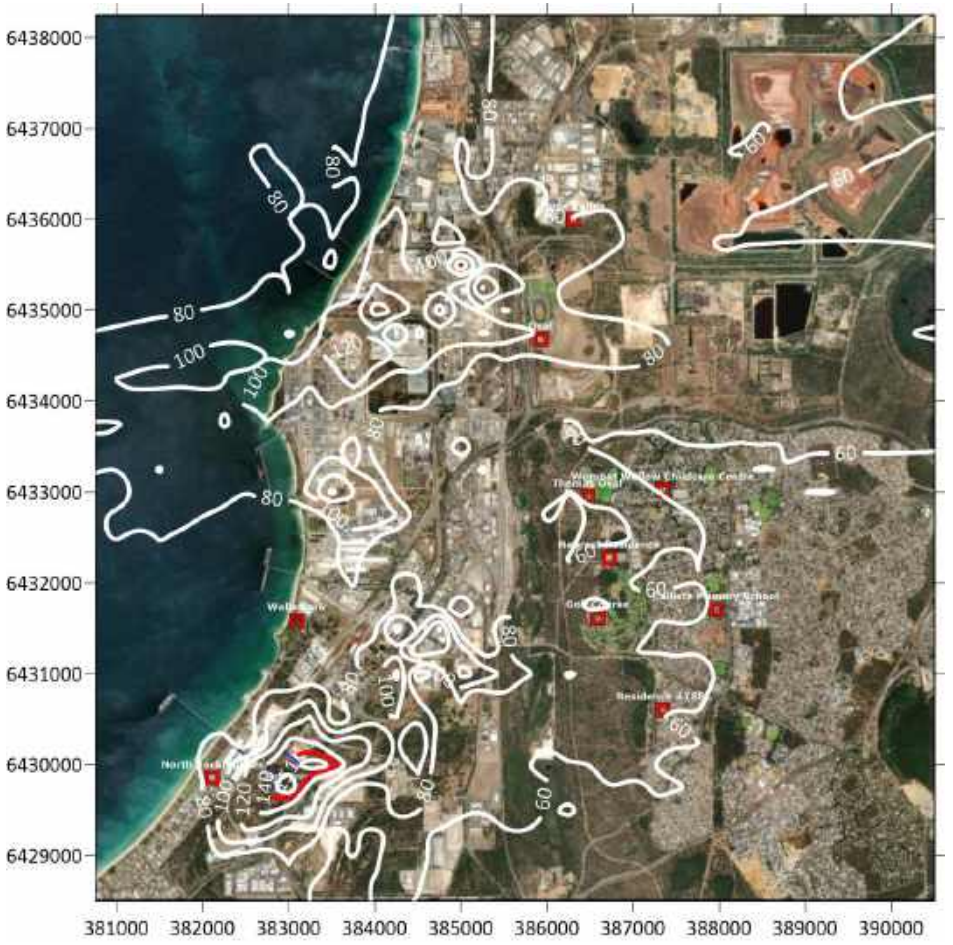
Date: July 2024

Figure 34

Isolation



Cumulative

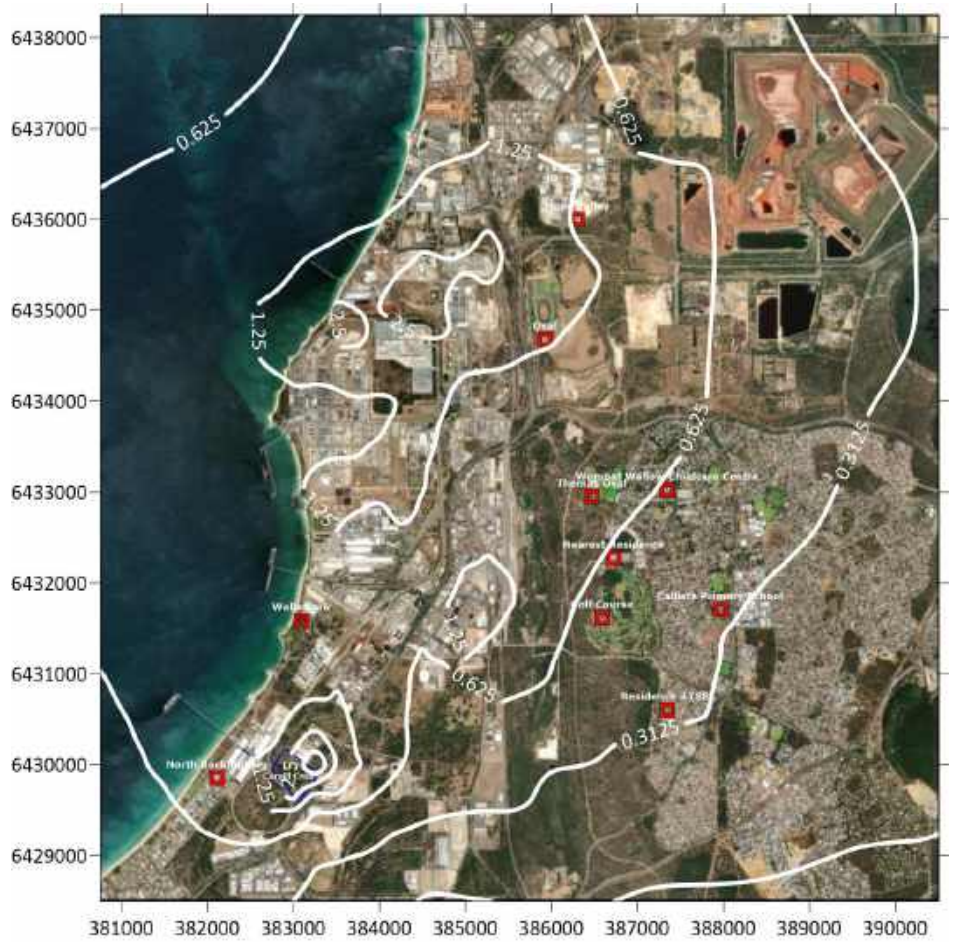


Scenario #4 (Gas Boiler Emissions with Future KIA Sources):
Maximum 1-hour Average Predicted NO_2 GLCs ($\mu g/m^3$)

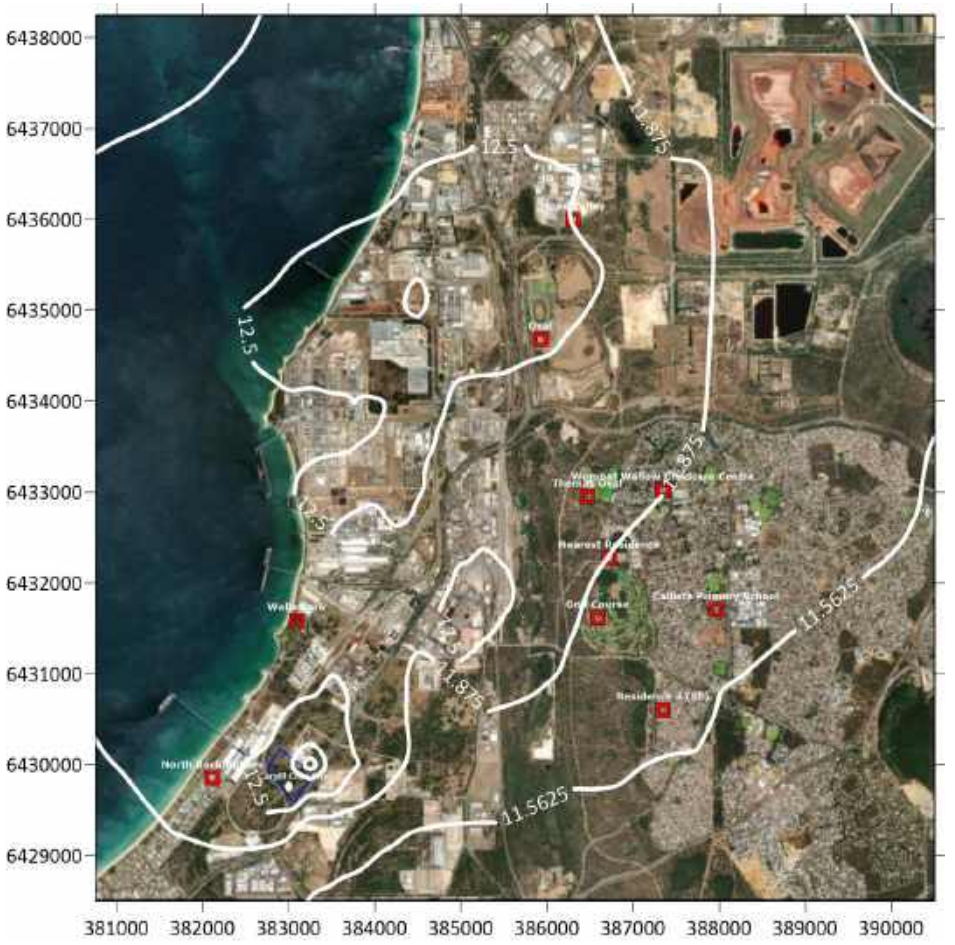
Date: July 2024

Figure 35

Isolation



Cumulative



Scenario #4 (Gas Boiler Emissions with Future KIA Sources):
Annual Average Predicted NO_2 GLCs (µg/m^3)

Date: July 2024

Figure 36

Appendix 2
Odour Risk Assessment

Confidential

OPAM Consulting
Odour Process
Audit Management



Cargill Crux Project East Rockingham
Works Approval Application

Odour risk assessment

Prepared for:

Ramboll

May 2024

Confidential

Project:	Cargill Crux Project – East Rockingham Works Approval Application
Scope of Work	Odour Risk Assessment
Prepared by:	OPAM Consulting +61 409 974 388 ABN: 66 136 352 648 Job Ref: OPAM 23090116
Clients:	Ramboll
Contact:	Jeff BARHAM – Principal consultant jbarham@ramboll.com

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			Copie(s)	**Date**
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1 Introduction

1.1 Context

Cargill Australia (**Cargill**) proposes to build a canola crushing plant adjacent to the CBH Kwinana Grain Terminal in East Rockingham. The capacity of the proposed plant is 3,000 tonnes per day (tpd).

At a high level, the components of the canola crushing plant encompass:

- Canola truck logistics facilities (seed silos);
- Canola processing, with the solvent hexane;
- Meal storage & loading out facility;
- Crude degummed canola oil storage & loading out (oil pipe to the jetty);
- Natural gas or biomass steam boiler;
- Wastewater treatment plant;
- Odour treatment facilities.

A works approval is required by the Department of Water and Environmental Regulation (**DWER**) (Part V under the Environmental Protection Regulations 1987) for this new operation.

Ramboll Australia Pty Ltd (Ramboll) has been contracted by Cargill to undertake an air quality assessment and to prepare the supporting documentation for the works approval application for this project. OPAM Consulting has been contracted by Ramboll to assist in collecting information related to the odour risk assessment in accordance with the DWER Guideline: Odour Emissions.

1.2 Purpose

This report gathers information relevant to the odour impact risk assessment for this project.

1.3 Scope

The *DWER Guideline: Odour Emissions* was published in June 2019 and recommends several tools that may be used to collect information about odour sources and emissions. Information and data should then be collated in a report to provide several lines of evidence that will be reviewed by DWER officers to assess the odour impact risk of the project.

Those tools have been designed to promote more empirical data to be used by the DWER officers for the odour impact risk assessment.

The Category of the proposed prescribed premises is 19 under the Environmental Protection Regulations 1987. Category 19 is not listed in Appendix 2 of the *DWER*

Guideline: Odour Emissions (**2019**). Therefore, according to this same Guideline, a detailed analysis is required.

The following scope of work related to the odour risk assessment for this project was implemented:

- An initial reconnaissance of the area of the future facility with visual identification of the existing sources and locations of the future plant.
- An Operational Odour Analysis (OOA) for the operations likely to emit odours;
- The Location review of the site;
- Odour field assessments.

2 Cargill Crux facility – Proposed operations

The key processes to be implemented at the facility for the processing of canola oil are as follows:

- Storage – Canola seeds are unloaded in receival pits and stored onsite in vertical steel silos.
- Preparation/Pre-pressing – Preparation includes cleaning, sifting, drying, preheating, dehulling, flaking and screw pressing. Pre-pressing splits the seed, ruptures the oil cells, and prepares the product for the solvent extraction plant.
- Solvent extraction – Extraction involves washing the product with solvent to obtain the seed oil, with meal as a product. The seed oil is produced with a small component of hexane present and is further processed and refined through distillation to remove the hexane. The meal undergoes a de-solventising process to remove the hexane prior to further processing for drying and cooling, with the final meal product sold as a protein source for feedstock.
- Neutralisation – Involves neutralising the fatty acids in the oil with caustic soda and phosphoric acid.
- Refining – Involves a bleaching process where trace metals and other impurities are removed from the oil using absorbing clay. The oil may then undergo a deodorisation stage where additional impurities are removed under temperature and vacuum. This stage is only a possibility at this point.
- Product Storage – The refined oils are stored in bulk storage tanks.
- Domestic and Process Wastewater Management - The onsite sources of process wastewater are the boilers, cooling towers, pre-press facility, the biofilter, the extraction facility and refinery. This water is collected and directed to the wastewater treatment plant onsite and then via a pump station on to the Water Corporation's Industrial Wastewater Treatment System.

From an odour point of view, odours will mainly be coming from the preparation and the extraction plants along with their associated odour treatment systems.

The preparation plant is the first stage of oil extraction from the seeds. This operation will occur in the preparation building which will be enclosed with extracted air and point source extraction at several process levels. Air from these points sources will be treated prior to being released to atmosphere. Bulk air extracted from the building will be sent to atmosphere through roof stacks.

The extraction building will adopt an open design and sealed processes and operations. Foul air will be extracted from point sources and will be treated through different stages with a final polishing phase at the extraction biofilter.

3. Detailed Analysis

3.1 Location review

The location review is a priority tool recommended in the DWER Odour Emissions Guideline. OPAM Consulting has performed a review of the surroundings and possible sensitive receptors according to the definition provided in the glossary of the *DWER Guideline: Odour Emissions*.

Figure 1 presents the location of:

- sensitive receptors including residences, institutions, and recreational places;
- industries and commercial use.

The closest sensitive receptor is the caravan park at about 400 m south-west of the future plant boundaries. The strip along the coast is a residential area and will be downwind from the proposed facility for easterly to north-easterly winds.

In addition to residences, institutions, and recreational places, *"commercial, industrial and institutional land uses that require high levels of amenity, or are sensitive to particular emissions, may also be considered sensitive land uses."*

Several industries are in the close vicinity of the future Cargill facility. Finally, a light industry and commercial zone is located south of the future facility (500 m for the closest point) and include manufacturing, servicing, storage, distribution, showrooms, and warehouses.

These commercial and industrial activities have been considered potential sensitive receptors (worst-case scenario) for the purpose of the supporting information requested for the odour risk assessment.

It should be noted that the Waste-to-Energy facility was not yet operational at the time of the OFAs.



Figure 1: Sensitive receptors, industrial and commercial land uses

The Cargill facility will be located on the coast, in the southern part of the Kwinana Industrial Area (**KIA**).

The terrain undulating from sea level up to about 10m on the east (+/- 4km from the coast) and up to about 10 to 30m (> 4km from the coast).

Odorous emissions will mainly be from the preparation building stacks and the residual odour emissions from the two biofilters (preparation and extraction) and several limited fugitive sources.

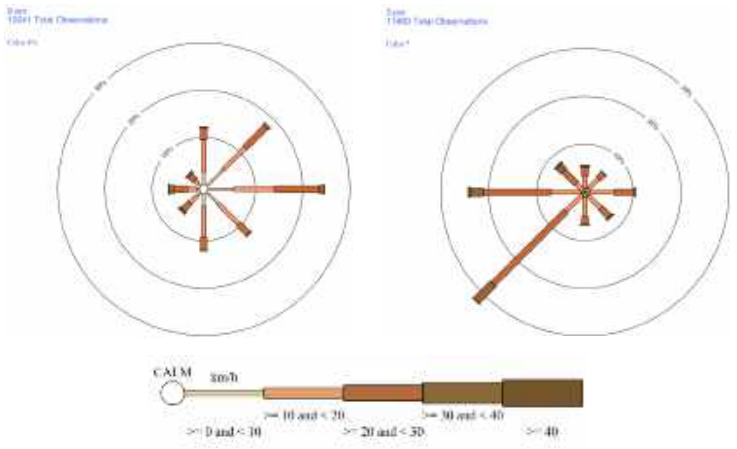
Regarding the prevailing wind conditions, **Figure 2** presents the wind roses for the 9am and 3pm periods between Feb. 1989 and Aug. 2023 as well as the five year wind rose (Apr. 2019 – Apr. 2024) for all hours obtained from data recorded at the Jandakot Airport. The Jandakot airport is located at 21 km northeast of the future Cargill facility.

Garden Island would have been another weather station to consider for the average wind conditions at East Rockingham. However, there are limitations due to the off shore location of the weather station compared to the coast and there is no long-term wind data from the BoM WS of Garden Island on the BoM website.

Comparison of the wind direction between Jandakot and Garden Island weather stations was frequently performed during the month of November 2023 and the month of January 2024 (while performing the odour field assessments). Wind directions were, for some occurrences, slightly different and wind speed was always higher at Garden Island which is expected.

BoM Jandakot Airport 9am and 3pm (Apr. 2019 – Apr. 2024)

Source: http://www.bom.gov.au/climate/averages/tables/cw_009172.shtml



BoM weather station of Jandakot Airport (Apr. 2019 – Apr. 2024) 8.52% of calm

Source: https://wind.willyweather.com.au/wa/perth/jandakot-airport.html

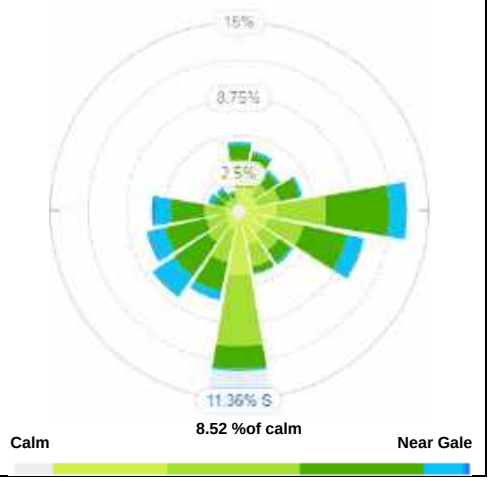


Figure 2: Wind roses (BoM Jandakot Airport)

The two wind roses in **Figure 2** do not represent the same periods. It appears that prevailing wind directions have slightly evolved for the last 5 years compared to previous longer periods.

Morning winds appears to be more easterly to east-southeasterly over the last 5 years compared to the last 34 years when they were more easterly to north-easterly.

Afternoon winds appear to be more southerly and south-westerly while they were more south-westerly and westerly over the last 34 years.

3.2 Operational Odour Analysis (OOA)

The Operational Odour Analysis (OOA) is a priority tool recommended in the DWER Odour Emissions Guideline.

This tool provides information about the operations and their monitoring, an evaluation of these corrective and contingency actions that will be implemented by Cargill to mitigate odour emissions.

Note:

It should be noted that although the concept and decisions about the processes to be built have been finalised, specifications related to some operations were not entirely finalised at the time of the draft of this report.

Table 1 is the DWER template providing the information regarding the Operational Odour Analysis (OOA) for the preparation and extraction operations at the new proposed Cargill facility in East Rockingham.

Table 1: Operational Odour Analysis (OOA) for the new Cargill facility

Odour emission operations review	Operational Condition
Cargill Crux Project	**Normal**
Odour sources and emissions	The main odour sources at a crushing and processing edible oil facility are the preparation and extraction operations with their associated odour treatment systems. All other static sources (bins, tanks, wastewater treatment plant, etc.) will be covered and limited volumes of fugitive emissions will occur from these sources. Trucks deliveries and collections will not be source of odours. Conveyor belts or material transportation within the site will be covered. **<u>Preparation building</u>** The preparation plant will encompass various stages including cleaning, sieving, heating, and flocking the seeds before pressing them to extract approximately 60% of the oil content. To facilitate moisture and dust control, as well as capture odorous airflow, multiple extraction points will be strategically positioned throughout the process. Initially, the collected airflow will be routed through a cyclone, then a scrubber/humidifier, and finally to the preparation biofilter. While the exact design is still under consideration, the airflow rate directed to the biofilter is anticipated to be around 50,000 m^3/h. This building will also include the meal pelletising operation with the foul air from this operation collected and directed to the extraction biofilter The preparation building will be enclosed and sealed to minimize fugitive emissions. Augers, tanks, presses, and conveyor belts will be covered or enclosed with extraction systems in place. Despite these measures, some fugitive emissions are inevitable. The bulk air within the building will be extracted and expelled through stacks with a total volumetric airflow rate anticipated to be around 200,000 m^3/h. This airflow will create a negative pressure environment, effectively limiting fugitive emissions from the building. **<u>Extraction building</u>** The extraction building will adopt an open design, featuring a roof but minimal walls, ideal for hot climates such as Perth. Due to the use of hexane and the odour from the solvent extraction system related to the notably high levels of hydrogen sulphide (H_2S), all processes and operations will be contained and extracted through point-level systems. Foul air will be extracted at a low volumetric airflow rate, typically a few hundred cubic meters, and conveyed to a caustic scrubber to mitigate H_2S. Despite this, the H_2S concentration at the outlet of the scrubber will still be relatively high, necessitating further dilution with the H_2S-free air from the meal pelletising operation to achieve concentrations of a few tens of parts per million (ppm) at the extraction biofilter's inlet.

Process controls	**<u>Preparation building</u>** • Sealed building The sealing and confinement of the building will be tested once built to verify that limited fugitive emissions occur. • Barometric louvers The number and locations of the barometric louvers will guarantee a homogeneous airflow within the building, the renewal of the foul air with fresh air and the absence of dead-zones. • Negative pressure within the building: Possible monitoring (and recording) and visual assessment of negative pressure at the personnel building doors (Magnehelic gauge) **<u>Extraction building</u>** • Sealed processes and operations Monitoring of the negative pressure within the whole process and operations. • Gas detectors It is currently being assessed if some hexane and H_2S detectors may be located at specific critical locations to verify the absence of fugitive emissions and associated odours. • In order to prevent an overpressure on the extraction plant from a restricted outlet, the vent gas stream will be equipped with an air break. This stream will be equipped with hexane and H_2S detectors. **<u>Biofilters (Preparation and Extraction)</u>** Temperature and relative humidity of the air entering the biofilters will be continuously monitored to guarantee that the air has a minimum of 90% relative humidity and a maximum temperature of 45°C. The back pressure of the media will also be monitored to inform about possible blockages and degradation of the media with time. As a general rule, double the initial back pressure should trigger actions. Visual inspection of the surface area of the media will be undertaken daily to verify the absence of weeds, vermin and to possibly detect the presence of short cuts resulting in partially or untreated air. Internal frequent assessments will verify that the odour concentration of a composite sample collected at the outlet of the biofilter will be around 500 ou.

Triggers and corrective actions	**<u>Preparation building</u>** A negative pressure of about -10 Pa is targeted across the building. If the negative pressure is continuously monitored and the alarm is triggered due to a loss of the negative pressure, then inspection of the building will occur as soon as practical to identify possible paths (open door, broken seal, broken/missing wall section, etc.) or engine/mechanical issue with a fan extracting the air of the building. Corrective actions will consist in fixing or repairing the identified issue as soon as practical. Some spare fans or engines will be stored at the facility. If a mechanical issue arises at a barometric louver, a specialist or the manufacturer will be called onsite to fix the issue. **<u>Extraction building</u>** If the negative pressure is lost within the process and operation or if a leak is detected (personnel on the ground or gas detector), an investigation will be undertaken immediately to identify the location and the cause of the issue. Repairs will be implemented as soon as practical to fix the issue. If scrubbing action is not performing as intended, operation can continue short term until the issue is resolved, as the biofilter should handle untreated vapour to a reasonable extent with the heavy dilution from the meal pelletising air stream. **<u>Biofilters (Preparation and Extraction)</u>** If the monitored temperature or relative humidity or back pressure returns a value out of the expected range: • A visual inspection of the probes will be undertaken to verify that they are fully operational. • A visual inspection of the negative pressure gauge will be undertaken to verify there is no blockage. A manual assessment with a portable handheld monitor (suitable for the measurement and calibrated) will be undertaken for temperature and moisture to verify the respective levels. If the levels manually assessed with portable monitors are not within the expected range, investigations of upstream operations will occur to understand where the abnormal temperature or relative humidity comes from (scrubber, humidifier, process, etc.). A visual inspection of the media from a walk on the biofilter media will provide possible clues about a sudden variation of the back pressure (water in excess, collapse of a section, etc.). If there is an excess of water, drainage will occur with time and the back

	pressure should come back to the expected range after few days. If there is a collapse of a section of the media, Cargill will contract a company to replace this section or any part of the section underneath the media which supports the bed if required. If the frequent assessment of the odour concentration returns some values above 500 - 800 ou, investigations should be performed which will include but not be limited to the temperature and relative humidity of the air at the inlet of the biofilter, the moisture of the media, the absence of water in excess in the media and absence of short cuts / preferential paths with untreated or partially treated air emitted to the atmosphere. If preferential paths are found, water may be added to the area as short cuts generally appear where sections of the bed are too dry. Additional compaction should also be undertaken.
Corrective action evaluation	**<u>Preparation building</u>** Once the issue is fixed, the negative pressure should be back to the usual setpoint for the building. Tests will be undertaken by the specialist to confirm the good condition of operation of the louver. **<u>Extraction building</u>** The setpoint for the negative pressure within the sealed operations should be back to normal in the network. **<u>Biofilters (Preparation and Extraction)</u>** If the problem is fixed, then temperature, relative humidity or negative pressure should show values within the expected range.
Contingency actions	**<u>Preparation building</u>** If the cause of the loss of negative pressure within the building has been identified but cannot be fixed within a short period of time, then it will be assessed whether the volumes of air and the odour level of these volumes are likely high and a possible risk for offsite odour impacts. Then an initial level of contingency would be a specific communication to the public to be made to inform about some maintenance operations that may be the cause of higher odour levels than usual for a certain period of time and the risk of odour impacts. If it is assessed that the conditions return a high or moderate risk, then the production at the preparation facility should stop for the duration of the works to be undertaken to fix the issue. **<u>Extraction building</u>** If the cause of the loss of the sealing of the operations has been identified but cannot be fixed within a short period of time, operations at

	the extraction building may stop for the duration of the repair due to health and exposure risk for the staff and as a secondary risk, odour emissions and possible offsite impacts. If vapour flow through the scrubber can't be maintained above what is being produced by the plant (indicated by either flow measurements or H_2S detection at the air break) due to a blockage in the scrubber, or if there were a fan failure, the plant will need to be stopped until the issue is corrected. **<u>Biofilters (Preparation and Extraction)</u>** If the repairs or the management of the issue is likely to create higher emissions than usual which may travel far and impact offsite receptors: • An initial level of contingency would be a specific communication to the public to be made to inform about some maintenance operations that may be the cause of higher odour levels than usual for a certain period of time and the risk of odour impacts. • A second level may require limiting or stopping production for the duration of the works to fix the issue.

Residual odour impact potential			
Operation / odour source	**Consequence**	**Likelihood**	**Impact potential**
New Cargill Crux operation	Slight	Unlikely	Low

It is recommended that a separate table is created for foreseeable abnormal conditions. For this activity, there is no abnormal operations that are foreseen but disruptions or inappropriate conditions within the process that could lead to odour emissions. These have been listed in the above table.

3.3 Odour Field Assessments

The third tool from the recommended list in the DWER Odour Emissions Guideline is the assessment of the current odour footprint around the future facility.

The purpose is to identify the current level of odour within the residential, commercial, and industrial areas in the surroundings of the future Cargill facility.

It is then expected that the new facility will not modify this environment by adding new odours that may not be accepted by the community.

5.4.1 Methodology

The odour field assessment (OFA) was performed following a modified method based on the EN 16841 Part 2:2016 standard. This standard is commonly used in Australia and New Zealand to perform such surveys and was derived from the German VDI 3940: Part 2 standard for Odour Plume Impacts assessments. This method establishes the contour of the grounded odour plume in the field.

For this engagement, the purpose of the OFAs undertaken was to determine the extent of the plume and distances at which the odour could be recognised from a source of odour emissions under specific meteorological and operating conditions.

DWER do not recommend any odour modelling for an existing site and do not support any odour criterion modelling especially for complex sources such as building with fugitive emissions or even surface area of biofilters.

Based on experience in odour monitoring and assessment of modelling odour impacts, OPAM Consulting supports this position.

OPAM Consulting questions the reliability and accuracy of the inputs and outcomes in the odour modelling of fugitive emissions from a volume source and the average odour concentration of a biofilter outlet odour concentration may vary depending on the sampling strategy for the composite sample.

The accuracy and reliability of modelling to predict odour impacts is noticeably low and rarely aligns with actual on-ground impacts. Odour emission rates of fugitive emissions from a building with no robust data on the source add a high level of uncertainty to the measurements and resulting odour emission rates.

Accordingly, OPAM Consulting believes that an odour assessment tool like OFAs that uses observational / empirical data is of higher value than a theoretical approach (modelling) for this project. This is also in accordance with the DWER recommendations for undertaking odour impact assessments.

OFA is one of the odour assessment tools detailed in the DWER Odour Emissions Guideline (**DWER, 2019**).

Prior to undertaking any OFA, OPAM Consulting performed a reconnaissance of the vicinity of the future location of the Cargill facility to assess the area, the public spaces

access (availability and suitability) to confirm that the minimum safety requirements for the odour panellists are met at every measurement point.

This reconnaissance also provides insights about other possible odour sources in the area for which odour emissions can also be recognised while patrolling.

Each OFA lasts between 1 and 1.5 hours. Sensory fatigue must be managed such as odour panellists remain focused on their task as well as are safety aware.

Only the dynamic plume method was used for the purpose of this engagement. OFAs are performed by odour panellists who have been tested and met the requirements of ANZ 4323.3:2001 standard. Odour panellists assess the absence or presence of odour downwind of an odour source to evaluate the plume extent.

The dynamic plume method is a survey repeated under similar but also different meteorological conditions. Two experienced odour panellists are required to perform the dynamic plume measurements. Panellists move following a path which crosses the location where the plume grounds. If the odour panellist recognises an odour, he/she will provide information on the following:

- An odour intensity level which will describe the strength of the recognised odour;
- The characteristic of the odour (what the odour smells like).

A single measurement involves assessing the air by standing at a specific location for about 30-45 seconds. Each coloured dot on the odour map represents a single measurement from a panellist at this point.

OPAM Consulting's Director is the field operator in charge of instructing the panellists about the measurement point or path to assess during a specific period of time.

5.4.2 Optimal conditions sought for the odour surveys

The purpose of these OFAs was to understand the current odour footprint from existing odour sources in the vicinity of the future Cargill facility.

Operational and meteorological conditions are the main factors regarding possible impacts. Other factors may be accounted for such as restricted access to certain areas in the vicinity of the investigated site.

A. Operational conditions

Operational conditions of existing facilities are unknown at the time of the OFA.

It was nonetheless noted that BHP Nickel West was not operational in January on the days of the OFAs due to large maintenance works on site.

The Waste-to-Energy facility was not yet operational during this assessment.

B. ***Meteorological conditions***

This engagement has considered odour dispersion of possible odour plumes emitted by various odour sources in the vicinity of the future Cargill plant.

Most of sensitive receptors are located south of the future Cargill facility location. Although it would have been informative to undertake some OFAs under northerly winds, it can be noted that due to the general flat topography in this area, plume dispersion from other odour sources under different wind conditions should be the same than under northerly winds.

OFAs were carried out under NE to SE winds for five surveys and under S to WNW winds for the other five surveys. Winds varied between almost still conditions up to winds of 4 m/s at ground levels (6 -9 m/s at 10m high).

C. ***Restricted access to certain areas***

Measurement points west of the future Cargill facility location were limited due to its proximity from the coast.

Surrounding is industrial zoning with very large industries and wide pieces of private lands that can't be accessed. All measurement points were on side of roads and carparks when available.

5.4.3 Presentation of the results

For each OFA, an odour map is prepared which depicts the findings of the odour panellists in the field.

A. ***Intensity***

The odour intensity indicates the strength at which an odour is recognised.

OPAM Consulting has not applied the German Odour Intensity Scale from the VDI 3940.Part3:2010. This scale has created a lot of confusion for years among odour specialists and regulators.

With the approval of the DWER Air Quality Branch specialists, OPAM Consulting and odour panellists rated odour intensity by implementing the Odour Intensity Scale used by Victoria EPA (**VEPA, 2022**). An addendum of the DWER Guideline: *Odour Emissions* should be published to propose an alternative to the recommended VDI 3940.Part3 German scale with this new 3 level scale for use in Western Australia. This scale is defined in **Table 2**.

Table 2*:* Odour intensity scale

Obvious	Odour is easy to recognise and always noticeable without any effort or focus on it. Odour can be described and may be attributed to a source.
Subtle	Odour is recognised, can be described, and may be attributed to a source. However, the panellist may need to focus by standing still, inhaling into the wind, and concentrating to recognise it.
0	No odour. Odour cannot be recognised and described with certainty.

B. Odour characteristics

From the OFAs performed, odours recognised and likely sources when it could be identified) are listed in **Table 3**:

Table 3: Types of odours recognised in the vicinity of the future Cargill facility

BHP Nickel West	Chemical odour, ammonia, caustic
PUMA fuel tank farm	Petrol, petrochemical
CBH Grain Terminal	Grainy odour
Mt Barker chicken – meat processing	Cooking chicken, sauce, spices
WA Kaolin	Kaolin, powdery odour
Vegetation	Floral, grassy, soil, dirt, eucalyptus
Other odours (unidentified source):	Burnt plastic, burnt bread type, smoke, metal, sour, cement and wet cement

A colour-coded representation of the odour characteristics used on the odour maps in this report is presented in **Table 4**.

Table 4: Colour code for odours recognised during this engagement

	BHP Nickel West	**PUMA tank farm**	**Mt Barker**	**CBH**	**WA Kaolin**	**Vegetation**	**Others**	**No odour**
Subtle	●	●	●	●	●	★	●	○
Obvious	●	●	●	●	●			

The level of odour intensity has been applied to the odour related to identified sources only. Other odours will be represented with only one colour when they have been recognised in the field.

Where no odour was recognised or an odour has been detected but could not be recognised or described with certainty, it was categorised as “No odour” and was represented by a white colour-code circle.

C. Meteorological conditions

For data post-processing, OPAM Consulting accessed the meteorological data of the following weather stations (see **Figure 3**):

- Wattleup (Northeast - 13 km) – DPIRD* 3m high
- Jandakot airport (Northeast - 21 km) – BoM 10m high

* Department of Primary Industry and Regional Development



Figure 3: Locations of the weather stations from the future Cargill plant

As discussed previously, Garden Island will generally provide slightly different wind directions and most of the time higher wind speeds (see Section 3.1).

Wind data is summarised in a table for each OFA with data from BoM Jandakot, DPIRD Wattleup and ground level monitoring by the field operator during the OFA.

OPAM Consulting (field operator) regularly recorded wind direction and wind speed in the field at different measurement points while patrolling. Air speed is measured with a handheld portable anemometer.

Arrows are used on each odour map to represent the average wind direction during the OFA. Arrows are mainly presenting the measurements onsite made by the field operator that were confirmed by the average wind direction from the two other weather stations.

D. Odour maps for OFAs – Dynamic plume method

Each odour map represents the results of the dynamic plume measurements during the OFAs including:

- A map of the area investigated with identification of the measurement position (numbers);
- A legend including:
  - The scale;
  - The wind arrows (maximum sector of wind during the OFA period);
  - The north direction;
  - Coloured signs for each single measurements following the colour code for the characteristic and intensity of the odour recognised in the field (detailed in **Table 3**).

5.5 Results of the OFAs

10 OFAs were carried out between 24th of October 2023 and 30th of January 2024.

5.5.1 OFA #1 – Tuesday 24 October 2023 (6.55 – 7.50)

Odour map for OFA #1 is presented in **Appendix 1**.

OFA #1 was carried out under light to gentle gusty E/NE winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 14°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[ENE – E]	[6.1 – 9.2] Max: 12 m/s	[13 – 15]	
DPIRD Wattleup	[50 - 110] [NE – ESE]	[0.8 – 3.3] Max: 6.1 m/s	[14 – 16]	
Field operator	[NE – E]	[1.6 – 3.8]	13	0/8

Observations

A chemical odour was recognised at points 1 and 43. A caustic odour was recognised at point 2. These odours were from BHP Nickel West.

An odour of petrol was recognised at point 3 from PUMA tank farm.

At point 6, a grainy odour was recognised from CBH.

A smoke odour was recognised at point 9. The source could not be determined.

5.5.2 OFA #2 – Thursday 2 November 2023 (9.56 – 11.23)

Odour map for OFA #2 is presented in **Appendix 2**.

OFA #2 was carried out under light to gentle gusty ENE/SE winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 28°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[NE – E]	[3.6 - 6] Max: 8.3 m/s	[27 – 30]	
DPIRD Wattleup	[60 - 140] [ENE – SE]	[0.6 – 2.5] Max: 5 m/s	[27 – 31]	
Field operator	[SE – ENE]	[0.8 – 4.2]	28	0/8

Observations

A cooking odour was recognised at point 52 from Mt Barker.

A burnt bread type odour was recognised at point 26 and a burnt plastic odour at point 22 without being able to identify the sources.

Vegetation odour (floral, eucalyptus, soil, dirt) was recognised at several points along the shore.

5.5.3 OFA #3 – Monday 6 November 2023 (9.47 – 11.25)

Odour map for OFA #3 is presented in **Appendix 3**.

OFA #3 was carried out under light SSW/NW winds (at the investigation area), a cloud cover of 8/8 and an average temperature of 25°C.

	Average wind direction range (deg)	**Average wind speed range (m/s) and max**	**Average Temperature (°C)**	**Cloud cover**
BoM Jandakot	[NW – S]	[2.5 – 5.3] Max: 7.2 m/s	[23 – 25]	
DPIRD Wattleup	[200 - 350] [SSW – NNW]	[0 – 1.9] Max: 3.3 m/s	[23 – 28]	
Field operator	[SW – WNW]	[0.7 – 2.1]	24	8/8

Observations

A petrochemical odour was recognised at point 1 from PUMA tank farm.

A cooking odour was recognised between points 47 and 48 from Mt Barker.

An ammonia odour was recognised at point 41 and on Patterson Rd south of the corner with Office Rd.

A burnt plastic was recognised at point 30 without being able to identify the source.

5.5.4 OFA #4 – Friday 10 November 2023 (6.27 – 7.59)

Odour map for OFA #4 is presented in **Appendix 4**.

OFA #4 was carried out under light ENE/SE winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 15°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[E – ESE]	[3.1 – 7.2] Max: 9.2 m/s	[14 – 17]	
DPIRD Wattleup	[95 - 160] [E - SSE]	[0 – 3.1] Max: 4.7 m/s	[14 - 17]	
Field operator	[ENE – SE]	[0.7 – 3.2]	14	0/8

Observations

A chemical odour was recognised at point 1 from BHP Nickel West.

A cooking odour was recognised at the corner of Alumina Rd and Patterson Rd and between points 47 and 52 from Mt Barker.

5.5.5 OFA #5 – Monday 13 November 2023 (18.22 – 19.35)

Odour map for OFA #5 is presented in **Appendix 5**.

OFA #5 was carried out under light E/SE winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 23°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[S – SE]	[2.5 – 3.6] Max: 4.2 m/s	[21 – 24]	
DPIRD Wattleup	[80 - 130] [E - SE]	[0 – 0.3] Max: 1.1 m/s	[19 - 22]	
Field operator	[ESE – SSE]	[< 0.4 – 1.4]	23	0/8

Observations

An ammonia odour was recognised at point 43b from BHP Nickel West.

5.5.6 OFA #6 – Friday 12 January 2024 (15.51 – 17.04)

Odour map for OFA #6 is presented in **Appendix 6**.

OFA #6 was carried out under light SE/SW winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 36°C.

	Average wind direction range (deg)		Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[E - SSE]		[3.1 – 5.6] Max: 8.3 m/s	[36 – 36.5]	
DPIRD Wattleup	15.50 – 16.00	16.00 – 17.05	[0 – 2.5] Max: 4.2 m/s	[35 - 39]	
	[E – SSE] [90 – 160]	[S – WNW] [180 – 285]			
Field operator	[SE - SW]		[1.2 – 4.5]	35	0/8

Observations

A petrol odour was recognised at point 56 from the petrol station at the corner of Patterson Rd and Ocean St.

5.5.7 OFA #7 – Monday 15 January 2024 (19.02 – 20.11)

Odour map for OFA #7 is presented in **Appendix 7**.

OFA #7 was carried out under light SSW/WSW winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 24°C.

	Average wind direction range (deg)		Average wind speed range (m/s) and max		Average Temperature (°C)	Cloud cover
BoM Jandakot	[S - WSW]		[3.1 – 4.2] Max: 4.7 m/s		[24 - 25]	
DPIRD Wattleup	19.00 – 19.45	19.45 – 20.10	19.00 – 19.45	19.45 – 20.10	[23 - 24]	
	[SSW – NW] [240 - 310]	About W	[0 – 1.1]	Close to 0		
Field operator	[SSW - WSW]		[<0.4 – 1.6]		24	0/8

Observations

A cement odour was recognised at point 43 likely coming from the maintenance works that were happening at BHPP Nickel West. A cooking odour was recognised between points 47 and 48 from Mt Barker.

A vegetation odour was recognised at point 21.

5.5.8 OFA #8 – Wednesday 17 January 2024 (18.43 – 20.00)

Odour map for OFA #8 is presented in **Appendix 8**.

OFA #8 was carried out under light WSW/SSW winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 22°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[WSW – WNW]	[5.3 – 6.1] Max: 7.2 m/s	[23 – 24]	
DPIRD Wattleup	[250 - 300] [WSW – WNW]	[0 – 1.7] Max: 2.5 m/s	[23 – 25]	
Field operator	[SSW – WSW]	[1.4 – 2.2]	22 Max 30°C	0/8

Observations

A metallic odour was recognised at point 42, 43 and 43b possibly from the maintenance works that were happening at BHP Nickel West. A cooking odour was recognised at 47 from Mt Barker. A petrol odour was recognised at point 54 without being able to identify the source of the emission. A kaolin (powdery) odour was recognised at point 51 likely from Kaolin WA. A sour odour was recognised at points 17 and 18. No source was identified.

5.5.9 OFA #9 – Monday 22 January 2024 (17.24 – 18.49)

Odour map for OFA #9 is presented in **Appendix 9**.

OFA #9 was carried out under light to gentle WSW/SSW winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 25°C.

	Average wind direction range (deg)	Average wind speed range (m/s) and max	Average Temperature (°C)	Cloud cover
BoM Jandakot	[WSW – SSW]	[5.3 – 8.9] Max: 11.4 m/s	[23 – 25]	
DPIRD Wattleup	[200 - 260] [SSW – W]	[0.8 – 3.3] Max: 5 m/s	[23 – 26]	
Field operator	[SSW – SW]	[2 – 4.2]	25	0/8

Observations

A chemical / acrid odour was recognised between points 54 and 55 likely from Bailey's Fertilisers.

A petrol odour was recognised at point 56 from the petrol station at the corner of Patterson Rd and Ocean St.

A kaolin (powdery) odour was recognised at point 51 likely from Kaolin WA.

A wet cement odour was recognised at points 18, 16, 28, 21, 22 and between 16 and 17. No source could be identified.

Ocean odour was recognised at points 12 and 13.

An odour of petrol was recognised at point 27 from the petrol station at the corner of Crocker St and Dixon Rd. An odour of petrol was also recognised at point 26 but no identified source of emission.

5.5.10 OFA #10 – Tuesday 30 January 2024 (9.42 – 11.22)

Odour map for OFA #10 is presented in **Appendix 10**.

OFA #10 was carried out under light to gentle ENE/SE winds (at the investigation area), a cloud cover of 0/8 and an average temperature of 28°C.

	Average wind direction range (deg)	**Average wind speed range (m/s) and max**	**Average Temperature (°C)**	**Cloud cover**
BoM Jandakot	[ENE – ESE]	[4.7 – 6.7] Max: 9.2 m/s	[28 – 32]	
DPIRD Wattleup	[60 - 160] [ENE – SSE]	[1.1 - 5] Max: 8.1 m/s	[26 – 32]	
Field operator	[ENE – SE]	[2.2 – 4.2]	28	0/8

Observations

A petrol odour was recognised at point 2 from PUMA tank farm.

A vegetation odour was recognised at points 44 and 14.

5.5.11 OFAs outcomes

Despite the industrial environment, there were limited odour impacts over the 10 OFAs carried out at different periods of the days and under different wind conditions.

There were mainly few occurrences of odours from BHP Nickel West, PUMA tank farm and Mt Barker processing facility.

Despite the large numbers of measurement points investigated at each OFA over a large surface area around the future location of the Cargill facility, no odour could be recognised at most of them.

It shows that the current odour background of the future Cargill facility is low.

6 Outcomes of the detailed analysis

The location review and the OOA indicated that the proposed operation should present low residual potential impacts.

Under the future operating conditions, the offsite odour footprint should be limited, mainly due to:

- the enclosed preparation building with extracted air pushed through roof stacks at high speed;
- the multiple extraction points strategically positioned throughout the preparation process to extract the foul air and direct it to a cyclone, then a scrubber/humidifier, and finally to the preparation biofilter;
- the sealed extraction system with high level H_2S air treated through a first scrubber stage before being diluted and polished through the extraction biofilter.

The odour field assessment has shown that the odour background was low in the surroundings of the future location of the Cargill facility.

With the information collected using the detailed analysis tools, it is anticipated that emissions from the future plant will be efficiently mitigated with the implementation of best practices and appropriate odour treatment technologies to maintain a low odour background in its vicinity.

7 Conclusion

Cargill Australia (**Cargill**) proposes to build a canola crushing plant adjacent to the CBH Kwinana Grain Terminal in East Rockingham. The capacity of the proposed plant is 3,000 tonnes per day (tpd).

Operations at such a facility emit odour emissions that should be controlled and mitigated to limit odour impacts in its vicinity.

The preparation/pre-pressing building will be enclosed and maintained under negative pressure to limit any fugitive emissions. Extracted air will be emitted to the atmosphere via roof stacks at high velocity to guarantee a high dilution of the plume.

Operations inside the preparation building will also be covered with point source extraction to capture the foul air and direct it through a cyclone prior to a scrubber and finally a biofilter.

The open extraction building will include a fully sealed process to avoid hexane and high H_2S concentration emissions to atmosphere. This foul air will be treated through a scrubber and then a biofilter.

With the design of the preparation and extraction operations proposed by Cargill, foul air emissions will be limited to possibly low volumes and odour intensity fugitive emissions.

With such a management of the odour emissions, it is not expected that the Cargill facility odour footprint will modify the currently low odour background identified through the odour field assessment.

With regard to the above, odour emissions from the proposed Cargill Crux facility should be considered low odour impact risk.

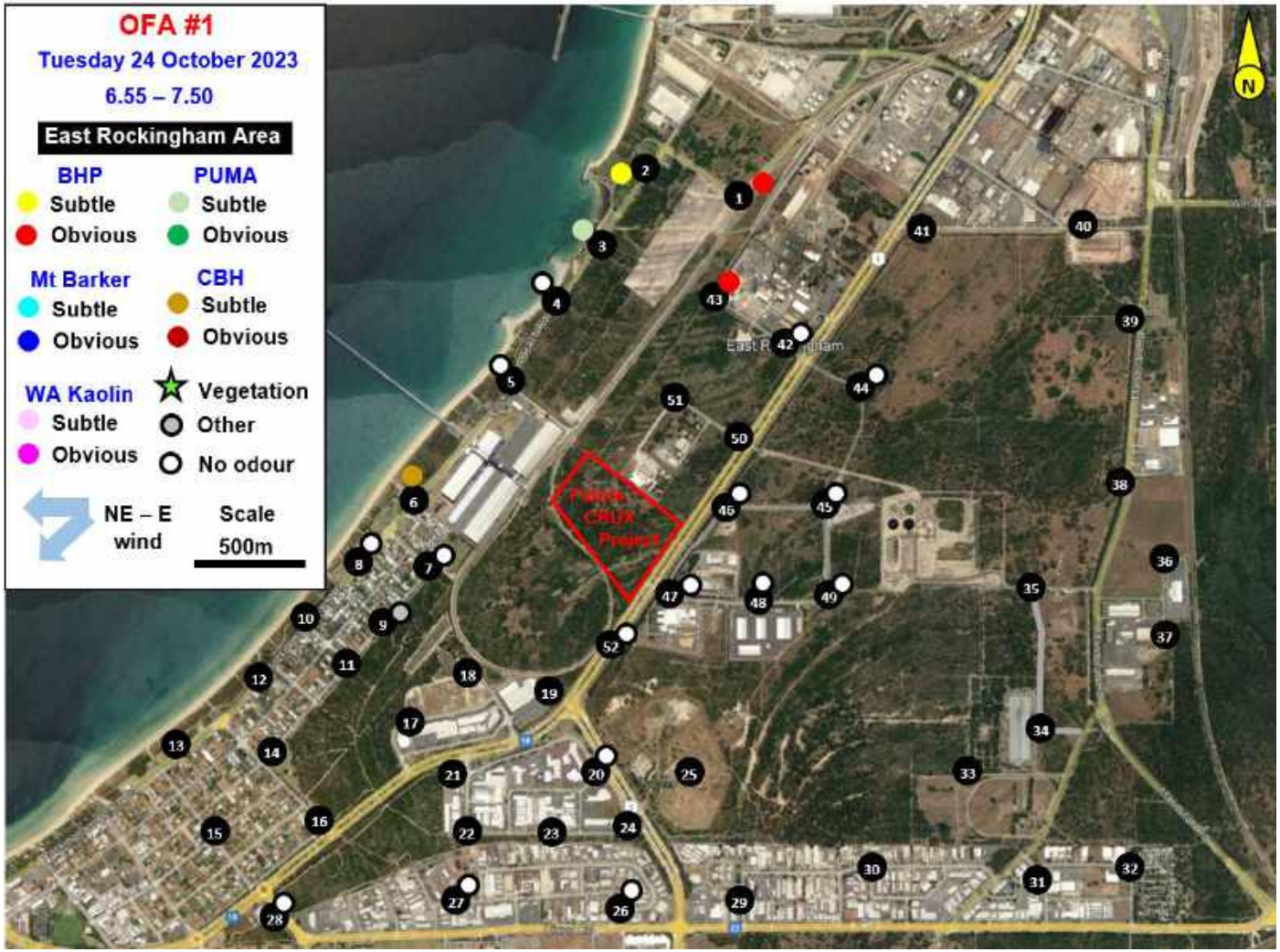
8 Bibliography

DWER, 2019: *Guideline: Odour Emissions, DWER WA*, Department of Water and Environmental Regulation, June 2019

VEPA, 2022: *Guidance for assessing odour* – Publication 1882, Victoria Environmental Protection Authority, June 2022

APPENDICES

Appendix 1: OFA #1 – Tuesday 24 October 2023 – 6.55 to 7.50



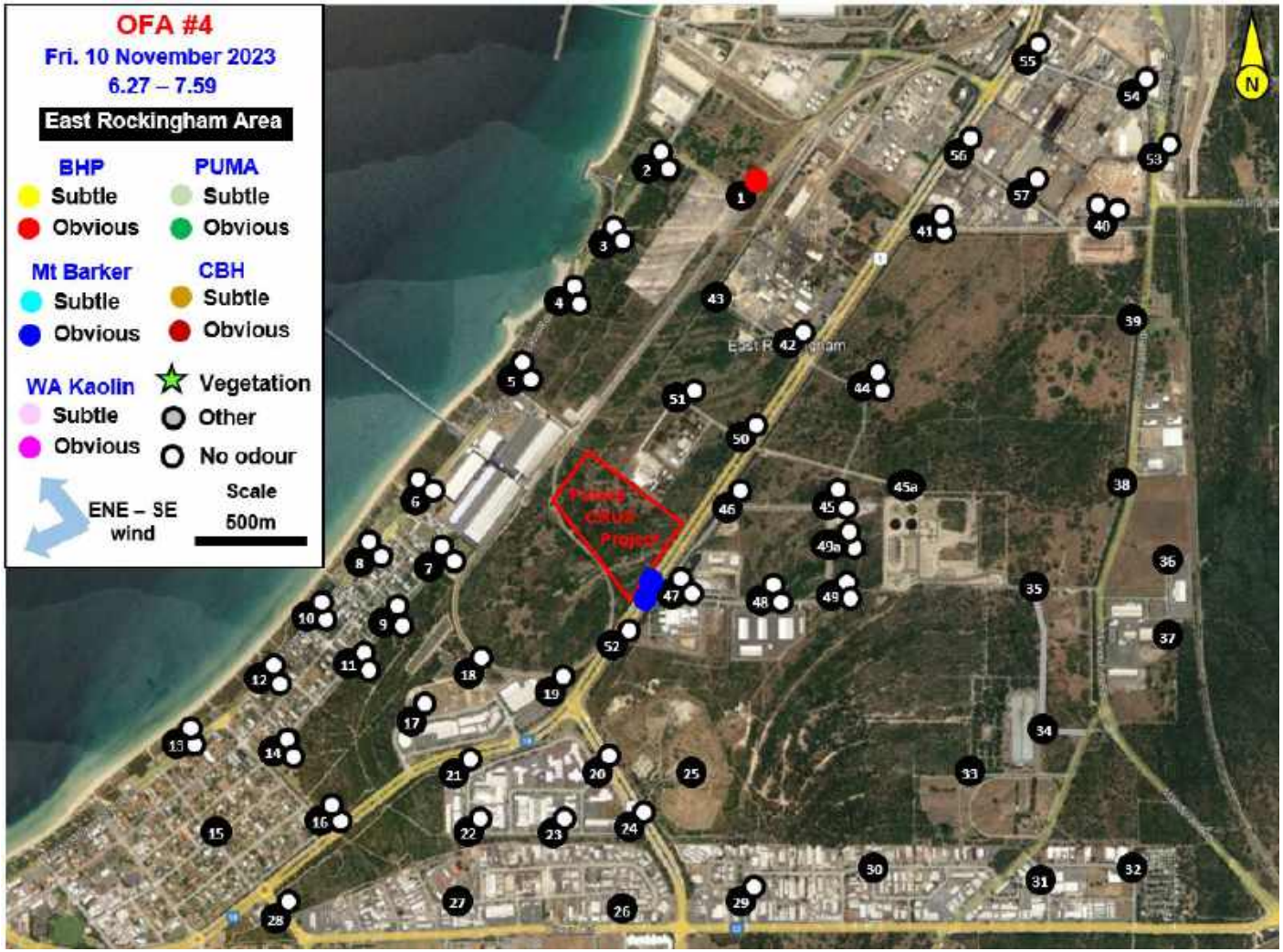
Appendix 2: OFA #2 – Thursday 2 November 2023 – 9.56 to 11.23



Appendix 3: OFA #3 – Monday 6 November 2023 – 9.47 – 11.25



Appendix 4: OFA #4 – Friday 10 November 2023 – 6.27 to 7.59



Appendix 5: OFA #5 – Monday 13 November 2023 – 18.22 to 19.35



Appendix 6: OFA #6 – Friday 12 January 2024 – 15.51 to 17.04



Appendix 7: OFA #7 – Monday 15 January 2024 – 19.02 to 20.11



Appendix 8: OFA #8 – Wednesday 17 January 2024 – 18.43 to 20.00



Appendix 9: OFA #9 – Monday 22 January 2024 – 17.24 to 18.49



Appendix 10: OFA #10 – Tuesday 30 January 2024 – 9.42 to 11.22



Appendix 3
Bushfire Assessment

Confidential

Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference: Lot 108 Patterson Road		
Suburb: Rockingham	**State:** WA	**P/code:** 6268
Local government area: City of Rockingham		
Description of the planning proposal: Construction of a Crushing Plan		
BMP Plan / Reference Number: 241628	**Version:** Rev A	**Date of Issue:** 11/09/2024
Client / Business Name: Ramboll		

Reason for referral to DFES	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	☐	☑
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	☐	☑

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)	☐	☑
Strategic planning proposal (including rezoning applications)	☐	☑
Minor development (in BAL-40 or BAL-FZ)	☐	☑
High risk land-use	☐	☑
Vulnerable land-use	☐	☑

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Gary McMahon	Level 3	35078	11/2024
Company Ecosystem Solutions		**Contact No.** (08) 9759 1960	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner  **Date** 11/09/2024

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Bushfire Management Plan

Lot 108 Patterson Road, East Rockingham

11 September 2024

Prepared for:
Ramboll
Attn: Jeff Barham



Limitations Statement

This report has been prepared in accordance with the Agreement between Ecosystem Solutions Pty Ltd and Ramboll (**"Client"**). It has been solely prepared for the construction of a new Crushing Plant at Lot 108 Patterson Road, East Rockingham(**"Site"**).

Information

In undertaking this work the authors have made every effort to ensure the accuracy of the information used. Unless otherwise stated in the report, Ecosystem Solutions Pty Ltd has not independently verified such information and cannot guarantee its accuracy or completeness.

Conclusions

Within the limitations imposed by the scope of work, preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable bushfire consultants under similar circumstances. No other warranty, expressed or implied, is made.

Reliance

This report is solely for the use of the Client and any reliance on this report by third parties will be at such party's sole risk. This report must only be presented in full and may not be used to support any other purpose than those set out in the report and the Agreement, except where prior written approval with comments are provided by Ecosystem Solutions Pty Ltd. All intellectual property rights in documents created by Ecosystem Solutions Pty Ltd remain the property of Ecosystem Solutions Pty Ltd.

Other parties should not rely on the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters. Ecosystem Solutions Pty Ltd accepts no Liability, or responsibility whatsoever for or in respect of any use or reliance upon this report and its supporting material subsequently used by others. Please note that the contents of this report may not be directly applicable towards another organisation's needs and may not contain sufficient information for purposes of other parties or for other uses.

Ecosystem Solutions Pty Ltd will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of this report.

Other limitations

The measures contained in this report cannot guarantee that a structure or building will not be damaged or would survive a bushfire event on every occasion. This is due to the degree of vegetation management, the unpredictable nature of fire behaviour (knowledge in this field continues to develop) and the unpredictable nature of extreme weather conditions.

The growth, planting or removal of vegetation, poor maintenance of any fire prevention/mitigation measures, addition of structures not included in this report, or other activity can and will change the bushfire threat to all properties detailed in this report. The implementation of fire precautions will depend on the actions of the landowner or occupiers of the land, over which Ecosystem Solutions Pty Ltd has no control. Should changes be made to the Site, a new Bushfire Management Plan is required. Ecosystem Solutions Pty Ltd accepts no Liability, including Liability for any Loss in connection with:

- a Claim, damage, or injury to property, or persons caused by fire;
- further growth, planting, or removal of vegetation on the Site;
- poor maintenance of any fire protection measures;
- additional structures not included in this assessment; or
- any other activity that may change the bushfire threat level.

The Client and owner of the Site each acknowledge that they have been made aware of the exclusions above and that such exclusion of Liability is reasonable in all the circumstances.
This report is valid for a period of two years only from the date of its issue. All BAL ratings identified in this report are indicative and are required to be verified at the time of construction of individual buildings to ensure appropriate setbacks identified in the Site/building have been achieved.

STATEMENT OF CONFORMITY – PLANNING AND DEVELOPMENT ACT 2005





Gary McMahon
B.Sc. M. Env Mgmt. PG Dip Bushfire Protection. C.EnvP, BPAD Level 3 (35078)

The signatory declares that this Bushfire Management Plan meets the requirements of State Planning Policy 3.7 and the Guidelines for Planning in Bushfire Prone Areas V1.4.

DISCLAIMER

**All capitalised terms used in the Limitations Statement above that are not defined are defined in the Agreement between Ecosystem Solutions Pty Ltd and the Client.*

*** The limitations above are subject to any relevant rights or remedies that the Client may be entitled to under legislation, including Schedule 2 of the Competition and Consumer Act 2010 (Cth).*

Document Control

Client – Ramboll

Site – Lot 108 Patterson Road, East Rockingham

Version	Revision	Purpose	Author	Reviewer	Submitted	
					Form	Date
Report	Rev A	Initial Report	DC (Level 2 - BPAD 48409)	GM (Level 3 - BPAD 35078)	Electronic (email)	11/09/2024

Filename: Y:\PROJECTS\241628 Lot 108 Patterson Road, East Rockingham BMP 4 Element\Reports\Lot 108 Patterson Road, East Rockingham BMP 4 Element.docx

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1 Proposal

This Bushfire Management Plan (BMP) has been prepared for Lot 108 Patterson Road, East Rockingham (hereafter referred to as the 'Site') by Dani Cuthbert (Dip TM., Dip BM., & BPAD 48409- Level 2) with review provided by Gary McMahon (BPAD35078 – Level 3) from Ecosystem Solutions.

The proposal is to construct a Crushing Plant, with site plan provided in Figure 1.

The Lot is located within a bushfire prone area, as declared by *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (Figure 2).

A Bushfire Attack Level (BAL) Assessment has been completed for the Site, resulting in a rating of BAL-FZ. With the implementation and maintenance in perpetuity of the Asset Protection Zone detailed in this Bushfire Management Plan, BAL-29 can be achieved for all habitable buildings, as defined by the *Guidelines for Planning in Bushfire Prone Areas*.

The purpose of this BMP is to detail the bushfire management methods and requirements that will be implemented within the Site to facilitate the construction of the Crushing Plant. The aim of this BMP is to reduce the threat to residents and fire fighters in the event of a fire within or near the Site.



Figure 1: Emergency accessway

Cargill Project, Cruc Canola Crushing Plant, Kwinana, East Rockingham

Figure 1 Site plan for Lot 108 Patterson Road, East Rockingham

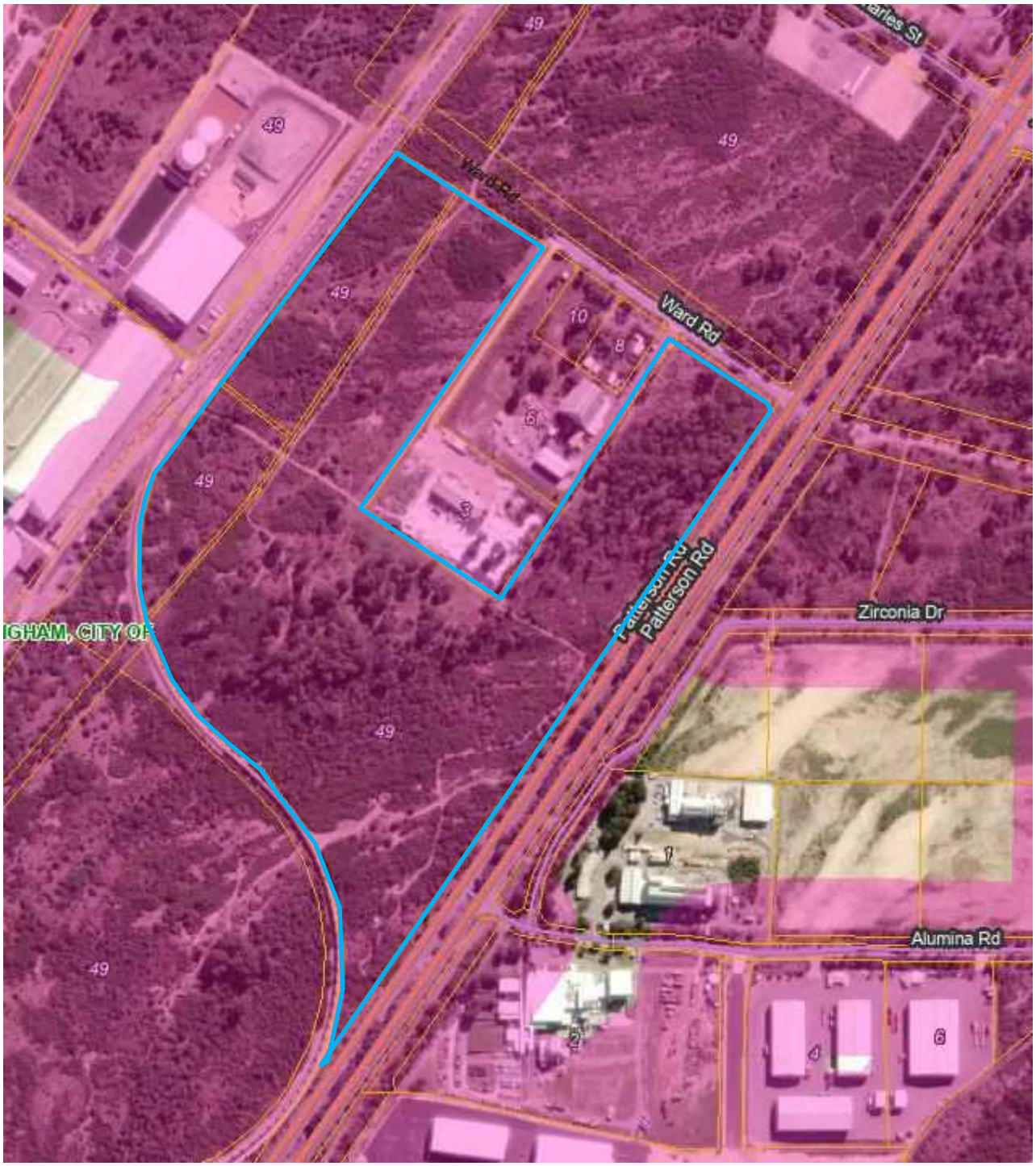


Figure 2 Extract Map of Bush Fire Prone Areas (SLIP, accessed 17th May 2024), showing Lot 108 Patterson Road, East Rockingham in the blue polygon.

2 Bushfire Assessment Results

2.1 Assessment Inputs

A Site Inspection was conducted on the 14th of May 2024 by Dani Cuthbert (BPAD 48409 - Level 2) and Gary McMahon (BPAD35078 – Level 3), for the purpose of determining the Bushfire Attack Level.

All vegetation within 150 m of the Site was classified and the slope under the vegetation determined in accordance with AS 3959-2018, shown in the photos below with map provided in Figure 3 of the current extent, with Figure 4 showing the post development site conditions.

Plot	1	Vegetation Classification or Exclusion Clause	Class A Forest Upslope/Flat
			
Photo ID: 1			*Photo ID: 2*
Description / Justification for Classification			Open Forest Vegetation of trees 10 – 30 m in height, with a canopy cover over 30%, with a shrub and grass understory. No vegetation modification is proposed within this plot.

Plot	2	Vegetation Classification or Exclusion Clause	Class B Woodland Upslope/Flat
			
Photo ID: 3			*Photo ID: 4*
			
Photo ID: 5			*Photo ID: 6*
Description / Justification for Classification			Low open woodland vegetation within the medium strip, of trees up to 20m in height over a managed grass understory. No vegetation modification is proposed within this plot.

Plot	3	Vegetation Classification or Exclusion Clause	Class A Forest Upslope/Flat
			
Photo ID: 7		*Photo ID: 8*	
			
Photo ID: 9		*Photo ID: 11*	
			
Photo ID: 12			
Description / Justification for Classification		Open Forest Vegetation of trees 10 – 30 m in height, with a canopy cover over 30%, over a shrub and unmanaged understory. Vegetation modification will occur within this plot to establish the Crushing Plant.	

Plot	4	Vegetation Classification or Exclusion Clause	Class A Forest Upslope/Flat
			
Photo ID: 13		*Photo ID: 14*	
Description / Justification for Classification		Open Forest Vegetation of trees 10 – 30 m in height, with a canopy cover over 30%, over a shrub and unmanaged understory. Vegetation modification will occur within this plot to establish the Emergency Access Way.	

Plot	5	Vegetation Classification or Exclusion Clause	Class D Scrub Upslope/Flat
			
Photo ID: 10		*Photo ID: 15*	
			
Photo ID: 16		*Photo ID: 17*	
			
Photo ID: 18		*Photo ID: 19*	
Description / Justification for Classification		Closed scrub vegetation up to 6 metres in height, with an unmanaged grass understory. Vegetation modification will occur within this plot to establish the Crushing Plant.	

Plot	6	Vegetation Classification or Exclusion Clause	Class D Scrub Upslope/Flat
			
Photo ID: 20			*Photo ID: 21*
			
Photo ID: 22			
Description / Justification for Classification			Closed scrub vegetation up to 6 metres in height, with an unmanaged grass understory. No vegetation modification is proposed within this plot.

<table>
<tr><td>Plot</td><td>7</td><td colspan="2">Vegetation Classification or Exclusion Clause</td><td>Excluded S 2.2.3.2 (a), (e) or (f)</td></tr>
<tr><td colspan="3"> 
</td><td colspan="2"> 
</td></tr>
<tr><td colspan="3">Photo ID: 23</td><td colspan="2">Photo ID: 24</td></tr>
<tr><td colspan="3"> 
</td><td colspan="2"></td></tr>
<tr><td colspan="3">Photo ID: 25</td><td colspan="2"></td></tr>
<tr><td colspan="3">Description / Justification for Classification</td><td colspan="2">Vegetation more than 100 m from the Site has been excluded under S 2.2.3.2 (a). Non vegetated areas including roads, access ways, railways and buildings are excluded under S 2.2.3.2 (e). Low threat vegetation including managed road reserves are excluded under S 2.2.3.2 (f).
Post development the entire development footprint is excluded under S 2.2.3.2 (e) or (f).</td></tr>
</table>



Figure 3 Map of Vegetation Class and Effective Slope – Current Extent

2.2 Post Development Assessment

The Determined Bushfire Attacked Level (highest BAL) for this Site Post Development has been determined in accordance with clause 2.5 of AS 3959 – 2018, based on the post development vegetation classification (Figure 4) with map provided in Figure 4 and detailed map provided in Figure 5.



Figure 4 Map of Vegetation Class and Effective Slope – Post Development



Figure 5 BAL Contour Map – Post Development

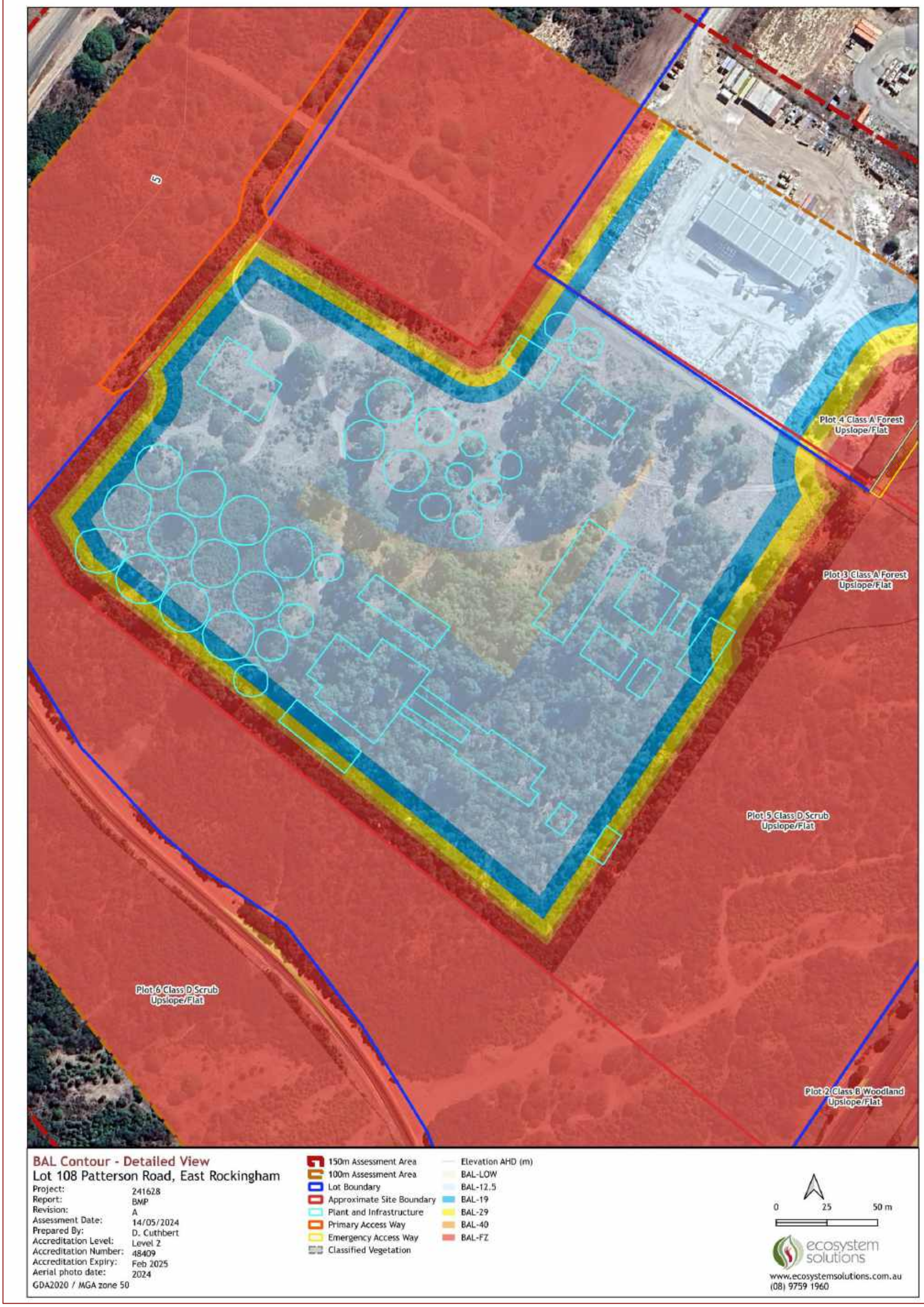


Figure 6 BAL Contour Map – Detailed View – Post Development

3 Environmental Considerations

3.1 Native Vegetation – modification and clearing

The Site contains remnant native vegetation. Modification of this vegetation will be required to establish the Asset Protection Zone to the standard of the Guidelines (Appendix B). A vegetation survey of the Site has been undertaken (One Tree Botanical), which should be read in conjunction with this Bushfire Management Plan.

Existing trees can be retained within the Asset Protection Zone, if the trunks at maturity are 6 metres from all elevations of a habitable building, branches at maturity do not touch or overhang a building, lower branches are removed to a height of 2 metres above the ground or surface vegetation and canopy cover is less than 15%, with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy.

This bushfire assessment assumes that relevant government approvals for any vegetation modification will be achieved prior to the commencement of any clearing.

The area has been assessed for environmental values using a simple desktop review (Table 2) for values under the *Environment Protection and Biodiversity Act 1999* (Cmth). Protected Matters Search Tool identifies a number of declared rare flora and fauna species or species habitat likely to occur within the area.

Table 1 Ecological values - results of simple desktop review

Environmental Value	Yes or No	If Yes - describe
Conservation Covenants	No	Not applicable
Bushfire Forever Sites	No	Not applicable
Conservation Category Wetlands and Buffer	Yes	Becher point wetlands is within 10km of the Site.
Environmentally Sensitive Areas (ESAs)	Yes	The Site is within an ESA or ESA buffer.
Threatened Ecological Communities (TECs)	Yes	Banksia Woodlands of the Swan Coastal Plain ecological community, Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion, Sedgelands in Holocene dune swales of the southern Swan Coastal Plain and Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain Ecological Community may occur within the area.
Threatened Flora	Yes	There are a number of Threatened flora species of species habitat that are known to occur within the area.
Threatened Fauna	Yes	There are a number of Threatened fauna species or species habitat that are known to occur within the area including the Western Ringtail Possum (Critically Endangered) and three Black Cockatoo species (Endangered/ Vulnerable).

3.2 Re-vegetation / Landscape Plans

No active revegetation is required. Any future planting of vegetation, or failure to maintain the Asset Protection Zone to the standard detailed in this BMP, can change the BAL rating significantly.

4 Assessment Against the Bushfire Protection Criteria

4.1 Compliance with the Acceptable Solutions for each Element

Bushfire Protection Criteria - Element 1 - Location		
Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property, and infrastructure.		
Acceptable Solution	**Compliance**	**Assessment Statements**
A1.1 Development location *The strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL-29 or below.*	Compliance with this acceptable solution is met.	The BAL Contour Assessment for post development (Figure 5) show that all habitable buildings, as defined by the guidelines, achieve a BAL-29 or lower rating, with the implementation and maintenance in perpetuity of the Asset Protection Zone detailed in A2.1 below. Some infrastructure will be located within areas of BAL-40, however these are not habitable buildings.

Bushfire Protection Criteria – Element 2 – Siting and Design		
Intent: To ensure that the siting and design of development minimises the level of bushfire impact.		
Acceptable Solution	**Compliance**	**Assessment Statements**
A2.1 Asset Protection Zone (APZ) *Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:* • *Width: Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a bushfire does not exceed 29kW/m² (BAL-29) in all circumstances.* • *Location: the APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes).* • *Management: the APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones.'* (Appendix B).	Compliance with this acceptable solution is achieved.	Post development all habitable buildings, as defined by the Guidelines, will be located within areas of BAL-29 or lower. Plant and infrastructure will be established within the entire development footprint; therefore this area will be non-vegetated post development. Any vegetation that is retained within the development area will be managed to Asset Protection Zone Standards, therefor the entire site will meet the standards of an Asset Protection Zone, post development.

Bushfire Protection Criteria – Element 3 – Vehicular Access		
Intent: To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.		
Acceptable Solution	**Compliance**	**Assessment Statements**
A3.1 Public Roads Public roads are to meet the minimum technical requirements in Table 6, Column 1. The trafficable (carriageway/ pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Developments (IPWEA Subdivisional Guidelines), Liveable Neighbourhoods, Austroad Standards and/or any applicable standards for the local government area.	Compliance with this element is achieved.	The extension of Ward Road will be constructed in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Developments (IPWEA Subdivisional Guidelines), Liveable Neighbourhoods, Austroad Standards and/or any applicable standards for the local government area.
A3.2a Multiple Access Routes Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access). If the public road access to the subject site is via a no-through road with cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 metres from the subject lot(s) boundary to an intersection where two-way access is provided. The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to the site constraints and the following requirements are let: • The no-through road travels toward a suitable destination; and • The balance of the no-through road, that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area – Figure 23 (Appendix B).	Compliance with this element is achieved.	Ward Road, which is an existing no through road, will be extended to access the Site. Access to the Site via a no through road is unavoidable as the Site is constrained by a train line on the south west and north west boundaries, and Patterson Road to the east. Main Roads WA have confirmed that direct vehicular access from the Site onto Melville Mandurah Highway (Patterson Road) is not supported as it is declared 'Control of Access' Road under Section 28A of the *Main Roads Act 1930*. Due to the unavoidable access via a no through road, a compliant Emergency Access Way (EAW, refer A3.2b below) has been proposed from the Site to Ward Road to provide an alternative access/egress route. This EAW results in a 170m portion of Ward Road being a no through road, which travels towards a suitable destination. The access to the Site is legacy of past planning approvals and the proponent is proposing to increase the access to the site to the greatest extent possible.

Bushfire Protection Criteria – Element 3 – Vehicular Access		
A3.2b Emergency access way An emergency access way is to meet all the following requirements: • Requirements in Table 6, Column 2 (Appendix B); • Provides a through connection to a public road; • Be no more that 500 metres in length; and • Must be signposted and if gated, gates must open the whole trafficable width and remain unlocked.	Compliance with this element is achieved.	Due to the demonstrated site constraints to provide multiple access roads via a public road, a compliant Emergency Access Way has been proposed. The EAW will be approximately 400 metres in length, provides connected to a public road and will be constructed to the requirements of Table 6, Column 2, including a 6 metre trafficable surface, and 4.5m vertical clearance. The EAW must be signposted, and any gates must remain unlocked.

Bushfire Protection Criteria – Element 3 – Vehicular Access		
3.6 Private Driveways *There are no private driveway technical requirements where the private driveway is:* • *within a lot serviced by reticulated water;* • *no greater than 70 metres in length between the most distant external part of the development site and the public road measured as a hose lay; and* • *accessed by a public road where the road speed limit is not greater than 70 km/h.* *In circumstances where all of the above conditions are not met, or the private driveway is in a non-reticulated water area, the private driveway is to meet all the following requirements:* • *requirements in Table 6, Column 4* (Appendix B)*;* • *passing bays every 200 metres with a minimum length of 20 metres and a minimum additional trafficable width of two metres (i.e., the combined trafficable width of the passing bay and constructed private driveway to be a minimum six metres); and* • *turn-around area as shown in Figure 28* (Appendix B) *and within 30 metres of the habitable building.*	Compliance with this element is achieved.	The internal access within the Site is continuous, with multiple entry and exist points to Weld Road, therefore, turn around areas are not required. The internal access will also connect to the proposed Emergency Access Way. The driveway will be suitable for fire appliances, with a minimum 4 metre trafficable surface, 6 metre horizontal clearance and 4.5 metre vertical clearance and will meet other requirements of Table 6, Column 4 of the Guidelines (Appendix B).

Bushfire Protection Criteria – Element 4 - Water		
Intent: To ensure that water is available to the subdivision, development, or land use to enable people, property, and infrastructure to be defended from bushfire.		
Acceptable Solution	**Compliance**	**Assessment Statements**

A4.2 Provision of water for firefighting purposes
Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies:
• *The provision of a water tank(s), in accordance with the requirements of Schedule 2* (Appendix B)*; and*
• *Where the provision of a strategic water tank(s) is applicable, then the following requirements apply:*
  ◦ *land to be ceded free of cost to the local government for the placement of the tank(s);*
  ◦ *the lot or road reserve where the tank is to be located is identified on the plan of subdivision;*
  ◦ *tank capacity, construction, and fittings, provided in accordance with the requirements of Schedule 2; and*
  ◦ *a strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds).*
Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s), in accordance with the requirements listed above.
	Compliance with this element is achieved.	The Site is supplied with a reticulated water supply in accordance with Water Corporation's 'No. 63 Water Reticulation Standard'.

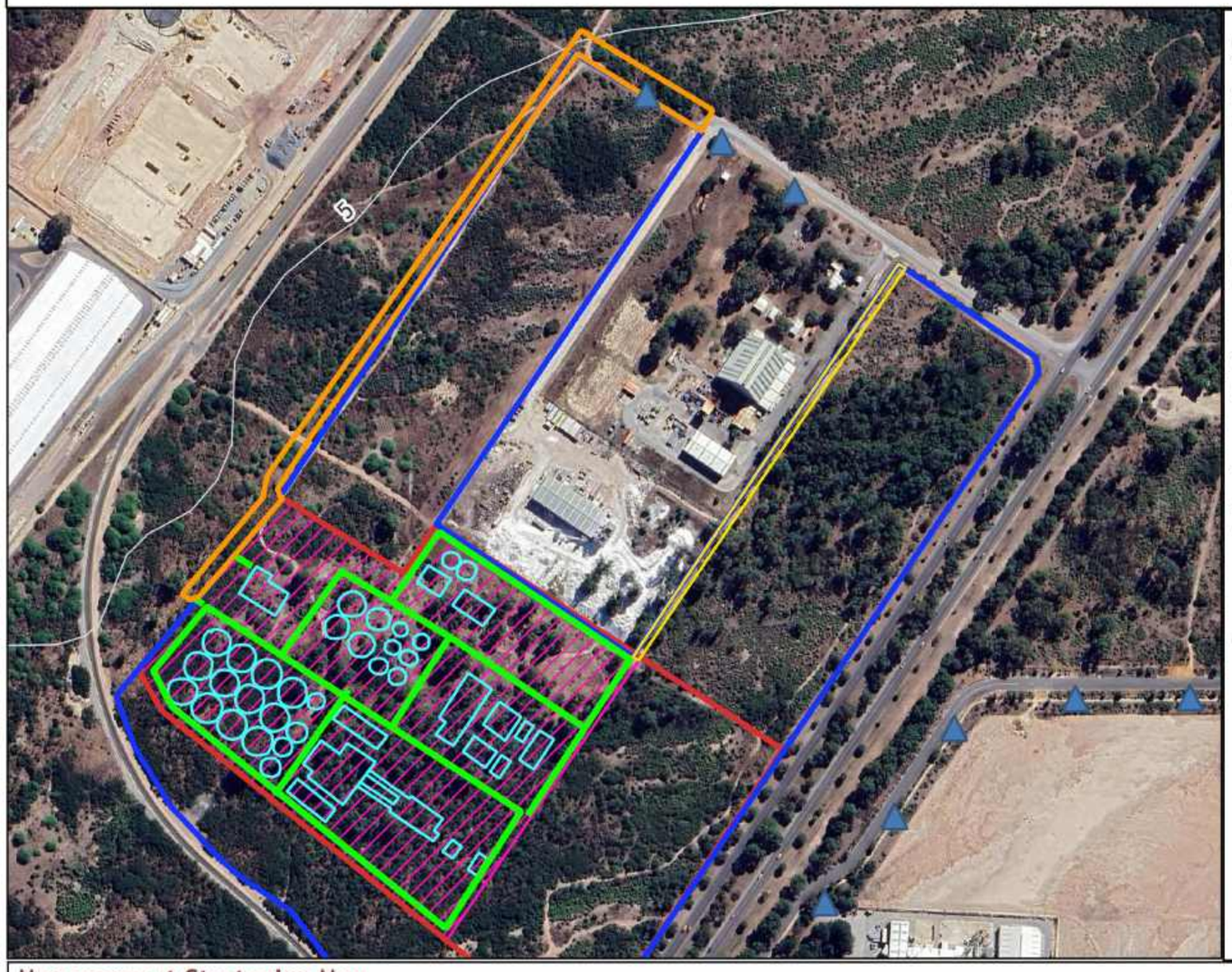
4.2 Summary of the Assessment Outcomes

This plan provides acceptable solutions and responses to the performance criteria outlined in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC, Dec 2021).

The layout and design of the development is such that no habitable structure will be required to be exposed to a radiant heat flux in excess of 29 kW/m^2 (BAL-29) providing the management as outlined in the plan is adopted.

A summary of the Bushfire Management Strategies to be implemented is provided in Figure 7.

Spatial representation of the proposed risk management measures



An Asset Protection Zone (APZ) must be maintained over the entire development footprint to establish a defendable space for fire fighters. Vegetation within the APZ is to comply with Schedule 1, Element 2 of the Guidelines for Planning in Bushfire Prone Areas.

Internal vehicular access with be constructed to have a minimum 4m trafficable surface, 6m horizontal clearance and 4.5m vertical clearance. The internal access is continuous, therefore turnabout areas are not required.

External access, including the extension of Ward Road and the Emergency Access Way will be constructed to the standards within the Guidelines.

Reticulated water supply is provided to the Site according to the Water Corporations 'No. 63 Water Reticulation Standards'. This is consistant with the Water Corporation data, WCORP-070.

Maintenance of the APZ, Emergency Access Way and internal access ways are the responsibility of the land occupier.

Management Stratagies Map

Lot 108 Patterson Road, Rockingham

Project:	241628
Report:	BMP
Revision:	A
Assessment Date:	05/09/2024
Prepared By:	D. Cuthbert
Accreditation Level:	Level 2
Accreditation Number:	48409
Accreditation Expiry:	Feb 2025

GDA2020 / MGA zone 50

Legend

- Lot Boundary
- Approximate Site Boundary
- Plant and Infrastructure
- Emergency Access Way
- Primary Access Way
- Internal Access
- Asset Protection Zone
- Water_Hydrant__WCORP-070_

0 100 200 m

ecosystem solutions

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(08) 9759 1960

Figure 7 Map of Bushfire Management Strategies

5 Responsibilities for Implementation and Management of the Required Bushfire Measures

The responsibilities for the Landowner/Occupier and Local Government are outlined in Table 3 and Table 34 respectively.

Table 2 Developer Responsibilities

Number	Action	Due	Completed
1	Establish and maintain the Asset Protection Zone which complies with Schedule 1 of the Guidelines and as specified in this Bushfire Management Plan.	Post Planning approval, Prior to construction & ongoing	☐
2	Construct the extension to Weld Road in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Developments (IPWEA Subdivisional Guidelines), Liveable Neighbourhoods, Austroad Standards and/or any applicable standards for the local government area.	Post Planning approval, Prior to construction	☐
3	Construct and maintain the Emergency Access Way in accordance with the Guidelines.	Post Planning approval, Prior to construction & ongoing	☐
4	Construct and maintain all internal access ways in accordance with the Guidelines.	Post Planning approval, Prior to construction & ongoing	☐
5	Provide a copy and obtain endorsement of this Bushfire Management Plan by those with responsibility under this plan including Builders, Landowners/Occupiers and City of Rockingham.	Post planning approval	☐

Number	Action	Due	Completed
5	Place a notice on the Certificate of Title, advising of the existence of this Bushfire Management Plan. Wording to be provided by City of Rockingham.	Prior to use of the Site.	☐

Table 3 City of Rockingham's Responsibilities

Number	Action	Due
1	Monitor landowner compliance with the annual firebreak notice.	Ongoing
2	Administer the requirements of the *Bush Fires Act 1954*, *Planning and Development Act 2005* and the *Building Act 2011*.	Ongoing

6 Conclusion

This report provides a Bushfire Management Plan for Lot 108 Patterson Road, East Rockingham, addressing the four bushfire protection criteria detailed in the *Guidelines for Planning in Bushfire Prone Areas* (Dec 2021). The BAL Assessment has determined the proposed building BAL-FZ, however with the implementation and maintenance in perpetuity of the Asset Protection Zone detailed in this Bushfire Management Plan, BAL-29 can be achieved for all habitable buildings.

Bushfire safety is a shared responsibility between governments, fire agencies, communities, and landowners. The planning and building controls outlined in this plan will reduce the risk of bushfire to people and property. It will not remove all risk however, and damage to a building in a bushfire event may occur.

6 Glossary

AS3959: Australian Standard 3959 Construction of Buildings in Bushfire Prone Areas.

Asset Protection Zone (APZ): A low fuel area immediately surrounding a building, as defined in the Guidelines.

BAL: Bushfire Attack Level (BAL) as set out in the Australian Standards 3959 Construction of Buildings in Bushfire Prone Areas (AS3959, as referenced in the Building Code of Australia (as amended).

BAL Assessment: An assessment prepared in a manner and form set out in AS3959 to determine a BAL. It is strongly recommended that BAL Assessments are prepared by accredited Level 1 BAL Assessors, unless otherwise exempt in these Guidelines.

Bushfire: An unplanned fire burning vegetation. A generic term which includes grass fires, forest fires and scrub fires both with or without a suppression objective.

Bush Fire Season: Dates determined by the Local Government each year where compliance with the Firebreak Notice is required under Part 3 Division 6 Section 33 of the *Bush Fires Act 1954.* The Firebreak Notice also includes dates where burning is prohibited and dates where burning is restricted with an approved burning permit required.

Bushfire Hazard: The potential or existing flammability of vegetation that, in association with topography and slope, when ignited may cause harm to people and/or damage to property and/or infrastructure.

Bushfire Management Plan (BMP): A document that sets out short-, medium- and long-term risk management strategies for the life of the development. It is strongly recommended that Bushfire Management Plans are prepared by accredited Bushfire Planning Practitioners in accordance with the requirements set out in the Guidelines on behalf of the landowner/proponent with the assistance of the responsible authority for emergency services where required.

Bushfire Planning Practitioner: A person who holds Level Two or Level Three accreditation under the Western Australian Bushfire Association Framework.

Bushfire Prone Area: An area that has been designated by the Fire and Emergency Services Commissioner under s.18P of the Fire and Emergency Services Act 1998 as an area that is subject, or likely to be subject, to bushfires. Such areas are identified on the Map of Bush Fire Prone Areas and can be found on the Department of Fire and Emergency Services website.

Bushfire Risk: The chance of a bushfire igniting, spreading, and causing damage to people, property, and infrastructure.

Bushfire Risk Management: Means the application of the bushfire protection criteria contained in the Guidelines.

Development Application: An application for approval to carry out development or change a land use under either a local planning scheme or regional planning scheme. This includes local development plans but excludes application for single house and ancillary dwellings on a lot or lots less than 1,100m^2.

Guidelines: Refers to the Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015), as amended (currently V1.4, Dec 2021).

Habitable building: Means a permanent or temporary structure on land that –

a. Is fully or partially enclosed; and

b. Has at least one wall of solid material and a roof of solid material; and

c. Is used for a purpose that involves the use of the interior of the structure by people for living, working, studying or being entertained.

Minor Development: Refers to applications in residential built-out areas at a scale which may not require full compliance with the relevant policy measures. Classes of development considered under this definition, with the exclusion of applications for unavoidable development, are;

- A single house on an existing lot 1,100m^2 or greater;
- An ancillary dwelling on a lot of 1,100m^2 or greater;
- Change to vulnerable land use in an existing residential development.

Residential Built out Area: A lot that has access to reticulated water and is within or contiguous with, urban area of town (or similar)

Short Term Accommodation: Temporary accommodation provided either continuously or from time to time with no guest accommodation for more than three months in any 12-month period.

Vulnerable Land Use: A land use where persons may be less able to respond in a bushfire emergency. Examples of what constitutes a vulnerable land use are provided in the Guidelines.

WAPC: Western Australian Planning Commission

Appendix A City of Rockingham's Fire Control Notice

Fire Control Notice 2023 – 2024

Your property must comply on 1 December 2023 and be maintained through to 31 May 2024

First and final notice to owners and/or occupiers of all land within the City of Rockingham

---

Penalty of up to $5,000 for non-compliance

rockingham.wa.gov.au

city of Rockingham

where the coast comes to life

As a measure to assist in the control of bushfires and pursuant to the powers contained in ***Section 33 of the Bush Fires Act 1954***, you have a legal requirement to carry out fire prevention works on your property. Your property must comply on 1 December 2023 and be maintained through to 31 May 2024.

"Take notice that pursuant to ***Section 33 (4) of the Bush Fires Act 1954***, where the owner and/or occupier of the land fails or neglects to comply with the requisitions of this Notice within the specified times, the City of Rockingham may by its officers and with such servants, workmen and contractors, vehicles and machinery as the officers deem fit, enter upon the land and carry out the requisitions of this Notice which have not been complied with and pursuant to ***Section 33 (5) of the Bush Fires Act 1954***, the amount of any costs and expenses incurred may be recovered from you as the owner and/or occupier of the land."

Compliance inspections will commence on 1 December 2023. Failure to comply with the City's Fire Control Notice may result in a penalty of up to $5,000, with additional contractor and administration costs to carry out fire prevention works on your property.



All land with an area of 4047m^2 or more (more than one acre)

Owners/Occupiers of developed and vacant land are required to:

- install and maintain mineral earth firebreaks as per firebreak specifications
- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back to clear access.

All land with an area of less than 4047m^2 (less than one acre)

Owners/Occupiers of vacant land are required to:

- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- have the entire vacant land clear of weed or long grasses by slashing, mowing or other means to a height no greater than 50 mm and maintained in this state.

Owners/Occupiers of developed land are required to:

- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back to clear access.

Firebreak Specifications

- must be not less than three (3) metres wide immediately inside and along all boundaries (including on boundaries adjacent to roads, rail and drain reserves and all public open space reserves)
- must be not more than four (4) metres wide (further width extensions may be considered upon written application for approval to the City)
- may have a corner turning radius of up to ten (10) metres
- must have a vertical clearance height of four (4) metres, with all over hanging vegetation trimmed back clear of the firebreak
- must be a mineral earth firebreak with a continuous trafficable surface for a 4WD vehicle, clear of any obstructions and must not terminate in a cul-de-sac (dead end)
- maintained and living lawns are acceptable in conjunction with, or in lieu of mineral earth firebreaks, provided that the same width and height requirements for a firebreak are maintained.

Firebreaks are intended to minimise the spread or extension of a bushfire and provide safe access on your property for emergency vehicles (ensuring fire does not travel under the vehicles or underfoot).



Bushfire Management Plan

Previously known as a Fire Management Plan. All properties that are subject to a Bushfire Management Plan as a result of a subdivision or development application or an approved treatment plan, must comply with the requirements of such plans in their entirety.

Additional Works

In addition to the requirements of this Notice, regardless of land size and location, you may be required to carry out further fire prevention works to reduce hazards considered necessary by an Authorised Officer. Any further requirement would be specified by way of a "work order" forwarded to the address of the owner(s) and/or occupier(s).

Some examples of these could be:

- ensure roofs, gutters and walls of all buildings on the land are free of flammable matter
- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- reduce unmanaged grasses/weeds by slashing, mowing or other means
- reduce long grasses in areas not being grazed or cultivated by slashing, mowing, bailing or by other means
- reduce vegetation to a low threat state from the outer edge of the firebreak through to the property boundary (e.g. no long grass or overhanging branches)
- assets identified in the City's **Bushfire Risk Management Plan 2018 - 2022** or any land identified with a treatment plan to reduce risk to assets.

Any owner and/or occupier who engages a contractor to undertake works on their behalf is responsible for ensuring that the completed works meet the requirements of this Fire Control Notice.

Any Fire Control Notice previously published by the City of Rockingham in the Government Gazette or in any locally circulated newsprint is hereby revoked.

Variation to the Fire Control Notice

To request authorisation to use other methods of fire prevention on your land outside of this notice, please apply in writing together with an 'Application to Vary Location and Type of Firebreaks' form (available on the City's website rockingham.wa.gov.au). Submit completed forms to the City of Rockingham no later than 31 October 2023.

A submission for a variation is required annually for the duration of that year's Fire Control Notice period.

If you require further information or would like to talk with a Fire Control Officer, please call **9528 0333** or email **firecontrol@rockingham.wa.gov.au**

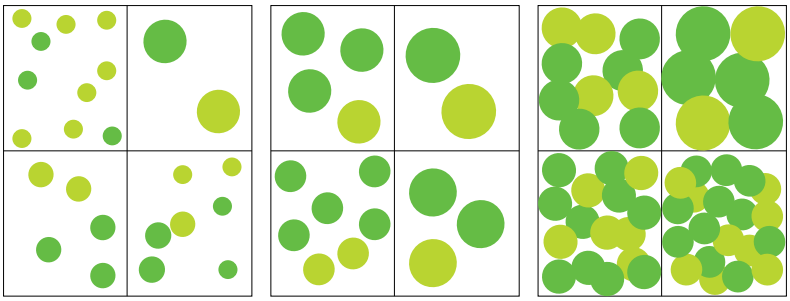


Appendix B Technical Requirement of the Guidelines for Planning in Bushfire Prone Areas



ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ. **Figure 19:** Tree canopy cover – ranging from 15 to 70 per cent at maturity  15% 30% 70%
Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.



ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*



Table 6: Vehicular access technical requirements

TECHNICAL REQUIREMENTS	1 Public roads	2 Emergency access way[1]	3 Fire service access route[1]	4 Battle-axe and private driveways[2]
Minimum trafficable surface (metres)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (metres)	N/A	6	6	6
Minimum vertical clearance (metres)	4.5			
Minimum weight capacity (tonnes)	15			
Maximum grade unsealed road[3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%)		
Maximum grade sealed road[3]		1:7 (14.3%)		
Maximum average grade sealed road		1:10 (10%)		
Minimum inner radius of road curves (metres)		8.5		

Notes:

[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5% -7.1 degree) entry and exit angle.

EXPLANATORY NOTES

E3.6 Private driveways

In areas serviced by reticulated water, where the road speed limit is not greater than 70 km/h, and where the distance from the public road to the further part of the habitable building is no greater than 70 metres, emergency service vehicles typically operate from the street frontage.

In the event the habitable building cannot be reached by hose reel from the public road, then emergency service vehicles will need to gain access within the property. Emergency service vehicles will also need to gain access within the property, where access to reticulated water (fire hydrants) is not possible. In these situations, the driveway and battle-axe (if applicable) will need to be wide enough for access for an emergency service vehicle and a vehicle to evacuate.

Turnaround areas should be available for both conventional two-wheel drive vehicles of residents and Type 3.4 fire appliances. Turn-around areas should be located within 30 metres of habitable buildings. Circular and loop driveway design may also be considered.

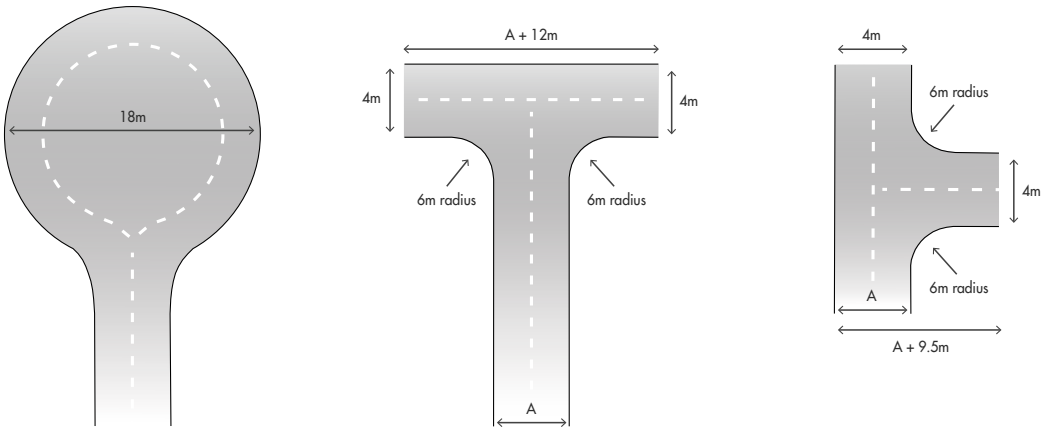


Figure 28: Design requirements for a turn-around area for a private driveway or battle-axe

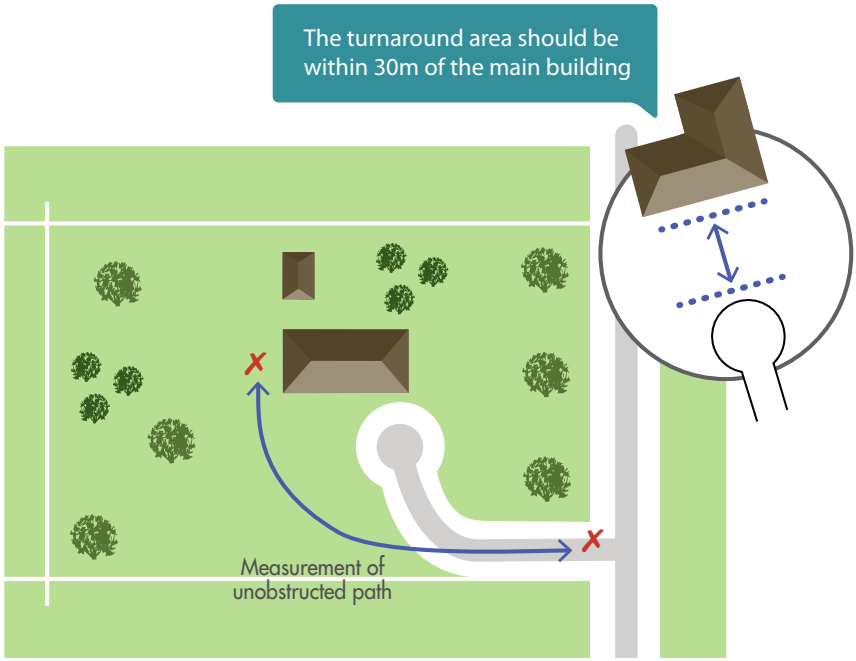


Figure 29: Design requirements for a private driveway where required under A3.6



SCHEDULE 2: WATER SUPPLY DEDICATED FOR BUSHFIRE FIREFIGHTING PURPOSES

2.1 Water supply requirements

Water dedicated for firefighting should be provided in accordance with Table 7 below, and be in addition to water required for drinking purposes.

Table 7: Water supply dedicated for bushfire firefighting purposes

PLANNING APPLICATION	NON-RETICULATED AREAS
Development application	10,000L per habitable building
Structure Plan / Subdivision: Creation of 1 additional lot	10,000L per lot
Structure Plan / Subdivision: Creation of 3 to 24 lots	10,000L tank per lot **or** 50,000L strategic water tank
Structure Plan / Subdivision: Creation of 25 lots or more	50,000L per 25 lots or part thereof Provided as a strategic water tank(s) or 10,000L tank per lot

2.2 Technical requirements

2.2.1 Construction and design

An above-ground tank and associated stand should be constructed of non-combustible material. The tank may need to comply with AS/NZS 3500.1:2018.

Below ground tanks should have a 200mm diameter access hole to allow tankers or emergency service vehicles to refill direct from the tank, with the outlet location clearly marked at the surface. The tank may need to comply with AS/NZS 3500.1:2018. An inspection opening may double as the access hole provided that the inspection opening meets the requirements of AS/NZS 3500.1:2018. If the tank is required under the BCA as part of fire hydrant installation, then the tank will also need to comply with AS 2419.

Where an outlet for an emergency service vehicle is provided, then an unobstructed, hardened ground surface is to be supplied within four metres of any water supply.

2.2.2 Pipes and fittings

All above-ground, exposed water supply pipes and fittings should be metal. Fittings should be located away from the source of bushfire attack and be in accordance with the applicable section below, unless otherwise specified by the local government.

2.2.2.1 Fittings for above-ground water tanks:

- Commercial land uses: 125mm Storz fitting; or
- Strategic water tanks: 50mm or 100mm (where applicable and adapters are available) male camlock coupling with full flow valve; or
- Standalone water tanks: 50mm male camlock coupling with full flow valve; or
- Combined water tanks: 50mm male camlock coupling with full flow valve or a domestic fitting, being a standard household tap that enables an occupant to access the water supply with domestic hoses or buckets for extinguishing minor fires.

2.2.2.2 Remote outlets

In certain circumstances, it may be beneficial to have the outlet located away from the water supply. In such instances in which a remote outlet is to be used, the applicant should consult the local government and DFES on their proposal.

Appendix 4
Environmental Noise Assessment

Confidential

CARGILL

GOLDEN CRUX PROJECT
EAST ROCKINGHAM
CANOLA PROCESSING FACILITY

ENVIRONMENTAL NOISE ASSESSMENT

JUNE 2024

OUR REFERENCE: 32837-1-24050

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
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DOCUMENT CONTROL PAGE

ENVIRONMENTAL NOISE ASSESSMENT

GOLDEN CRUX PROJECT

Job No: 24050

Document Reference: 32837-1-24050

FOR

CARGILL

DOCUMENT INFORMATION			
Author:	Paul Daly	**Checked By:**	Tim Reynolds
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EXECUTIVE SUMMARY

Ramboll, on behalf of Cargill commissioned Herring Storer Acoustics to carry out an acoustic study of noise emissions for a proposed Canola Processing Facility (Golden Crux Project) located in East Rockingham.

Cargill proposes to construct and operate the Canola Facility at Lot 108 Patterson Road, East Rockingham in the City of Rockingham.

This acoustic assessment is required for the approval process and is being undertaken prior to the final design of the plant being known. Whilst the plant design is undergoing final consideration, for the purpose of the predictive noise modelling, the current design has been used as a basis for the assessment.

The nearest noise sensitive premises (R1 Caravan Park) is situated approximately 550m to the west of the proposed plant. The worst-case noise receiver (minimal influencing factor) is located 1500m to the west of the proposed plant.

For the most stringent time period (night) the assigned L_{A10} noise level is 35 to 45 dB(A) depending on the location. The highest predicted noise emissions for the nearest noise sensitive premise was 36 dB(A). This includes all noise sources associated with the facility, including transport operations, as there may be deliveries or transport of product during this night time period.

The operating scenarios consider all noise sources from the proposed facilities operating at the same time. The calculated noise levels have been assessed under the highest night-time propagation weather conditions. Given this, the noise modelling would be considered conservative, as it is unlikely that all noise sources are operating at the same time under the worst-case propagation conditions.

The acoustic assessment shows that in the worst case, that noise received at a premise is below the assigned noise level. Thus, noise emissions from the proposed Cargill Golden Crux Facility would be deemed to comply with the requirements of the Regulations.

Additionally, as the assessable noise level emissions from the facility range from 5 to 9 dB(A) below the assigned noise level, the Golden Crux Facility would not be considered as significantly contributing to the noise level at the noise sensitive premises.

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1.	INTRODUCTION	1
2.	ACOUSTIC CRITERIA	2
3.	MONITORED AMBIENT NOISE	3
4.	METHODOLOGY	4
5.	RESULTS	6
6.	ASSESSMENT	6

APPENDICES

A	Location Plan Plant Layouts
B	Noise Contour Plots
C	Monitoring Data (To Be Updated)

1. INTRODUCTION

Ramboll, on behalf of Cargill commissioned Herring Storer Acoustics to carry out an acoustic study of noise emissions for a proposed Canola Processing Facility (Golden Crux Project) located in East Rockingham.

Cargill seeks to build a 2000 tonnes per day (tpd) canola crush plant adjacent to the CBH Kwinana Grain Terminal. The project would receive oilseeds by rail and some truck delivery. Significant storage capacity of vegetable oil and protein meal will be required on site. The processing facility will include a solvent extraction plant and is proposed to store on site up to 200mt of the solvent hexane. Cargill advises that some infrastructure and facilities may be shared with CBH, however the details of this are not available at the time of writing this report.

The proposed facility will be a purpose-built from new equipment with the components of the canola crushing plant comprising of the following components:

- Canola truck logistics facilities (seed silos).
- Canola processing, with the solvent Hexane.
- Meal storage & loading out facility.
- Crude degummed canola oil storage & loading out (oil pipe to the jetty).
- Natural gas or biomass steam boiler.
- Wastewater treatment plant.
- Compressed air station.
- Firefighting facilities.
- Weigh bridges.
- Switchgear station & MCC room.
- Buildings including offices, laboratory, maintenance facilities, other utilities, and truck parking areas.

The nearest noise sensitive premises (R1 Caravan Park) is situated approximately 550m to the west of the proposed plant. The worst-case noise receiver (minimal influencing factor) is located 1500m to the west of the proposed plant.

The Figure 1.1 shows the overall location plan for the Project.



FIGURE 1.1 – LOCATION PLAN

This report assesses night-time (worst case) noise emissions under maximum propagation conditions for the processing plant for compliance with the requirements of the Western *Australian Environmental Protection (Noise) Regulations 1997* (WA) *(the Noise Regulations)*.

2. ACOUSTIC CRITERIA

The criteria used is in accordance with the *Environmental Protection (Noise) Regulations 1997.* These regulations stipulate maximum allowable external noise levels that can be received at one premises from another premises. For the highly sensitive area of a noise sensitive premises the allowable noise levels are determined by the calculation of an influencing factor. The influencing factor is calculated for the usage of land within the two circles, having radii of 100m and 450m from the premises of concern. For other premises (ie commercial and industrial premises), including other areas of a noise sensitive premises, the allowable noise levels are fixed. Table 2.1 lists the baseline assigned noise levels for highly sensitive areas of a noise sensitive premises and the allowable noise levels for other premises.

TABLE 2.1 – ASSIGNED OUTDOOR NOISE LEVELS

Type of premises receiving noise	Time of day	Assigned level (dB)		
		$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
Noise sensitive premises: highly sensitive area (i.e within 15m of a dwelling)	0700 to 1900 hours Monday to Saturday	45 + IF	55 + IF	65 + IF
	0900 to 1900 hours Sunday and public holidays	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + IF	45 + IF	55 + IF
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.
IF = Influencing Factor

It is a requirement that noise from the site be free of annoying characteristics (tonality, modulation and impulsiveness) at other premises, defined below as per Regulation 9.

Where the above characteristics are present and cannot be practicably removed, the following adjustments are made to the measured or predicted level at other premises.

TABLE 2.2 – ADJUSTMENTS FOR ANNOYING CHARACTERISTICS WHEN MUSIC IS NOT PRESENT

Where tonality is present	Where modulation is present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB

The key receptors have been identified, as shown below, with the locations shown on Figure 2.1. These are typically locations within 100m from land classified as Industrial or Commercial (Type A or B) under the Noise Regulations as well as those outside the 450m land use circle. This provides both the closest in terms of distance to the project, as well as the most critical in terms of most stringent assigned noise level.

TABLE 2.3 – KEY RECEPTORS

Receptor	Assigned Noise Level dB(A) 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays
R1 –Caravan Park	45
R2 – Closest Residential Premise	42
R3 – Residence located 100m or greater from Industrial Land Use	38
R4 – Residence located 450m or greater from Industrial Land Use	35

The most critical assessment parameter is the L_{A10} noise level 'assigned level' at the respective receptor locations.



FIGURE 2.1 – RESIDENTIAL RECEIVER LOCATION MAP

3. MONITORED AMBIENT NOISE

As per the "Draft Guidelines on Environmental Noise for Prescribed Premises" (released in May 2016), continuous noise monitoring has been planned for this site, to establish the ambient noise levels.

At this stage of the project, this has been unable to be undertaken due to land access issues. However, ambient noise monitor will be undertaken prior to final submissions and the results included.

4. METHODOLOGY

Noise immissions[1] at the nearest neighbouring residential premises, due to noise associated with the proposed operations, were modelled using the computer programme SoundPlan. Sound power levels used for the noise modelling were based on both manufacturer data and measured sound pressure levels of similar equipment proposed for use on site.

This acoustic assessment is required for the approval process and is being undertaken prior to the final design of the plant being known. Whilst the plant design is undergoing final consideration, for the purpose of the predictive noise modelling, the current design has been used as a basis for the assessment.

The design configuration for the plant is contained in Appendix A. The sound power levels for individual equipment is shown in Table 4.1.

The modelling of noise levels has been based on noise sources and sound power levels shown in Figure 4.1 and Table 4.1.

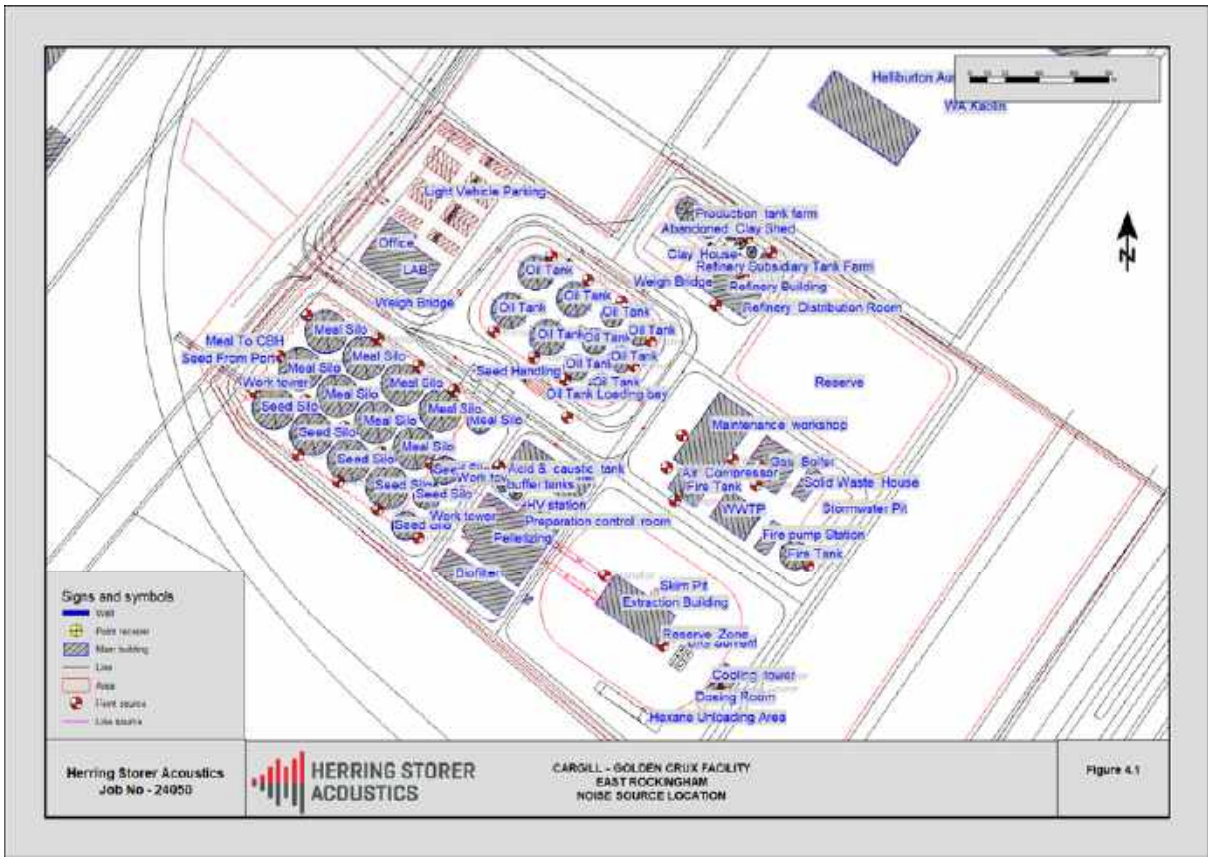


FIGURE 4.1 – GOLDEN CRUX FACILITY SOURCE LAYOUT

1 Immissions – noise received at a source
2 Emissions – noise emanating from a source and / or location

TABLE 4.1 – SOUND POWER LEVEL - NOISE SOURCES dB(A)

Noise Sources	Sound Power Level dB(A)	Comments
Canola Conveying/Storage/Receiving	98	Truck
Preparation Building	85 @1m SPL	External Noise Level from Façade
Extraction Building	89 Transfers 79 per metre Conveyors	Transfer and Conveyors
U/G Solvent	84	Pump
Hexane Unloading Area	98	Truck
Extraction Cooling Tower	96	2x Towers
Meal Silo & Work Tower	84	15x Pump / Extractors
Meal Loading Building	98	Truck
Biofilter system	85 @1m SPL	External Noise Level from Façade
Refinery Building	85 @1m SPL	External Noise Level from Façade
Refinery Subsidiary Tank Farm	84	4x Pumps
Oil Loading Bay	98	Truck
Oil Tanks Farm	84	10x Pumps
Office Building	-	-
Lab	-	-
Maintenance workshop	105	Open Doors
Truck Parking Lot	98	Truck
Biomass Steam Boiler	90 @1m SPL 90 @1m SPL	Stack (12m) External Noise Level from Façade
WWTP & Stormwater Pit	84	2x Pumps
HV Station	90	Transformer
Utility Station(Compressors)	85 @1m SPL	External Noise Level from Façade
Weight Bridge & Sampling House	98	Truck
Solid Waste House	85 @1m SPL	External Noise Level from Façade
Fire Tank	84	Pump
Dosing Room	-	-
Pelletizing	85 @1m SPL	External Noise Level from Façade
Seed Handing	98	Truck
Biomass Fuel Storage	84	Pump
Biomass Ash Treatment	85 @1m SPL	External Noise Level from Façade

Based on noise emissions from the above equipment, the following operating scenario was developed:

SCENARIO 1
Night operations (24 Hour)
Canola Plant
Transport in and out of site
Loading and unloading

It is noted, that for the scenarios considered, all equipment has been assumed to be operating at the same time.

The following input data was used in the calculations:

a) Provided site layouts.
b) Sound Power Levels as listed.
c) Ground contours and receiver points provided by client.

Weather conditions for modelling were as stipulated in the Environmental Protection Authority's "*Draft Guidance for Assessment of Environmental Factors No. 8 - Environmental Noise"* as listed in Table 4.3.

TABLE 4.3 – WEATHER CONDITIONS

Condition	Night	Day
Temperature	15°C	20°C
Relative humidity	50%	50%
Pasquill Stability Class	F	E
Wind speed	3 m/s*	4 m/s*

* From sources, towards receivers.

It is noted that 'worst case' wind conditions refer to conditions where there is a temperature inversion in conjunction with light winds in the direction from noise source to receiver, resulting in the highest sound propagation towards receiver locations.

5. RESULTS

A summary of the calculated noise levels for scenarios are shown in Table 5.1.

TABLE 5.1 – CALCULATED NOISE LEVELS, L_{A10} dB(A)

Receiver Name	Scenario 2 – Night Operations
R1	36
R2	34
R3	32
R4	30

Noise contour plots for the above scenarios are included in Appendix B.

6. ASSESSMENT

It is assumed that during the night period, the operational noise when received at the neighbouring premises will not have a 'tonality' characteristic, due to the distance, and the noise levels approaching the existing background noise level (based on the ambient noise monitoring to be conducted). Hence noise characteristics such as tonality, would not be applicable. At noise emission levels of around 30 dB(A) it will generally be the case that the noise emission level is low enough that the influence of background noise will result in the noise emission not being 'technically tonal', although that does not mean that some characteristics would not be audible.

Based on this, Table 6.1 contain the applicable adjustments, with Table 6.3 showing the assessable noise levels.

TABLE 6.1 – SCENARIO 1 - APPLICABLE ADJUSTMENTS AND ASSESSABLE LEVEL OF NOISE EMISSIONS, L_{A10} dB(A) NIGHT OPERATIONS

Noise Measurement Location	Calculated Noise Level Scenario 1 Day Time L_{A10}	Applicable Adjustments to Measured Noise Levels, Characteristics			Assessable Noise Level
		Where Noise Emission is NOT music			
		Tonality	Modulation	Impulsiveness	
R1	36	-	-	-	36
R2	34	-	-	-	34
R3	32	-	-	-	32
R4	30	-	-	-	30

TABLE 6.3 – ASSESSMENT OF NOISE LEVELS

Scenario	Receiver	Assessable Noise Level, dB(A)	Applicable Times of Day	Applicable L_{A01} Assigned Noise Level (dB)	Exceedance to Assigned Noise Level L_{A01} (dB)
Night Time	R1	36	Night (22:00 to 07:00)	45	Complies
	R2	34		42	Complies
	R3	32		38	Complies
	R4	30		35	Complies

For the most stringent time period (night) the assigned noise level is 35 to 45 dB(A) dependant on location. The highest predicted noise emissions for the nearest noise sensitive premise was 36 dB(A). This includes all noise sources associated with the facility, including transport operations, as there ~~will~~ may be deliveries or transport of product during this time period.

The operating scenarios consider all noise sources from the proposed facilities operating at the same time. The calculated noise levels have been assessed under the highest night-time propagation weather conditions. Given this, the noise modelling would be considered conservative, as it is unlikely that all noise sources are operating at the same time under the worst-case propagation conditions.

The acoustic assessment shows that in the worst case, that noise received at a premise is below the assigned noise level. Thus, noise emissions from the proposed Cargill Golden Crux Facility would be deemed to comply with the requirements of the Regulations.

Additionally, as the assessable noise level emissions from the facility range from 5 to 9 dB(A) below the assigned noise level, the Golden Crux Facility would not be considered as significantly contributing to the noise level at the noise sensitive premises.

APPENDIX A

LOCATION PLANS

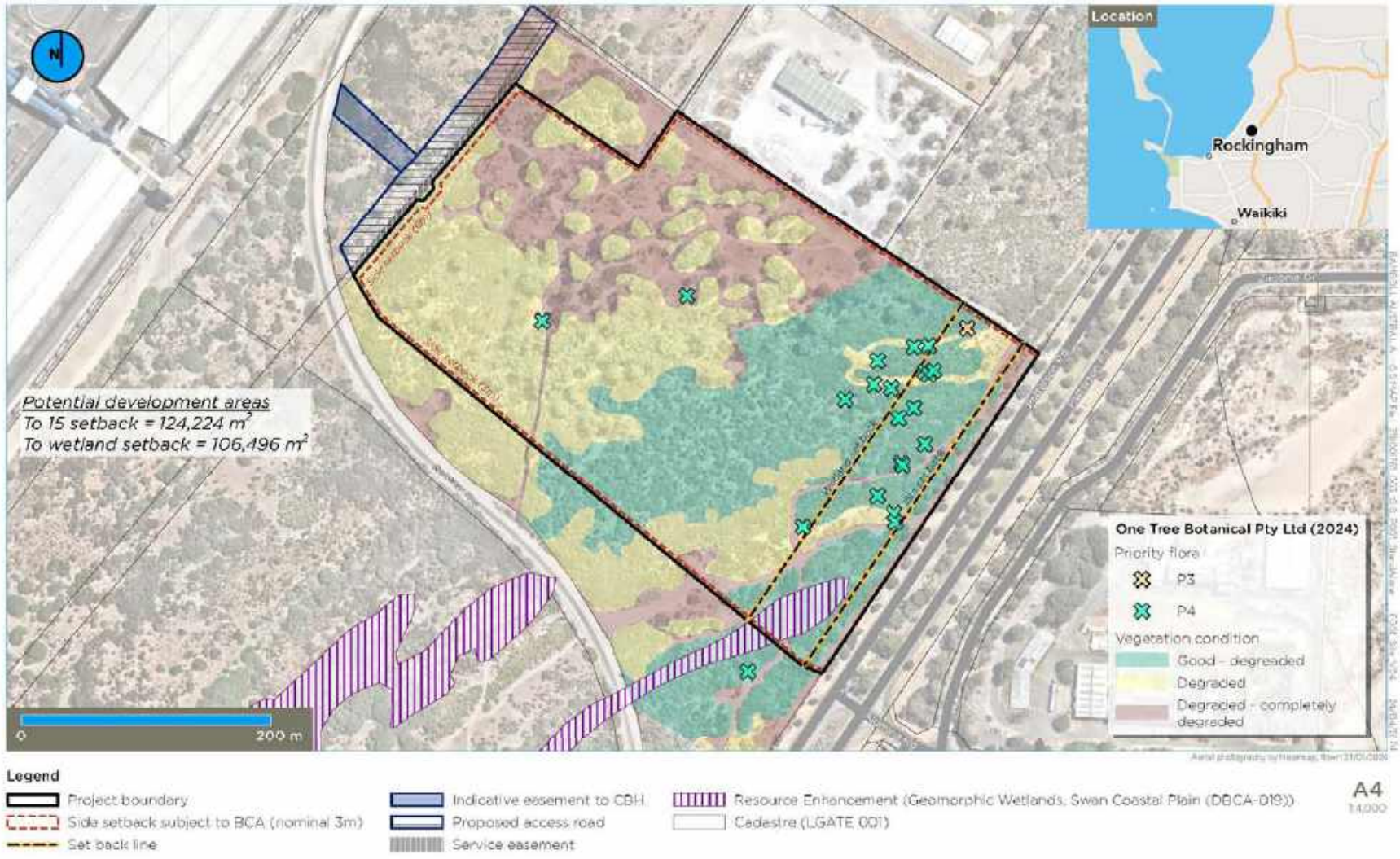
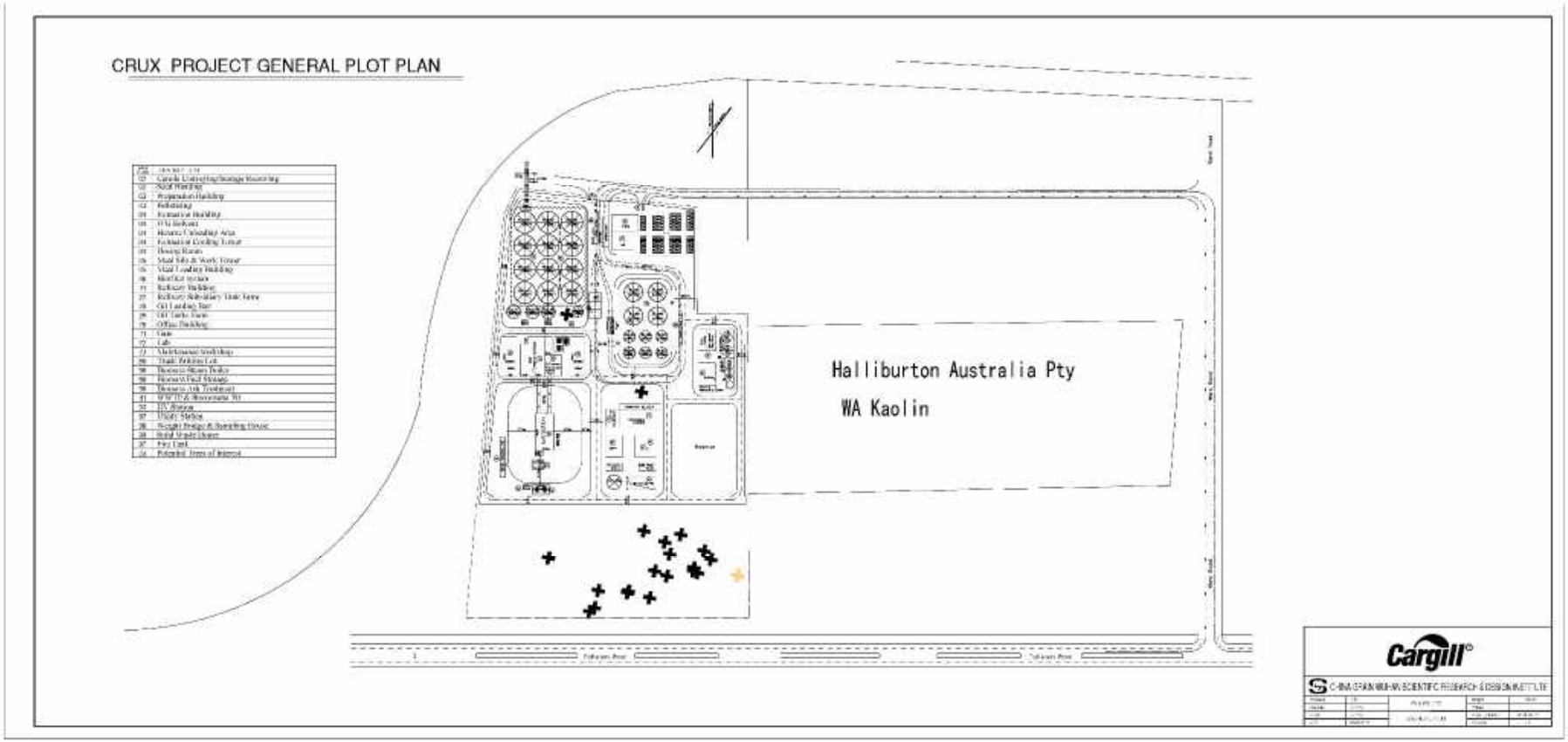


Figure 1: Site overview


CRUX PROJECT GENERAL PLOT PLAN
Halliburton Australia Pty
WA Kaolin
Cargill

APPENDIX B

NOISE CONTOUR PLOTS


HERRING STORER ACOUSTICS
Noise Level dB(A)
30
35
40
45
50
55
60
65
N
R1 (Caravan park) [45]
R2 [42]
R3 [38]
R4 [35]
Signs and symbols
Wall
Point receiver
Main building
Line
Area
Point source
Line source
Herring Storer Acoustics
Job No - 24050
Golden Crux Facility
Night Time Conditions
Worst Case Operating Noise Level Contour
Figure B1
Ref # 002

APPENDIX C

MONITORED DATA

TO BE UPDATED

Appendix 5
Flora and Vegetation Assessment

Confidential

CARGILL CRUX PROJECT ROCKINGHAM

Detailed Flora and Vegetation Survey






Prepared for Ramboll Australia Pty Ltd

MARCH 2024

ONE TREE
BOTANICAL

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MAYLANDS WA 6931
Phone: (08) 9371 9491
ABN: 15 159 204 976

Project: P2307 Cargill Crux Rockingham - Flora and Vegetation Survey

Version History:

Draft V1.0 (**Issued**: 13th February 2024 **Prepared by:** KM **Reviewed by:** JB
Final V1.1 (**Issued**: 25th March 2024 **Prepared by:** KM **Reviewed by:** JB

We respectfully acknowledge the Traditional Custodians of the land on which this survey was conducted, the Whadjuk people of Noongar Boodjar, their Elders past, present and emerging, and recognise their continued connection to the land and waters of this place.

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1. SUMMARY

The study area is located within Rockingham Industrial Zone (RIZ) (Figure 1). It is currently owned and managed by Development WA (formerly Landcorp). Cargill Australia Limited proposes to build an oilseed processing plant on the site, known as the Cargill Crux Project.

Ramboll Australia Pty Ltd engaged One Tree Botanical Pty Ltd to complete a Flora and Vegetation Survey in line with Environmental Protection Authority (EPA, 2016) guidelines. With particular emphasis on establishing whether the *'Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain (SCP)'* Threatened Ecological Community (TEC) was present.

This report presents the findings of this survey.

A total of 129 taxa were recorded during the survey, of which 54 or 41.9% were natives. The 129 taxa represented 40 different plant families and 109 plant genera.

Of the 54 native flora species, 35 were flora of 'other' conservation significance (EPA, 2016). This is high and these were mostly species representative of their range (range extents and extensions).

Two Priority Flora were recorded during the survey; Priority 3 grass *Austrostipa mundula* and Priority 4 forb *Conostylis pauciflora* subsp. *pauciflora* (Dawesville Conostylis).

Seventy-five introduced flora species (weeds) were recorded in the study area. Of those, 29 had a High Impact rating, and of those, 25 were also rated as having Rapid Invasiveness under Swan Region Ecological Impact and Invasiveness criteria (DBCA, 2023a).

Six vegetation types were defined for the study area:

A: QUINDALUP DUNES (BEACH RIDGE PLAINS COMPLEX AND COASTAL DUNES INTERFACE)

A1: Tall Closed to Open Forest *Eucalyptus gomphocephala* (Tuart) over weedy Grassland and Forbland. Occasional native Shrubs to Sparse Shrubland *Acacia rostellifera, Spyridium globulosum* (Basket Bush)*, Xanthorrhoea preissii* (Grasstree). Dry sands over limestone. Good-Degraded, Degraded, Degraded-Completely Degraded.

A2: Low to Tall Closed Shrubland *Acacia rostellifera* (Summer-scented Wattle) thickets over weedy Grassland and Forbland. Isolated native Shrubs and Forbs. Dry sands over limestone at various stages of regrowth. Degraded-Good to Degraded.

A3: Low to Tall Shrubland of *Acacia rostellifera, A. saligna* (Orange Wattle), *Hakea prostrata* (Harsh Hakea) over weedy Grassland and Forbland. Isolated native Shrubs, sedges and Forbs. More open and diverse than A2. Dry calcareous sands over limestone. Good-Degraded to Degraded.

A4: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* (Chenille Honeymyrtle) and *Acacia rostellifera* over weedy Grassland and Forbland. Isolated to Sparse native Shrubs and Forbs. Calcareous sands over limestone, becoming moister. Good-Degraded to Degraded.

A5: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* and/or *Melaleuca rhaphiophylla* (Swamp Paperbark) over Occasional Sedges to Sedgeland *Gahnia trifida* (Coast Saw-sedge) in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.

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A6: Mid Shrubland to Closed Shrubland Grasstrees *Xanthorrhoea preissii* in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.

A seventh category included Degraded-Completely Degraded areas.

The condition of the study area clearly indicated a history of sustained disturbance, resulting in high weed cover and diversity, and a loss of native species diversity. The literature suggests that this disturbance took the form of historical grazing and/or inappropriate fire regimes, with recreational use having an ongoing impact in later years.

Statistical analysis indicated that the study area represented Floristic Community Types (FCTs):

- FCT19: represents commonwealth TEC *'Sedgelands of the Holocene Dune Swales'* (Endangered). Also represents state-listed (Critically Endangered) TEC sub-type *'SCP19b: Woodlands over Sedgelands in Holocene dune swales of the southern SCP (FCT19 as originally described in Gibson et al. 1994)'*. Represented by Vegetation Types A3 (part) to A6 (Figure 3).

- FCT24 represents state-listed PEC (P3) SCP24: *'Northern Spearwood shrublands and woodlands'*.

- FCT30a (non-apex) represents state-listed (Critically Endangered) TEC: *'SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP (FCT30a as originally described in Gibson et al. 1994)'*

- There is also a secondary association with SCP29a: *'Coastal shrublands on shallow sands, southern SCP'* (FCT29a), which is a state-listed PEC (P3).

Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP

Quadrats in *Eucalyptus gomphocephala* (Tuart) Forest (Vegetation Type A1, Figure 3) aligned strongly with FCT24 and FCT30a. Tuart is a component of FCT24 (present in 24% of quadrats in Gibson *et al.,* 1994) and FCT30a (29%). There is a strong and consistent link between study area quadrats (RC02, RC05, RC08, RC10) and Gibson *et al.* (1994) and Keighery *et al*. (2020) FCT24 and FCT30a quadrats at Bold Park, Peppermint Grove, Nedlands, Naval Base, Henderson, Woodman Point, Lake Cooloongup and Garden Island. This constitutes a 30km known range for this vegetation, in a narrow near-coastal band from Bold Park to Rockingham (including estuarine areas of the Swan River).

The Approved Conservation and Listing Advice for *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* (DoEE, 2019) provided the framework for establishing whether this community is protected under the *EPBC Act*.

The *Eucalyptus gomphocephala* (Tuart) Forest present in the study area, fell into the patch size category of 2-5 hectares (DoEE, 2019). Under this category, it marginally qualifies as the *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* TEC, and therefore for protection under the *EPBC Act*.

However, the condition thresholds for this TEC are problematically low in the context of vegetation. There appear to be other considerations for this ecological community e.g. the scarcity of intact examples and their value as fauna habitat. While this site was in the 'Low' condition category (Table 19), it still qualified for TEC status on the basis that quadrats had more than four native species in them. When 30-40 species or more would be expected from moderately intact examples of Tuart vegetation communities on the SCP.

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2. PROJECT

2.1 BACKGROUND

The study area is located within Rockingham Industrial Zone (RIZ). It is zoned 'Industrial' under the Metropolitan Region Scheme (MRS).

Including the core area and access, the study area is approximately 20 hectares in size (Figure 1). It is part of a larger property, 49 Port Road Kwinana Beach, which is 130.7929 hectares in size in total.

The study area is currently owned and managed by Development WA (formerly Landcorp). There is a proposal by Cargill Australia Limited for this site to be developed as an oilseed processing plant, known as the Cargill Crux Project.

2.2 PURPOSE OF SURVEY

Approval was granted in 2011 for 'development' in the RIZ for industrial purposes under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. This approval is valid till 2035. However there are a series of conditions attached to the approval. Including if an 'action' has not been taken within five years of the approval (2011), written agreement is required of the Minister. The Minister also then has the authority under the approval, to reassess the approval if they believe that it is *'necessary or convenient for the better protection of listed threatened species and communities'*. Which opens the door to consideration of new information that has come to light in the interim. There are also audit, compliance and reporting requirements of any 'action' taken, where baseline data would be required.

In the 2011 approval, the focus was on the *'Sedgelands in Holocene Dune Swales'* Threatened Ecological Community (TEC) and Black Cockatoo habitat. Since that time the *'Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the SCP'* TEC has been listed for protected under the *EPBC Act*.

In this context, this study and report aims to provide both more detailed information in the form of a detailed baseline flora and vegetation assessment. And to assess the status of *'Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the SCP'* in the study area.

2.3 SCOPE OF WORKS

To obtain baseline survey data, Ramboll Australia Pty Ltd engaged One Tree Botanical Pty Ltd to complete a Flora and Vegetation Survey in line with Environmental Protection Authority (EPA, 2016) guidelines.

This specifically consisted of:

- Detailed and Targeted Flora and Vegetation Survey, with sampling techniques including Traverses, Quadrats, Relevés, Opportunistic Sampling and Vegetation Condition Rating (EPA, 2016 p. 7).
- A two-phase spring survey (September and October 2023).
- Report including a desktop review of available literature, background, methods and survey results.
- Assessment against the Diagnostic Criteria of the *'Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the SCP'* (DoEE, 2019).
- Data including but not limited to electronic report, photographs and digital mapping including Index of Biodiversity Surveys for Assessments (IBSA) package.

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FIGURE 1

LOCATION MAP OF THE CARGILL CRUX PROJECT ROCKINGHAM STUDY AREA

C:\GIS\Jobs\One Tree Botanical\P2307 - Cargill Rockingham Project\Figures\P2307_F01 Location Map of the Cargill Rockingham Study Area_240321.mxd

3. BACKGROUND

3.1 LAND USE HISTORY

There is little information available on the historic land uses for this specific area.

Historical aerial photography indicated that some kind of clearing or thinning of vegetation had occurred at some points, but the nature of it was unclear.

Very large and old specimens of *Eucalyptus gomphocephala* (Tuart) with some trunks over 1.4m diameter at breast height (DBH) and over 20m in height were present in the study area. There were also Tuarts at different stages of growth, many with a DBH of approximately 40cm as well as many saplings with DBH 10-15cm (See Appendix D).

There were also large old *Melaleuca rhaphiophylla* (Freshwater Paperbarks) (Plate 13), *Banksia littoralis* (Swamp Banksia) and *Xanthorrhoea preissii* (Grasstrees) with large trunks (Plate 15). Grasstree trunks are thought to grow between 2cm a decade and 1-2cm per year depending on different opinions, and some had trunks of at least 1m.

This all indicates that clearing wasn't wholesale and was more likely to be in the style of grazing and/or frequent fires, where the understorey is affected, but many overstorey species remain.

DEC (2011) states that the beach ridge plains of the Rockingham and Becher Plains, of which the study area is a part, were used for grazing of horses and cattle in the early days of settlement.

In recent times, there has been significant use by people camping and living onsite. Most of these camps have been removed in recent years, however there are still some small and relatively recent ones in very thick inaccessible parts of the vegetation. There are signs that it has also been used for recreation. Rubbish dumping was widespread, including garden and domestic and construction waste. Informal tracks are extensive throughout the site, particularly through the areas of Tuart Forest (Vegetation Type A1, Figure 3).

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3.2 CLIMATE AND SEASONAL CONDITIONS

There are no long term and open Bureau of Meteorology (BoM) weather recording stations nearby to the study area. Therefore Rockingham Post Office (Site No. 009036) rainfall data was used for the long term mean and Garden Island (Site No. 009256) was used for 2023.

The mean annual rainfall for Rockingham Post Office between 1898 when records first began and 1994 when the station closed, was 817mm (BoM, 2024). The lowest annual rainfall recorded for that period was 466mm in 1994, and highest 1213mm in 1955. The mean annual rainfall between 1961 and 1990 was 801mm. The lowest for that period was 545mm in 1977 and highest 1059mm in 1963.

In the months prior to the survey (April to September) 476mm of rain was recorded. Rainfall was sporadic however and there were dry periods through the growing period, particularly in August and October (Figure 2).

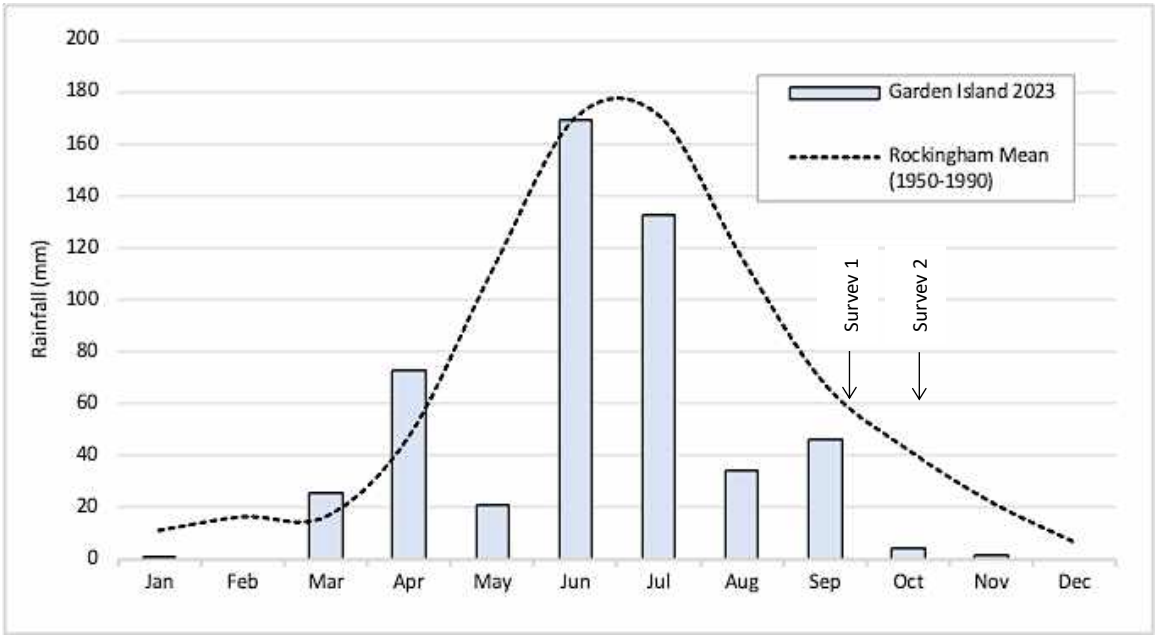


Figure 2: Rainfall Garden Island (BoM Site No. 009256) 2023 to November.

3.3 BIOREGIONAL CONTEXT

The following provides very broad contextual information only.

3.3.1 IBRA Regions and Sub-Regions

The survey area is in the Interim Biogeographical Regionalisation of Australia (IBRA) region of Swan Coastal Plain (SCP). It is within the sub-region SWA02: Perth (Thackway and Cresswell, 1995).

The Biodiversity Audit of Western Australia Bioregional Summary of SWA02: Perth (DCLM, 2002) describes the relevant section of the SCP as:

> *"The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia and Jarrah- Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials. Includes a complex*

series of seasonal wetlands and includes Rottnest, Carnac and Garden Islands etc. Rainfall ranges between 600mm and 1000mm annually and the climate is Mediterranean. The subregional area is 1,333,901ha."

It is described as having a *'High Species and Ecosystem Diversity and a large number of rare and threatened species and Ecological Communities'*.

The condition of the bioregion is described as:

> *"In many of the smaller reserves (<100ha) understorey species composition is often depauperate and in a degraded state resulting from grass and other weed invasion (however some small reserves, including those on the heavy soils of the eastern coastal plain are able to retain the majority of the original species), grazing impacts (including from kangaroos) and too frequent fires. Fire regimes based on biodiversity outcomes are generally absent, deliberately lit wildfires can and do occur frequently depending on the proximity of the reserve to urbanisation. Formalised biodiversity monitoring programs are absent."* (DCLM, 2002).

Threats are listed as clearing and fragmentation, grazing, feral predators, weeds, inappropriate fire regimes, diseases, changes to hydrology and recreational use.

3.3.2 Vegetation Survey of Western Australia (Beard, 1979)

The study area is in the Rockingham System as mapped by DPIRD (2021) (as modified from Beard, 1979).

The Rockingham System is the section of the Quindalup Dunes south of Fremantle (north of Fremantle becomes the Guilderton System). Beard describes the Rockingham System as including Rottnest, Carnac, Garden Islands and the coastal strip of vegetation from Fremantle southwards. This coastal strip is mostly only a few hundred meters wide, however it is at its widest in the area that includes Rockingham where it extends nine kilometres inland. The study area is just north of here, where the Rockingham System is four kilometres wide. The study area is 600m from the coastline at its closest point (Kwinana and Rockingham Beaches).

Table 1: Vegetation Associations (Beard, 1979, as amended)

Veg. Assoc.	Name	Vegetation (Shepherd *et al*., 2002)	Vegetation (Beard, 1979)	Extent and Reservation (Govt. of WA, 2019)
18	ROCKINGHAM_3048	Mixed heath with scattered tall shrubs Acacia spp., Proteaceae and Myrtaceae.	**xSZc** Scrub-heath on dunes	Originally 14,575 ha with 4,184 ha (28.7%) remaining. 19.2% reserved.

Extent figures do not fully take into account the condition of the remaining areas. It is likely that the amount of vegetation in Very Good or better condition is significantly less than these figures indicate. Vegetation Type is a broad categorisation made up of rarer sub-types, few of which have detailed data on how much remains. Govt. of WA (2019) data was also approximately five years old at the time of publication.

Many plant groups described below have undergone taxonomic reviews since 1979. The current names are provided in brackets.

Beard (1979) states that in the Rockingham System (including Rottnest and Garden Islands) *Callitris preissii-Melaleuca lanceolata* communities are the climax community to *Acacia rostellifera* thickets. He states on the mainland, that inland from the primary and secondary coastal dunes, the climax community is probably *Callitris preissii* low forest, but that there were at the time only isolated remnants, and that *Acacia*

rostellifera thickets were now the most common community. This has relevance to the findings for the vegetation in the study area.

Other species he described as typically present included *A. cochlearis, A. cyclops, Melaleuca huegelii* and *Dodonaea aptera*. He stated that two creepers *Clematis microphylla (linearifolia)* and *Hardenbergia comptoniana* are common. *Agonis flexuosa* is described as being present and at the northern extent of its range.

Beard goes on to describe the Rockingham System as built up out of beach ridges rather than wind-blown dunes. Frequently referred to as beach ridge plains. It is described as having a distinct vegetation, described as *'scrub heath for want of a better term'*. He states that it is much disturbed by fire and grazing. The most commonest species on these beach ridges are given as *Xanthorrhoea preissii* and *Acacia cyanophylla (saligna)*, with other species including those listed above; *A. cochlearis, A. cyclops, Melaleuca huegelii, Dodonaea aptera, Clematis microphylla (linearifolia), Hardenbergia comptoniana* and *Agonis flexuosa*.

3.3.3 Vegetation Complexes

According to 1:250,000-scale vegetation mapping by Heddle *et al.* (1980), the survey area is in Vegetation Complex 49: Quindalup Dunes.

Heddle *et al.* (1980) described the vegetation as consisting of mainly two alliances, the strand and foredune vegetation adjacent to the ocean, and the mobile and stable dune. The latter is most relevant to the study area and it is described as *Acacia cyclops, Anthocercis littorea, Lepidosperma gladiatum, Myoporum insulare, Nitraria schoeberi (billardierei), Olearia axillaris, Scaevola crassifolia, S. nitida, Spyridium globulosum, Westringia rigida* and *Wilsonia backhousei*. It also describes other local variations including *Eucalyptus foecunda, Pittosporum phillyreoides, Santalum acuminatum, Exocarpos sparteus* and *Acacia rostellifera*. Including a low closed forest of *Melaleuca lanceolata-Callitris preissii*.

Govt. of WA (2019) describe Quindalup Complex as:

> *'a coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of Melaleuca lanceolata (Rottnest Teatree) - Callitris preissii (Rottnest Island Pine), the closed scrub of Acacia rostellifera (Summer-scented Wattle) and the low closed Agonis flexuosa (Peppermint) forest of Geographe Bay'*.

The original total extent of Quindalup Complex on the SCP was 54,573.87ha, of which 33,011.64ha or 60.94% remains (Govt. of WA, 2019). With nine percent of the original extent protected within reserves.

The original extent of Quindalup Complex in the Perth Metropolitan Region (PMR) was 24,468.87ha of which 10,412.76ha or 42.65% remain. 4.6% of the original complex is protected within reserves within the PMR boundary.

The original extent of Quindalup Complex within the City of Rockingham was 11,061.73ha, of which 4,129.76ha or 37.33% remains. Of the original extent of this complex, 20.27% was within the City of Rockingham (Of the 15 LGAs that contain this complex, only the Shire of Gingin had more at 30.11%). The City of Kwinana to the north had 2.36%. Approximately 7.57% of what remains of this vegetation complex, is located within the City of Rockingham.

These figures do not take into account fully the condition of the remaining areas. It is likely that the amount of vegetation in Very Good or better condition is significantly less than these figures indicate. Near-coastal plant communities are vulnerable to degradation and weed invasion. A vegetation complex is a broad

vegetation categorisation made up of many rarer sub-types, few of which have detailed data on remnant status. Govt. of WA (2019) data was also approximately five years old at the time of publication.

3.3.4 Floristic Survey of the Southern Swan Coastal Plain (Gibson *et al.,* 1994)

Gibson *et al.* (1994) documented a series of flora and vegetation surveys that were completed on the southern SCP in the early 1990's. The study used scientific (phytosociological) quadrat-based methodology, completing 509 quadrats between Seabird and the Whicher Range near Busselton. This data was then analysed to determine the types of vegetation and patterns of distribution across the region. They referred to their vegetation types as Floristic Community Types (FCTs).

The data analysis completed by Gibson *et al.* (1994) was based on floristic composition alone rather than taking structure into account. The rationale for this was that using floristics is more appropriate for large datasets i.e. at a bioregional scale.

Since that time FCTs have been used to define and inform Western Australian and Commonwealth listings of Priority (PECs) and Threatened (TECs) Ecological Communities on the SCP.

Gibson *et al.* (1994) identified seven FCTs occurring on the Quindalup Dunes, these were:

WETLANDS

FCT19 Sedgelands on Holocene Dune Swales
FCT17 *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands (also on Spearwood Dunes)

DRYLANDS

FCT29a Coastal shrublands of shallow sands.
FCT29b *Acacia* shrublands on taller dunes.
FCT30a *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands.
FCT30b Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodland.
FCT30c Other mallees and scrubs (also on Spearwood Dunes).

Two FCTs they assigned to the Spearwood Dunes have relevance to this study; *'FCT24: Northern Spearwood shrublands and woodlands'* and *'FCT25: Southern E. gomphocephala-Agonis flexuosa woodlands'*.

All these FCTs (apart from FCT30c, which is a poorly defined) represent state and/or commonwealth listed PECs and TECs. FCT30c was later reassigned to FCT30c2: *'Woodlands and shrublands on Holocene dunes'*.

The authors themselves were aware that 509 quadrats over the large geographical area involved, was not comprehensive enough to adequately define the vegetation fully. The study was meant to be a starting point to build on a more comprehensive bioregional dataset. The Quindalup Dunes particularly were not well sampled by Gibson *et al.* (1994). Keighery *et al.* (2020) attempts to remedy this, boosting the dataset to 1,163 quadrats, including more data from the Quindalup Dunes. This is still low for the area involved, and some of these are relevés rather than quadrats. A lack of a more comprehensive bioregional quadrat database has ongoing consequences for fully identifying poorly represented vegetation types on the SCP.

The Keighery *et al.* (2020) study does identify additional FCTs for the Quindalup Dunes and these are:

S11 Northern *Acacia rostellifera-Melaleuca acerosa (systena)* shrublands.
S12 Rottnest Island *Melaleuca lanceolata* and/or *Callitris preissii* forests and woodlands.
S13 Northern *Olearia axillaris-Scaevola crassifolia* shrublands.
S14 *Spinifex longifolius* grassland and low shrublands.

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3.4 DATABASE SEARCH RESULTS

3.4.1 Priority and Threatened Flora

The DBCA Threatened Species and Communities Branch species database search did not identify any records of state listed Priority (PF) or Threatened Flora (TF) as being previously known from within the study area boundary.

A search of the *EPBC Act* Protected Matters Search Tool (DCCEEW, 2023) listed 10 Threatened Flora (TF) as potentially occurring in the region. None of these species have previously been recorded from within the study area. The likelihood screening for this tool is less than ideal.

Table 2 summarises the results from both the *EPBC Act* Protected Matters Report and the DBCA Threatened Species and Communities Branch flora database search, and identifies the likelihood of each occurring within the study area.

Table 2: Threatened and Priority Flora Database Search Results (DBCA & *EPBC Act* Protected Matters Databases)

WESTERN AUSTRALIA	CONSERVATION STATUS*			OCCURRENCE (Known/Likely/Possible/Unlikely)
	Rating	WA	EPBC	
Andersonia gracilis	T	VU	EN	Unlikely on Quindalup Dunes. Wetland, dampland habitat E SCP.
Banksia mimica	T	VU	EN	Unlikely on Quindalup Dunes.. Known from lower lying areas E SCP.
Diuris drummondii	T	EN	VU	Unlikely on Quindalup Dunes. Wetter habitat.
Caladenia huegelii	T	CR	EN	Unlikely on Quindalup Dunes.
Diuris micrantha	T	VU	VU	Unlikely on Quindalup Dunes. Wetter habitat.
Diuris purdiei	T	EN	EN	Unlikely on Quindalup Dunes.
Drakaea elastica	T	CR	EN	Unlikely on Quindalup Dunes.
Drakaea micrantha	T	EN	VU	Unlikely on Quindalup Dunes.
Macarthuria keigheryi	T	EN	EN	Unlikely on Quindalup Dunes.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	CR	CR	Unlikely on Quindalup Dunes.
Thelymitra variegata	T	CR	-	Unlikely on Quindalup Dunes.
Acacia sp. Binningup (G. Cockerton *et al.* WB 37784)	P1			Possible. Record near Lake Cooloongup. Very distinctive, not seen during survey.
Lachnagrostis nesomytica subsp. *paralia*	P1			Possible-Likely. Known only from dune swales Garden Island.
Acacia benthamii	P2			Possible-Unlikely. More common Spearwood Dunes.
Austrostipa mundula	P3			**Recorded during survey.**
Beyeria cinerea subsp. *cinerea*	P3			Possible. Known from shallow near-coastal sands between Two Rocks and Mandurah.
Calandrinia oraria	P3			Possible. Known from near-coastal dunes and limestone, occasionally inland. Guilderton-Mandurah.
Pimelea calcicola	P3			Possible. Near-coastal limestone ridges. Preston-Seabird.
Sphaerolobium calcicola	P3			Possible-Likely. Sand over limestone, interdunal swamps. Preston-Seabird.
Dodonaea hackettiana	P4			Likely. Common between Rockingham and Swan River, on calcareous sand and near limestone.
Eucalyptus foecunda subsp. *foecunda*	P4			Possible to Likely. Relatively common in near-coastal areas between Preston and Jurien Bay. Records in surrounding area. Not seen during survey.
Jacksonia sericea	P4			Possible. 62 records Mandurah to Gnangara. Likes disturbed edges and can be latent in undisturbed vegetation. More commonly on Spearwood Dunes.

** See Section 4 for definitions of conservation status codes. Habitat preference information from WAH (1998-) and DBCA database search results.*

3.4.2 Threatened and Priority Ecological Communities

The DBCA Threatened Species and Communities Branch database search identified 13 Priority (PEC) and/or Threatened (TEC) Ecological Communities within approximately 20km of the study area. A search of the *EPBC Act* Protected Matters Search Tool (DCCEEW, 2023) listed nine TECs as potentially occurring.

Table 3 summarises the results from both database searches and identifies the likelihood of each occurring.

Table 3: TEC and PEC Database Search Results (DBCA & EPBC Protected Matters Databases)

WESTERN AUSTRALIA	COMMONWEALTH *(EPBC Act)*	STATUS*			OCCURRENCE Known/Likely/Possible/Unlikely
		DBCA	*BC Act*	*EPBC*	
Stromatolite like freshwater microbialite community of coastal brackish lakes (Lake Clifton)	Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	-	CR	CR	Unlikely.
Stromatolite like microbialite community of coastal freshwater lakes (Lake Richmond)	Thrombolite (microbial) community of coastal freshwater lakes of the SCP (Lake Richmond)	-	CR	EN	Unlikely.
SCP26a: *Melaleuca huegelii - M. systena* shrublands of limestone ridges (FCT26a)	Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	-	CR	CR	Unlikely.
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the SCP.	Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP.	P3	-	CR	Present however condition of vegetation is extremely marginal.
SCP25: Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT25)	Can be component of Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP.	P3	-	CR	Affiliations in the study area (Section 6.2).
Brackish microbial community No. 1 of a coastal saline lake (Lake Walyungup)		P1	-		Unlikely.
Banksia Dominated Woodlands of the Swan Coastal Plain (SCP) IBRA Region.	Banksia Woodlands of the SCP.	P3	-	EN	Unlikely. Rare on Quindalup Dunes and not present in study area.
SCP19a: Sedgelands in Holocene dune swales of the southern SCP (FCT19)	Sedgelands in Holocene dune swales of the southern SCP.	-	CR	EN	
SCP19b: Woodlands over Sedgelands in Holocene dune swales of the southern SCP (FCT19)	Sedgelands in Holocene dune swales of the southern SCP.	-	CR	EN	Known occurrence of this TEC in the study area.
Subtropical and Temperate Coastal Saltmarsh.	Subtropical and Temperate Coastal Saltmarsh.	P3	-	VU	Unlikely. Habitat not present.
SCP30a: *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the SCP (FCT30a)		-	CR	-	Strong affiliations in the study area. Not present as the climax community (Section 6.2).
SCP24: Northern Spearwood shrublands and woodlands (FCT24).	-	P3	-	-	Strong affiliations in the study area (Section 6.2).)
SCP29a: Coastal shrublands on shallow sands, southern SCP (FCT29a).		P3	-	-	Some affiliations in the study area (Section 6.2).
SCP29b: *Acacia* shrublands on taller dunes southern SCP (FCT29b).		P3	-	-	Weak affiliations in the study area (Section 6.2).

** See Section 4 for definitions of conservation status codes.*

4. LEGISLATION AND GUIDELINES

4.1 ENVIRONMENTAL PROTECTION ACT 1986 WESTERN AUSTRALIA

The *Environmental Protection (EP) Act 1986* is the guiding legislation for Environmental Impact Assessment (EIA) in Western Australia. Formal assessments for projects likely to have significant impacts are completed by the EPA under this legislation.

4.1.1 Environmental Protection *(Clearing of Native Vegetation) Regulations 2004*

The *EP Act* includes the *Clearance of Native Vegetation Regulations 2004* under which clearing permits are required to clear native vegetation. The permit system is administered by either the Western Australian Department of Water and Environmental Regulation (DWER), or for exploration activities, the Department of Mines, Industry Regulation and Safety (DMIRS).

4.1.2 Technical Guidance under the *EP Act 1986*

The EPA's Technical Guidance for Flora and Vegetation Surveys for EIA (EPA, 2016) outlines the supporting information required for flora and vegetation assessments under the *EP Act 1996*.

4.2 *BIODIVERSITY CONSERVATION ACT 2016 - WESTERN AUSTRALIA*

As of January 1st 2019, the *Biodiversity Conservation (BC) Act 2016* replaced the *Wildlife Conservation Act 1950* in Western Australia.

All native flora species are protected under the *BC Act 2016*. Flora cannot be taken without a permit. There are substantially higher and broader ranging penalties under the new act, up to $500,000 for individuals and $2,500,000 for corporate entities for disturbing matters listed under the act, including Threatened species and communities.

Additionally, there are substantial fines to individuals and organisations for failing to report matters of environmental significance.

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4.2.1 Threatened Flora (TF) (Western Australia)

The *BC Act 2016* protects state listed Threatened Flora (TF). The TF list is regularly reviewed with updates published in the Government Gazette and also published on Florabase (WAH, 1998).

Each TF species is also given a rank which is consistent with IUCN Red List criteria (Table 4).

Table 4: Definition of Threatened Flora Species (DBCA, 2019).

T: Threatened species	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). ***Threatened flora*** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below: **CR: Critically Endangered** Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*". **EN: Endangered** Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*". **VU: Vulnerable** Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".
X: Presumed extinct species	**EX Extinct species** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora. **EW Extinct in the wild species** Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

4.2.2 Priority Flora (PF) (Western Australia)

The DBCA maintain a supplementary Priority Flora (PF) list. The status of PF are regularly updated and published on Florabase (WAH, 1998-).

Species on the PF list are not specifically protected under current legislation, however they are closely considered in EIA processes. They are described in EPA (2016) as flora of 'other' conservation significance.

Priority 1 to 3 flora are species that are awaiting assessment for Threatened Flora (TF) status but which do not currently have enough information to enable that assessment. The three categories represent the order of priority for assessment.

Priority 4 species are those species that are adequately known, rare but not threatened and which require regular monitoring.

Table 5 defines the four categories of PF.

Table 5: Priority Flora Conservation Codes and Definitions (DBCA, 2019).

P1: Priority One Poorly-known species	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2: Priority Two Poorly-known species	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3: Priority Three Poorly-known species	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4: Priority Four Rare, Near Threatened and other species in need of monitoring	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

4.2.3 Threatened Ecological Communities (TECs) (Western Australia)

Sixty-five TECs have been gazetted under the *BC Act 2016* as of 26th May 2023. Of which 45 of these are Critically Endangered, 9 are Endangered and 11 are Vulnerable (DBCA, 2023).

Table 6 defines these criteria.

Table 6: Criteria for Western Australian Threatened Ecological Communities (TECs) (*BC Act 2016*)

Collapsed (CO)	An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time: (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover: (i) its species composition or structure; or (ii) its species composition and structure.
Critically Endangered (CR)	An ecological community is eligible for listing in the category of critically endangered ecological community at a particular time if, at that time: (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of endangered ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.
Vulnerable (VU)	An ecological community is eligible for listing in the category of vulnerable ecological community at a particular time if, at that time: (a) it is not a critically endangered ecological community or an endangered ecological community; and (b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.

Recovery plans and interim recovery plans have been developed by DBCA for state listed TECs. These plans are designed to identify the threatening processes most affecting the survival of TECs.

4.2.4 Priority Ecological Communities (PECs) (Western Australia)

In Western Australia, potential TECs that do not meet criteria, are not adequately defined, or do not have adequate information, are added to the PEC List as Priority 1, 2 or 3 (Table 7).

PECs are not specifically protected under current legislation however they are listed in EPA (2016) under 'significant vegetation' and are considered during EIA.

There are 390 PECs listed by the DBCA Threatened Species and Communities Branch (DBCA, 2023).

Table 7: Priority Ecological Communities (PECs) Definitions and Criteria (DBCA, 2023).

Priority One: Poorly-known ecological communities	Communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two: Poorly-known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority Three: Poorly known ecological communities	i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: ii) Communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approx. 10 years), or; iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.	i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five: Conservation Dependent ecological communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

4.3 ENVIRONMENTAL PROTECTION BIODIVERSITY CONSERVATION ACT 1999

Under the Commonwealth *Environmental Protection Biodiversity Conservation (EPBC) Act 1999,* TECs and TF as Matters of National Environmental Significance (MNES) are protected.

4.3.1 Threatened Flora (TF) (Federal)

Commonwealth-listed TF are largely the same species that are listed under the Western Australian *BC Act 2016*. There are six categories of Threatened Flora under the *EPBC Act* (Table 8).

Table 8: Categories of Threatened Flora Species under the *EPBC Act 1999* (IUCN-Equivalent Status)

EX: Extinct	No reasonable doubt that the last member of the species has died.
EW: Extinct in the Wild	Species known only to survive in cultivation, in captivity or as a naturalised population well outside its past range or it has not been recorded in its known habitat in an appropriate season anywhere in its past range despite exhaustive surveys.
CR: Critically Endangered	Species is considered to be facing an extremely high risk of extinction in the wild.
EN: Endangered	Species is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future.
VU: Vulnerable	Species is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future.
CD: Conservation Dependent	Species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered.

4.3.2 Threatened Ecological Communities (TECs) (Federal) (*EPBC Act 1999*)

The Commonwealth *Environmental Protection Biodiversity Conservation Act 1999 (EPBC Act 1999)* provides legislative protection for TECS. Table 9 outlines the criteria for listing of TECs under the *EPBC Act*.

Table 9: Threatened Ecological Communities (TECs) Definitions and Criteria (*EPBC Act* Regulations, 2013).

Critically Endangered (CR)	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered (EN)	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable (VU)	If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

Listing under the *EPBC Act* provides not only protection but also conservation advice, recovery plans, identification of critical habitat and key threatening processes.

4.4 WEEDS

4.4.1 Environmental Weeds

Swan Region Ecological Impact and Invasiveness Rating

DBCA (2023a) is a rating system that provides a way of assessing the environmental threat of the weeds present within native vegetation.

Ecological Impact rating ranges from Low Impact, which refers to a species that causes minimal disruption to ecological processes or loss of biodiversity, to High Impact, which causes acute disruption of ecological processes, alters vegetation structure, composition and function of ecosystems. Examples of impacts include but not limited to changed fire regime, changed nutrient conditions, changed hydrological patterns, changed soil erosion patterns, changed geomorphological processes, changed biomass distribution, changed light distribution, loss of biodiversity, substantially reduces regeneration opportunities of native plants, allelopathic effects.

The Ecological Impact of species within the Region includes four categories:

L Low
M Medium
H High
U Unknown

The Invasiveness Rating refers to the rate of spread of a weed in native vegetation, including factors of establishment, reproduction and long-distance dispersal (>100m). Factors affecting rate of spread include ability to outcompete (light, moisture, nutrients, rapid root growth), sexual or asexual reproduction, need for disturbance to establish. Reproduction factors include time to seeding, seed production, vegetative reproduction. Long-distance dispersal mechanisms include wind, water, animals, human activity.

The Invasiveness of species within the Swan Region includes four categories:

S Slow
M Moderate
R Rapid
U Unknown

The weeds recorded in the study area that were rated High or Medium impact are presented in Table 15.

4.4.2 Biosecurity and Agriculture Management Act 2007 (BAM Act)

This act replaces amongst other related legislation, the *Agriculture and Related Resources Protection Act 1976*, which legislated for the control of Declared Plants in Western Australia (Sandy Lloyd DAFWA, pers. comm.). The *BAM Act* represents the only legally binding requirement for weed control and/or eradication in Western Australia.

Under the *BAM Act 2007* the 'Declared Plants' list has been replaced by the Western Australian Organism List (WAOL). The WAOL is administered by the Western Australian Department of Agriculture and Food (DPIRD, 2023). There are three categories of Declared Pest on the WAOL list (Table 10).

This list is more relevant to agricultural than environmental weeds.

Table 10: Categories of Declared Pest under the *BAM Act 2007* (DPIRD, 2023)

The C1 category (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
The C2 category (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
The C3 category (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area, which currently is free of that pest.

4.4.3 Weeds of National Significance (WONS)

The Weeds of National Significance (WONS) (DoEE, 2019) project was an initiative of the Commonwealth in collaboration with state governments aimed at establishing a national prioritisation process for environmental weeds. Thirty-two species of WONS have been prioritised to date, based on invasiveness, potential for spread and environmental, social and economic impacts. Their ability to be managed was also taken into account. This programme was in the early stages of development and was a work in progress, before what appears to be mothballing during the last government. The last addition was in 2012. It only includes an extremely limited subset of environmental weeds. It is not clear what the current status of this project is. The existing WONS list has also been incorporated in to the WAOL (Section 4.4.2).

5. METHODS

5.1 FIELD SURVEY

The field survey consisted of a Detailed Survey and a Targeted Survey (EPA, 2016 p. 5). Sampling techniques consisted of Traverses, Quadrats, Relevés, Opportunistic Sampling and Vegetation Condition Rating (EPA, 2016 p. 7).

A mid-spring survey was completed on the 12-15th September 2023, with a follow up late spring survey on the 17-19th October 2023.

5.1.1 Traverses

Traverses were conducted on foot at approximately 10m intervals on average across vegetated areas to record:

- Priority, Threatened and other flora of conservation significance (as defined by EPA, 2016).
- A comprehensive flora inventory.
- Weed species.
- Vegetation type and condition boundaries.
- Any matters of interest e.g. including but not limited to rubbish, vegetation type and condition.

Half of the transects were walked during the September 2023 survey, and half during October.

5.1.2 Relevés

Forty-four relevés were recorded and the data from these is presented in Appendix B. Their location is provided on Figure 3 and in Appendix D.

Relevés were used to describe the vegetation, particularly where the condition was not good enough for a quadrat. EPA (2016) describes a relevé is an unmarked area from which data is collected and is a low intensity survey technique. It states that *"information collected within a relevé should include location, GPS coordinates and datum, list of species, vegetation structure, landform and soils, vegetation condition, period since the last fire, and description of disturbances"*.

The following details were recorded for each Relevé:

- GPS coordinates (accuracy <3m) (datum GDA94).
- Vegetation structure (NVIS) (ESCAVI, 2003).
- Dominant flora species.
- Any other flora species that were typical, diagnostic, or not recorded elsewhere.
- Vegetation condition rating.
- Photographs of representative vegetation.

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5.1.3 Quadrats

Ten quadrats were established in representative vegetation across the study area.

Quadrat sizes were 10m x 10m in line with established methodology for the SCP. An area surrounding the quadrat approximately 30m x 30m was also surveyed to record other species typical of the vegetation type.

The information recorded for each quadrat included:

- AMG Coordinates in GDA94 datum (accuracy <3m but more typically <0.5m) for each corner of quadrat (Appendix D).
- All flora species and their height and foliar cover (Appendix B) as required by EPA (2016). Species that overhung the quadrat were included.
- Vegetation structure based on National Vegetation Information System (NVIS) (ESCAVI, 2003) as required by EPA (2016).
- Photographs (taken from NW corner of quadrat) (Appendix C).
- Habitat information including but not limited to landform, aspect and soil and leaf litter.
- A condition rating using condition scale(s) in Table 11.

5.1.4 Opportunistic Sampling

Opportunistic sampling is any informal survey technique used to supplement sampling data (EPA, 2016). Any points of interest were recorded and location information taken.

5.1.5 Vegetation Condition Rating

EPA (2016) provides a condition scale to be used in EIA (Table 11).

Table 11: Vegetation Condition Scale (EPA, 2016)

Condition		EPA (2016) Condition Scale*
P	**Pristine**	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
E	**Excellent**	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
VG	**Very Good**	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
G	**Good**	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
D	**Degraded**	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
CD	**Completely Degraded**	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

* Scale modified from Trudgen (1991) and Keighery (1994).

5.1.6 Licencing

Botanist Kelli McCreery completed the survey under Flora Taking (Biological Assessment) Licence No. FB62000185-2 (valid 3 Mar 2022 to 30 Sep 2025) under Regulation 62 of *Biodiversity Conservation Regulations 2018*. And Permit to Take Threatened Flora TFL 2223-0049 (valid 3 Aug 2022 to 25 Sept 2025) under Section 40 of the *Biodiversity Conservation Act 2016.* Permission to access the property to conduct the survey was granted by Development WA.

5.2 FLORA IDENTIFICATIONS, TAXONOMY AND NOMENCLATURE

Flora identifications were completed by a survey botanist with over 25 years of experience on the SCP. Flora were identified using the taxonomic, reference material and other resources of the Western Australian Herbarium (WAH).

Priority Flora were confirmed by Michael Hislop, the duty botanist at the WAH.

Nomenclature was based on Florabase (WAH, 1998). All taxa were cross-referenced against Florabase to ensure that names were current at the time of publication.

5.3 DATA ANALYSIS

Numerical analyses were conducted on quadrat data collected during the survey. Data was analysed using multivariate analysis run on the programme 'R' (R Development Core Team, 2007).

The most important stage of multivariate analysis was ensuring quality quadrat data was collected, consistently and with a comprehensive species inventory for each quadrat.

5.3.1 Floristic and Structural Analysis of Study Area Quadrats

Only data from the 10 quadrats were used at this stage, and 21 of the 44 relevés that were considered to be of a similar quality to quadrat data. The purpose was as a tool to aid in defining and mapping the vegetation types present in the study area, based on both structure and floristics.

Different parameters were tested, presence-absence (floristics) data alone. Foliar cover percentage (floristics and structure). Foliar cover percentages were then converted to the Braun-Blanquet style cover class scale used in NVIS, which is an analysis of floristics and simplified structure. The analysis was run with and without weeds.

Different agglomerative methods were used. Combinations of Kulczynski and Bray-Curtis ordination and Average and/or Ward linkage, cover weighted or presence-absence.

All these methods returned similar results. Kulczynski, Average weighted with NVIS cover classes was presented in this report as a representative result (Figure 5).

5.3.2 Floristic Community Type (FCT) Analysis Against Gibson *et al.* (1994) Dataset

The 10 quadrats recorded as a part of this survey were also then compared to quadrats surveyed as a part of A Floristic Survey of the Southern SCP (Gibson *et al.,* 1994) (Figure 6).

As many TECs and PECs were originally defined based on the FCTs in Gibson *et al.* (1994), the purpose of recreating this methodology was to help confirm the presence or otherwise of TECs and PECs.

The agglomerative method used was Kulczynski ordination and Average linkage. This is closer to the original Gibson *et al.* (1994) methodology (Czekanowski, Average) than the Bray Curtis and Average that is more frequently used. However both methods were tested and the results were similar.

Consistent with Gibson *et al.* (1994) methodology, this was a floristic analysis based on presence-absence data only with no weighting for cover.

To ensure the datasets were as compatible as possible, the nomenclature and taxonomy of flora was reverted to what it would have been in 1994.

Then each of the 10 quadrats recorded in this survey were run one at a time against the Gibson *et al.* (1994) dataset. Referred to as the single site insertion method, a term developed by local botanist Malcolm Trudgen. An excerpt of the results for each single site insertion dendrogram is presented in Figures 7-16 and summarised in Table 16.

5.3.3 Floristic Community Type (FCT) Analysis Against Keighery *et al.* (2020)

The same methodology was repeated for the Keighery *et al.* (2020) dataset. This dataset includes the original 509 quadrats assessed by Gibson *et al. (*1994), plus an additional 589 quadrats (and relevés). It includes more Quindalup Dunes data, which is relevant to this study.

The results of the single site insertion results are summarised in Table 16.

Many of the new plots added to the Keighery *et al.* (2020) are relevés or incomplete plots, which are described as being suitable for analysis, however this is debateable and may introduce noise, however this was minimised as much as was possible.

5.4 VEGETATION MAPPING

Polygons were drawn using a combination of aerial photography interpretation and field observations. Some boundaries were defined using GPS coordinates recorded during on-ground surveys.

Vegetation type within each polygon was defined based on a wide range of information including but not limited to the statistical and generalised post-survey analysis of quadrat data and field observations. Both structural and floristic characteristics of the vegetation were taken into account.

Descriptions of vegetation types used NVIS (ESCAVI, 2003) structural formation terminology as per the requirements of the EPA (2016).

Simon Crofts from Environmaps produced the mapping presented in this report, and the supporting Index of Biodiversity Surveys for Assessments (IBSA) (EPA, 2021) package.

5.5 CONSERVATION SIGNIFICANCE ASSESSMENT

Conservation significance was assessed based on the following criteria.

5.5.1 Threatened Species and Communities

Assessment of the conservation significance of flora and vegetation recorded during the survey involved cross-referencing all taxa recorded against criteria for significance under Western Australian and Commonwealth legislation and guidelines (Section 4.0). This included TF and TECs under the Western Australian *BC Act* and the Commonwealth *EPBC Act*.

5.5.2 Flora of 'Other' Conservation Significance (EPA, 2016)

Species other than those listed under state and federal legislation and guidelines e.g. TF, may have conservation significance. These are defined by the EPA (2016) as those species that may include but not be limited to those that have or are:

- Priority flora species.
- Locally endemic or associated with a restricted habitat type.
- New species or anomalous features that indicate a potential new species.
- Representation of a species range (extensions, edges of ranges or an outlier population).
- Unusual species including restricted sub-species, varieties or naturally occurring hybrids.
- Relictual status, representative of taxonomic groups no longer in the broader landscape.

For range implications, the geographic distributions of all flora species recorded were checked using the map-based resources of the Australian Virtual Herbarium (AVH) (Council of Heads of Australasian Herbaria, 2013) and Florabase (WAH, 1998-). The collection status and distribution of flora was based on WA Herbarium specimen records only.

Vegetation of 'Other' Conservation Significance (EPA, 2016)

Vegetation other than that listed under state and federal legislation and guidelines e.g. TECs, may have conservation significance. Defined by the EPA (2016) as that which may include but not be limited to vegetation that:

- Represents a PEC.
- Has a restricted distribution.
- Has implications due to historical impacts.
- Has a role as a refuge.
- Provides a function required to maintain the ecological integrity of a significant ecosystem.

6. RESULTS AND DISCUSSION

6.1 FLORA

6.1.1 Statistics

A total of 129 taxa were recorded during the survey, of which 54 or 41.9% were natives.

The 129 taxa represented 40 different plant families and 109 plant genera.

The families represented by the largest number of species are shown in Table 12. The genera represented by the largest number of species are shown in Table 13.

See Appendix A and B for full lists of species recorded for the survey area.

Table 12: Dominant Vascular Plant Families Recorded in the Survey area

Family	Common Name	Native	Introduced	Total
POACEAE	Grasses	4	20	**24**
ASTERACEAE	Daisies	1	11	**12**
FABACEAE	Peas, Wattles	7	4	**11**
MYRTACEAE	Myrtles, Eucalypts, Melaleuca etc.	8	2	**10**
CYPERACEAE	Sedges	6	0	**6**
ASPARAGACEAE	Asparagus-Lily Family	2	3	**5**
CARYOPHYLLACEAE	-	0	5	**5**
EUPHORBIACEAE	Spurges	1	3	**4**
PROTEACEAE	Banksia, Grevillea, Hakea etc.	4	0	**4**

Table 13: Dominant Vascular Plant Genera Recorded in the Survey area

Genus	Common Name	Native	Introduced	Total
Melaleuca	Paperbarks, Teatree	4	0	**4**
Acacia	Wattles	3	0	**3**
Eucalyptus	Gum Trees	2	1	**3**
**Ehrharta*	Veldt Grasses	0	3	**3**
**Vulpia*	Fox Tail Grasses	0	3	**3**
Austrostipa	Spear Grasses	2	0	**2**
**Brassica*	Radish, Turnip, Canola	0	2	**2**
Bromus	Brome Grasses	1	1	**2**
**Euphorbia*	Spurges	0	2	**2**
Hakea	Hakea	2	0	**2**
Lepidosperma	Sedges	2	0	**2**
**Trifolium*	Clovers	0	2	**2**

6.1.2 Conservation Significant Flora

Threatened Flora

No Threatened Flora (TF) species listed under the *EPBC Act 1999* or the *BC Act 2016* were recorded during the survey.

Other Flora of Conservation Significance

See Section 5.5 for a definition of species that have conservation significance (over and above those listed as Threatened Flora).

Two Priority Flora were recorded during the survey; Priority 3 grass *Austrostipa mundula* and Priority 4 forb *Conostylis pauciflora* subsp. *pauciflora* (Dawesville Conostylis).

Austrostipa mundula **Priority 3 Flora**

A perennial grass that was approximately 70cm tall in the study area, that flowers and sets seed in September through October. From the Poaceae or grass family.

Speargrasses are a difficult group taxonomically. This species has been overlooked in WA for decades because of this. This species is widespread in South Australia. Only after Williams (2022) completed a review of the specimens in the WA Herbarium, was it found to occur sporadically along the coastline of southern Western Australia. He cites four records from the Perth region, two of which have now been lost to development, one in the north near Yanchep and one in the south in a reserve surrounded by industrial development. The latter record appears to be in Henderson approximately 8km to the NNE of the study area.

A single individual of this species was recorded. Another common and very similar Speargrass *Austrostipa flavescens* was recorded more frequently across the study area.

The individual was recorded in Vegetation Type A6: *Xanthorrhoea preissii* in dune swales of the beach ridge plain (Figure 3). This is consistent with Williams (2022) study which speculates that in wetter times it was more widespread across WA, but as the climate has dried, it has retreated to a few locations around the coastline. The swales of the beach ridge plain represent a relatively uncommon moister near-coastal habitat. It was recorded in vegetation that was in Good-Degraded to Degraded condition (Figure 4)

The specimen collected in the study area was confirmed by the WA Herbarium as representing *A. mundula*.

Priority 3 Flora are taxa that are poorly known and in need of further study, but which are known from several locations (DBCA, 2019) (Section 4.2.2).

There were 15 collections of this species in the WAH at the time of publication (Council of Heads of Australasian Herbaria, 2013), from near-coast areas between Caiguna to Yanchep.

Conostylis pauciflora **subsp.** ***pauciflora*** **Priority 4 Flora**

Perennial grass-like forb to 35cm, that flowers from August to October, known from sand over limestone on consolidated dunes (WAH, 1998-) (Plates 1 & 2). From the Haemodoraceae family, which includes Kangaroo Paws.

This species is a part of the *C. aculeata-C. candicans* group of *Conostylis* as described by Hopper (1978). This group hybridises and some species are thought to be stable hybrids, including *C. pauciflora*. There are two subspecies both of which are Priority 4 Flora.

The WA Herbarium confirmed the identity of this species and sub-species. They stated however that this group was in need of a taxonomic revision.

Twenty three individuals of this species were recorded, as scattered individuals across cleared and uncleared areas (Figure 3) in vegetation that was in Good-Degraded to Degraded condition (Figure 4).

Priority 4 Flora are taxa that are rare or near-threatened that have been adequately surveyed and are either considered not currently in need of special protection and/or not considered conservation dependent (DBCA, 2019) (Section 4.2.2).

There were 57 collections of this species in the WAH at the time of publication (Council of Heads of Australasian Herbaria, 2013). Its main range is along near-coast areas between Wanneroo and Lancelin, and Rockingham south to Preston. There is an unexplained gap between Rockingham and Joondalup.

This species has an unresolved status taxonomically. Its range is relatively large, however it grows in near-coastal areas that have been and continue to be a focus for development. The record in the study area represents a gap in its known distribution, therefore the specimens collected in the study area will be lodged with the WA herbarium to help to address this data gap.



Plate 1 *Conostylis pauciflora* subsp. *pauciflora* (P4) habit. Near RC06.



Plate 2 *Conostylis pauciflora* subsp. *pauciflora* (P4) flowers. Near RC06.

Range and Representation Implications

As the study area is both at the western extent of the continent, and contains wetland-damplands, many of the native species recorded in the study area had range implications (Table 14). More species would have represented westerly range extents, except for their presence on Garden and Rottnest Islands.

Table 14: Species of Conservation Significance - Range Implications (EPA, 2016)

Species	Significance
Acanthocarpus preissii	Near east extent of known range at this latitude.
Adriana quadripartita	Near east extent of known range at this latitude on the SCP.
Agonis flexuosa	Near N extent large range (Swan River is thought to be actual N extent).
Alyxia buxifolia	One of a few species mainly known from arid regions, with disjunct populations SCP coast.
Austrostipa mundula (P3)	Near N extent known range. E and W extent range SCP. Poorly collected SCP (4 records WAH).
Banksia littoralis	W extent of known range at this latitude on the SCP. Unusual records less than 1km from beach.
Machaerina juncea	W extent of known range at this latitude on the SCP. Unusual records less than 1km from beach. Known from other FCT19 sites on beach ridge plains between Rockingham and Port Kennedy.
Bromus arenarius	One of a few species mainly known from arid regions, with disjunct population along SCP coast.
Cassytha r. forma *racemosa*	W extent of known range at this latitude on the SCP.

Species	Significance
Conostylis p. ssp. *pauciflora*	Poorly collected in S PMR. One record WAH (Port Kennedy).
Cyrtostylis huegelii	W extent of known range at this latitude on the SCP.
Dianella revoluta var. *divaricata*	W extent of known range. Slight range extension. Poorly collected southern PMR (1 record WAH at Bibra Lake).
Eucalyptus r. subsp. *rudis*	W extent of known range. Unusual near-coastal record. Range extension approx. 7km to W. Possibly a hybrid with *E. camaldulensis* (present in area as plantings).
Ficinia nodosa	At E extent of known range at this latitude.
Geranium solanderi	Poorly collected southern PMR (4 records WAH).
Grevillea obtusifolia	W extent known range. Poorly collected southern PMR (0 records WAH). Closest record Pinjarra. Mainly known from Bullsbrook-Gingin area. Possibly has spread from landscaping.
Hakea prostrata	W extent known range. Range extension ca. 8km to W at this latitude.
Hakea varia	W extent known range at this latitude.
Jacksonia furcellata	W extent known range at this latitude.
Kennedia prostrata	W extent known range at this latitude.
Lepidosperma calcicola	Poorly collected southern PMR (3 records WAH).
Lepidosperma longitudinale	W extent known range. Range extension ca. 10km to W at this latitude. Unusual near-coastal record (known from wetlands).
Lomandra maritima	Poorly collected southern PMR (6 records WAH).
Melaleuca rhaphiophylla	W extent known range. Range extension ca. >10km to W at this latitude. Unusual near-coastal record (known from wetlands). A record from Lake Richmond.
Melaleuca v. subsp. *viminea*	W extent known range. Range extension ca. 5km to W at this latitude. Unusual near-coastal record (known from wetlands). A record from Port Kennedy (Becher Plain).
Microtis m. var. *media*	W extent known range. Range extension 5km to W at this latitude. Unusual near-coastal record.
Muehlenbeckia adpressa	W extent known range. Range extension ca. 5km to WNW at this latitude. Unusual near-coastal record. Poorly collected southern PMR (4 records WAH). Indicator of FCT19.
Opercularia vaginata	W extent known range at this latitude.
Poa porphyroclados	W extent known range at this latitude.
Poranthera microphylla	Unusual near coastal record (one record on Garden Island otherwise at W extent known range).
Rhagodia b. subsp. *baccata*	E extent known range at this latitude.
Senecio condylus	W extent known range at this latitude.
Thysanotus manglesianus	W extent known range. Range extension ca. 10km to W at this latitude.
Tricoryne elatior	NW extent known range at this latitude.
Xanthorrhoea preissii	W extent known range. Poorly collected southern PMR (7 records WAH). Record at Lake Richmond and Safety Bay otherwise no near-coastal records.

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6.1.3 Weeds

Environmental Weeds

Seventy-five introduced flora species (weeds) were recorded in the study area (Appendix A & B). Of those, 29 had a High Impact rating, and of those, 25 were also rated as having Rapid Invasiveness (Table 15). See Section 4.4.1 for more detail on these criteria.

Table 15: Swan Region Ecological Impact and Invasiveness (DBCA, 2023a) of Weed Species in Study Area.

SPECIES	COMMON NAME	IMPACT	INVASIVENESS
**Arctotheca calendula*	Capeweed	High	Rapid
**Asparagus asparagoides*	Bridal Creeper	High	Rapid
**Avena barbata*	Wild Oats	High	Rapid
**Brassica tournefortii*	Mediterranean Turnip	High	Rapid
**Bromus diandrus*	Giant Brome	High	Rapid
**Carduus pycnocephalus*	Slender Thistle	High	Rapid
**Cenchrus setaceus*	Fountain Grass	High	Rapid
**Centaurea melitensis*	Maltese Cockspur	High	Rapid
**Cynodon dactylon*	Couch	High	Rapid
**Eragrostis curvula*	African Lovegrass	High	Rapid
**Euphorbia terracina*	Geraldton Carnation Weed	High	Rapid
**Freesia leichtlinii X*	Freesia	High	Rapid
**Fumaria capreolata*	White Flower Fumitory	High	Rapid
**Fumaria muralis* subsp. *muralis*	Wall Fumitory	High	Rapid
**Gomphocarpus fruticosus*	Narrow Leaf Cottonbush	High	Rapid
**Hyparrhenia hirta*	Tambookie Grass	High	Rapid
**Hypochaeris glabra*	Flatweed	High	Rapid
**Lagurus ovatus*	Hare's Tail Grass	High	Rapid
**Lolium perenne*	Rye Grass	High	Rapid
**Olea europaea* var. *europaea*	Olive	High	Rapid
**Pelargonium capitatum*	Rose Pelargonium	High	Rapid
**Solanum laciniatum*	Kangaroo Apple	High	Rapid
**Vulpia fascicularis*	Sand Fescue	High	Rapid
**Vulpia muralis*	Wall Fescue	High	Rapid
**Vulpia myuros* forma *myuros*	Rat Tail Fescue	High	Rapid
**Schinus terebinthifolia*	Brazilian Pepper	High	Moderate
**Cenchrus clandestinus*	Kikuyu Grass	High	Slow
**Oxalis pes-caprae*	Soursob	High	Slow
**Hordeum leporinum*	Barley Grass	High	Unknown
**Ehrharta longiflora*	Annual Veldt Grass	Medium	Rapid
**Petrorhagia dubia*	Velvet Pink	Medium	Rapid
**Polycarpon tetraphyllum*	Allseed	Medium	Rapid
**Ricinus communis*	Castor Oil Plant	Medium	Rapid
**Solanum nigrum*	Blackberry Nightshade	Medium	Rapid
**Trachyandra divaricata*	Dune Onion Weed	Medium	Rapid
**Urospermum picroides*	False Hawkbit	Medium	Rapid
**Agave americana*	Century Plant	Medium	Moderate

Declared Pest Plants (BAM Act 2007)

One of the weeds recorded in the study area **Asparagus asparagoides* (Bridal Creeper) is a Declared Pest Plant - s22(2) under the *BAM Act*. This species was automatically added to the WAOL due to a listing as a WONS. It has been allocated no conditions for keeping or control.

A second species **Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush) is a Declared Pest Plant - s22(2) in other Local Government Areas (LGAs), primarily outside the PMR and including wheatbelt and south-west LGAs. The control requirements are *'C3 Management: Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism'.* These requirements do not apply to the City of Rockingham, however it may be worthwhile keeping in mind when proposed activities may involve transport to and from LGAs where they do.

The *BAM Act* is more relevant to agricultural rather than environmental weeds. The listings are weighted towards preventing the importation and spread of new weeds, with limited requirements to control existing ones. However it is the only legal framework that covers weeds in Western Australia.

See Section 4.4.2 for an explanation of Declared Pests.

Weeds of National Significance

One species listed as Weeds of National Significance (WONS) (Section 4.4.3) was recorded in the survey area, **Asparagus asparagoides* (Bridal Creeper).

This species is described as a long-lived highly invasive vine that is destroying large areas of native vegetation in southern Australia.

This list has not been actively reviewed for over ten years, it is not a comprehensive list of the serious environmental weeds that may be present.

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6.2 VEGETATION

6.2.1 Vegetation Types

The study area included six vegetation types with a seventh including highly disturbed (Degraded to Completely Degraded).

A: QUINDALUP DUNES (BEACH RIDGE PLAINS COMPLEX AND COASTAL DUNES INTERFACE)

A1: Tall Closed to Open Forest *Eucalyptus gomphocephala* (Tuart) over weedy Grassland and Forbland. Occasional native Shrubs to Sparse Shrubland *Acacia rostellifera, Spyridium globulosum* (Basket Bush)*, Xanthorrhoea preissii* (Grass Tree). Dry sands over limestone, soils becoming moister at east extremity. Good-Degraded to Degraded.

A2: Low to Tall Closed Shrubland *Acacia rostellifera* (Summer-scented Wattle) thickets over weedy Grassland and Forbland. Isolated native Shrubs and Forbs. Dry sands over limestone at various stages of regrowth. Degraded-Good to Degraded.

A3: Low to Tall Shrubland of *Acacia rostellifera, A. saligna* (Orange Wattle), *Hakea prostrata* (Harsh Hakea) over weedy Grassland and Forbland. Isolated native Shrubs, sedges and Forbs. More open and diverse than A2. Dry calcareous sands over limestone. Good-Degraded to Degraded.

A4: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* (Chenille Honeymyrtle) and *Acacia rostellifera* over weedy Grassland and Forbland. Isolated to Sparse native Shrubs and Forbs. Calcareous sands over limestone, becoming moister. Good-Degraded to Degraded.

A5: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* and/or *Melaleuca rhaphiophylla* (Swamp Paperbark) over Occasional Sedges to Sedgeland *Gahnia trifida* (Coast Saw-sedge) in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.

A6: Mid Shrubland to Closed Shrubland Grasstrees *Xanthorrhoea preissii* in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.

B: DEGRADED TO COMPLETELY DEGRADED

Tracks. Extensive throughout study area from a history of use by rough sleepers and recreation.

Heavily disturbed vegetation retaining very few native species. Some occasional overstorey native Shrubs or trees. Understorey almost entirely Forb and/or Grass weeds with some woody Tree and Shrub weeds.

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Vegetation Type A1: Tall Closed to Open Forest *Eucalyptus gomphocephala* (Tuart) over weedy Grassland and Forbland. Occasional native Shrubs to Sparse Shrubland *Acacia rostellifera, Spyridium globulosum* (Basket Bush)*, Xanthorrhoea preissii* (Grass Tree). (Plate 3 & 4).

Other native Tall Shrubs included *Acacia saligna* and *A. cyclops*. In the eastern part of this vegetation where it transitions to adjacent vegetation types, *Melaleuca huegelii* subsp. *huegelii* becomes increasingly dominant.

Most of the lower strata flora species were absent. Isolated Low Shrubs *Leucopogon parviflorus, Lysiandra calycina* and *Rhagodia baccata* subsp. *baccata* were present in a small area of slightly better condition vegetation surrounding quadrat RC02 (Figure 3).

There was typically a Sparse Vineland of natives *Clematis linearifolia, Cassytha racemosa* forma *racemosa, Hardenbergia comptoniana, Muehlenbeckia adpressa* and/or weed **Asparagus asparagoides*.

Occasional native Grasses *Austrostipa flavescens, Poa porphyroclados* and Sedge *Lepidosperma calcicola* were recorded in a small, slightly better condition near RC-02 (Figure 3). However the Grassland was dominated by weeds **Ehrharta longiflora* (Annual Veldt Grass), **Bromus diandrus* (Great Brome), **Lagurus ovatus* (Hare's Tail Grass), **Lolium perenne* (Rye Grass) and/or **Avena barbata* (Wild Oats).

The weedy Open Forbland was dominated by **Euphorbia terracina* (Geraldton Carnation Weed) and **E. peplus* (Petty Spurge). There were many Forb and Grass weed species recorded from this vegetation, including woody weeds and garden escapes from dumping of domestic and garden waste.

Vegetation in patchy condition varying frequently from Good, Good-Degraded, Degraded through to Degraded-Completely Degraded condition. Understorey impacted by weeds and historical disturbance leading to a loss of diversity.

The four quadrats (RC02, RC05, RC08, RC10) had a mean richness of 27.3 $\pm$ 9.7 (n=4) species with a weed frequency of 16.3 per quadrat. In the statistical analysis these quadrats were closest to FCT24 (mean species richness 41.8, weed frequency 14.2 n=25) and FCT30a (mean species richness 21.1, weed frequency 6.3 n=7). Eight relevés were also completed (MN02, 03, 05, 06, 10, 11, 37, 43) (Figure 3) (Appendix B & D).



Plate 3 Vegetation Type A1: Open *Forest Eucalyptus gomphocephala*. Near RC02 and RC05. Higher shrub diversity, patchy condition (Good-Degraded) with weedy understorey.



Plate 4 Vegetation Type A1: RC10. Open Forest *Eucalyptus gomphocephala*. Degraded condition, remnant shrubs over weedy understorey.

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Vegetation Type A2: Low to Tall Closed Shrubland *Acacia rostellifera* (Summer-scented Wattle) thickets over weedy Grassland and Forbland. Isolated native Shrubs and Forbs. (Plates 5 & 6).

Occasional Isolated Trees of *Eucalyptus gomphocephala*, particularly near interface with Vegetation Type A1. Dry sands over limestone. At various stages of regrowth, *Acacia rostellifera* regrowth varied from 50cm tall to 5m. It was very dense in places and almost impenetrable.

Other Tall Shrubs included Isolated *Melaleuca huegelii* subsp. *huegelii*, increasing in cover near interface with Vegetation Type A4. Mid Shrubs included Isolated to Sparse *Spyridium globulosum* and *Xanthorrhoea preissii*.

There was an Isolated to Sparse Vineland of *Clematis linearifolia*. Very few native Forbs, Sedges and Grasses remained, however there was Isolated Forb *Dianella revoluta* var. *divaricata*, with Grass *Austrostipa flavescens* and Sedge *Lepidosperma calcicola* seen at one location each.

Understorey was a Grassland dominated by **Ehrharta longiflora* with **Avena barbata, *Bromus diandrus, *Lagurus ovatus, * Brachypodium distachyon* and/or **Lolium perenne* frequently co-dominant. There was an Open Forbland dominated by weeds **Euphorbia peplus* and **E. terracina*.

Almost entirely Degraded with small localised areas in Degraded-Good condition near interface with Vegetation Types A4 and A6. Understorey impacted by weeds and historical disturbance leading to an almost entire loss of diversity.

No quadrats were placed in this vegetation due to the poor condition. Twelve relevés were completed in this vegetation (MN01, 04, 07, 08, 09, 14, 16, 26, 31, 32, 34, 35) (Figure 3) (Appendix B & D).



Plate 5 Vegetation Type A2: MN34. Closed Shrubland *Acacia rostellifera*. Thickets view from outside. Degraded.



Plate 6 Vegetation Type A2: MN26. Closed Shrubland *Acacia rostellifera*. Thickets view from inside. Degraded condition, remnant overstorey over weeds (Grass **Ehrharta longiflora*, Forb **Euphorbia peplus* typically)

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Vegetation Type A3: Low to Tall Shrubland of *Acacia rostellifera, A. saligna* (Orange Wattle), *Spyridium globulosum, Hakea prostrata* (Harsh Hakea) over weedy Grassland and Forbland. Isolated native Shrubs, Sedges and Forbs.

Dry calcareous sands over limestone, low dunes in beach ridge plain complex.

This vegetation occurred within the area planned for the access road. It was clearly still a part of the beach ridge plain complex across the local area and was floristically similar to Vegetation Type A4 (Figure 3 and 5), however it was drier and becoming more typical of standard near-coastal dune vegetation. More open and diverse than Vegetation Type A2. The presence of such species as *Hakea prostrata* differentiated it from Vegetation Type A2 and the much sparser *Acacia rostellifera*. *Xanthorrhoea preissii* was also typical, however it appeared to be present due to the proximity of beach ridge plain swales, where this species is dominant.

The understorey was dominated by weeds, typically a Grassland dominated by **Avena barbata* (Wild Oats), **Bromus diandrus* (Great Brome) and/or **Lagurus ovatus* (Hare's Foot Grass) (Plate 8 & 9), with *Ehrharta longiflora in shaded areas. There was also a weedy Open Forbland typically of **Sixalix atropurpurea* (Scabiosa) and **Trachyandra divaricata*.

Occasional native understorey species included the coastal shrub *Adriana quadripartita*, Forbs Dianella *revoluta* var. *divaricata* and *Lomandra maritima*, Vine *Clematis linearifolia*, Sedge *Lepidosperma calcicola* and Grass *Austrostipa flavescens.*

Mostly in Degraded (Plate 7) condition with very localised Good-Degraded (Plate 8) patches. Understorey impacted by weeds and historical disturbance leading to a loss of diversity.

No quadrats were placed in this vegetation due to the poor condition. Four relevés were completed (MN20, 21, 36 and 41)(Figure 3)(Appendix B & D).



Plate 7 Vegetation Type A3: MN41. Degraded.



Plate 8 Vegetation Type A3: MN42. Localised Good-Degraded patch.

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Vegetation Type A4: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* (Chenille Honeymyrtle) and *Acacia rostellifera* over weedy Grassland and Forbland.

Calcareous sands over limestone. Possibly a part of the beach ridge plains complex. Varies from pale drier sands to localised seasonally damp areas that are darker and with more clay. Forms a mosaic in places with Vegetation Types A5 and A6 (Figure 3). (Plates 9-12).

Difficult to interpret. *Melaleuca huegelii* subsp. *huegelii* is usually found on limestone ridges, as a Low Shrubland on drier soils, however no outcropping limestone was seen. In the study are this species was most dominant on a low rise (6m elevation) amongst the beach ridge plains (2-4m). It was assumed that there was limestone underlying this area, although it is unusual to see it so uniformly covered by soil (Tuart also often grows over subsoil limestone).

In places there were pure stands of *Melaleuca huegelii* subsp. *huegelii* (Plate 11). The understorey was far less weedy, with moss beds dominating, however there were still few native species present. This community also grades into the beach ridge plains dampland communities downslope (Vegetation Types A5 and A6, Figure 3).

Other tall Shrubs typically *Spyridium globulosum, Acacia saligna*, Mid Shrubs *Xanthorrhoea preissii*. Very occasional Isolated Low Trees *Banksia littoralis* (Swamp Banksia) or *Melaleuca rhaphiophylla* (Freshwater Paperbark). Occasional native understory Shrubs *Leucopogon parviflorus, Thomasia cognata*.

There was an Isolated to Open Vineland of *Clematis linearifolia, Cassytha racemosa* forma *racemosa* and *Muehlenbeckia adpressa.*

There frequently was a Sparse Sedgeland of *Gahnia trifida* in wetter areas and *Lepidosperma calcicola* occurred in drier areas.

There was a weedy Grassland dominated by **Ehrharta longiflora* but also typically **Avena barbata, *Lagurus ovatus, *Bromus diandrus, *Lolium perenne*. Occasional native Grasses *Austrostipa flavescens* and/or *Poa porphyroclados* in drier areas.

A weedy Forbland dominated by **Euphorbia peplus* with **Euphorbia terracina, *Galium murale* and **Lysimachia arvensis* also typical. Occasional native Forbs typically *Dianella revoluta* var. *divaricata, Tricoryne elatior, Caladenia latifolia, Conostylis pauciflora* subsp. *pauciflora* (P4).

Very patchy condition, Good to Degraded overall, with very localised Good and Degraded patches. Understorey impacted by weeds and historical disturbance leading to a loss of diversity.

The three quadrats (RC06, RC07, RC09) in this vegetation had a mean species richness of 37.7 $\pm$ 1.4 (n=3) species with a weed frequency of 22 species per quadrat. In the statistical analysis these quadrats were closest to FCT24 (mean species richness 41.8, weed frequency 14.2 n=25) and FCT30a (mean species richness 21.1, weed frequency 6.3 n=7).

Eleven relevés were completed in this vegetation (MN12, 13, 15, 17, 20, 23, 24, 27, 28, 33, 38) (Figure 3) (Appendix B & D).

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Plate 9 Vegetation Type A4: Typical with mixed *Melaleuca huegelii* subsp. *huegelii* and *Acacia rostellifera* closed overstorey. MN24. Good-Degraded.



Plate 10 Vegetation Type A4: Typical with mixed *Melaleuca huegelii* subsp. *huegelii* and *Acacia rostellifera* closed overstorey. MN27. Degraded.



Plate 11 Vegetation Type A4: Tall Closed *Melaleuca huegelii* subsp. *huegelii.* Dampland basin variant on clayier soil. RCO7. Good and Good-Degraded.



Plate 12 Vegetation Type A4: Denser, purer stands of *Melaleuca huegelii* subsp. *huegelii*, with fewer weeds and moss beds (still few native species). RC06. Good and Good-Degraded.

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Vegetation Type A5: Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* and/or *Melaleuca rhaphiophylla* (Swamp Paperbark) over Occasional Sedges to Sedgeland *Gahnia trifida* (Coast Saw-sedge) in swales. (Plates 13-14).

Calcareous sands with more clay over limestone, seasonally damp. A part of the beach ridge plains complex. These areas were present at very localised low points in dune swales. Some of these areas were still damp during the later October surveys.

As this vegetation is only in small areas, it is on a continuum with and heavily influenced by adjacent vegetation (Vegetation Types A2-A4 and A6). In this context, other typical Tall Shrubs included *Acacia rostellifera, A. saligna, A. cyclops, Spyridium globulosum* and *Xanthorrhoea preissii*, and Low Shrub *Thomasia cognata*. There were Isolated Low to Mid Shrubs present, some species which are more typical of wetlands and damplands further inland, including *Melaleuca viminea* subsp. *viminea* and *Grevillea obtusifolia*.

Sparse to Open Vineland of *Clematis linearifolia, Muehlenbeckia adpressa* and **Asparagus asparagoides.*

The sedgeland was dominated by *Gahnia trifida*, however very occasionally other native dampland sedges *Lepidosperma longitudinale, Machaerina juncea* and *Ficinia nodosa* were recorded.

There was a Sparse Forbland dominated by weeds **Euphorbia peplus* and **Galium murale* and a variety of other weedy species. Occasional native Forbs *Dianella revoluta* var. *divaricata*.

There was a Sparse Grassland dominated by a variety of weeds including **Ehrharta longiflora, *Avena barbata, *Lagurus ovatus, *Briza minor, *Brachypodium distachyon, *Bromus diandrus*. No one species was consistently dominant at all locations.

This vegetation varied from localised Good patches, Good-Degraded and Degraded condition due to the understorey impacted by weed invasion and historical disturbance resulting in loss of diversity.

The quadrat (RC04) in this vegetation had a mean species richness of 36 species with a weed frequency of 21 species. In the statistical analysis (Table 16) this quadrat was closest to FCT19 (mean species richness 22.6, weed frequency 6.9 n=3) (Gibson *et al.,* 1994). Four relevés were completed in this vegetation (MN19, 28, 29, 30) (Figure 3) (Appendix B & D).



Plate 13 Vegetation Type A5: Dampland basin variant on clayier soil. *Melaleuca rhaphiophylla*. MN29. Good and Good-Degraded condition in this area.



Plate 14 Vegetation Type A5: MN19. Good and Good-Degraded condition in this area.

Vegetation Type A6: Mid Shrubland to Closed Shrubland Grasstrees *Xanthorrhoea preissii* in swales. (Plates 15-16).

Calcareous grey sands with more clay over limestone, seasonally damp, often darker than surrounding soil. A part of the beach ridge plains complex.

Other Mid-Tall Shrubs included Isolated *Acacia rostellifera, A. saligna, Spyridium globulosum, Melaleuca rhaphiophylla* and/or *M. huegelii*. A single occurrence each of *Hakea varia* and *Grevillea obtusifolia* were recorded in this vegetation. Low Shrub *Thomasia cognata* occurred occasionally.

There was a Sparse to Open Vineland of *Clematis linearifolia* and the weed **Asparagus asparagoides.*

There was a Sparse Sedgeland to Isolated Sedges of *Gahnia trifida* and *Lepidosperma calcicola*, but also occasional *Ficinia nodosa*.

There was a Sparse Forbland dominated by weeds **Euphorbia peplus, *Crassula glomerata, *Hypochaeris glabra, *Galium murale* and a variety of other weedy species. Occasional native Forbs included *Dianella revoluta* var. *divaricata, Tricoryne elatior, Caladenia latifolia* and/or *Lomandra maritima.*

There was a Sparse Grassland dominated by a variety of weeds including **Avena barbata, *Bromus diandrus, Vulpia myuros* forma. *myuros, *Briza minor*. Native grasses *Poa porphyroclados* and *Austrostipa flavescens* were often present, up to one percent cover in places.

This vegetation had localised Good patches but overall was in Good-Degraded to Degraded condition, due to the understorey being impacted by weed invasion and historical disturbance resulting in loss of diversity.

The two quadrats (RC01, RC03) in this vegetation had a mean species richness of 36.0 $\pm$ 1.1 species with a mean weed frequency of 21 species per quadrat. In the statistical analysis (Table 16) these were closest to FCT24 (mean species richness 41.8, weed frequency 14.2 n=25) and FCT19 (mean species richness 22.6, weed frequency 6.9 n=3) (Gibson *et al.,* 1994).

Five relevés were also completed in this vegetation MN17, 18, 25, 39, 40) (Figure 3) (Appendix B & D).



Plate 15 Vegetation Type A6: Dampland basin variant on clayier soil. RC03. Good and Good-Degraded in and around this quadrat.



Plate 16 Vegetation Type A6: MN39. Good and Good-Degraded.

B: DEGRADED TO COMPLETELY DEGRADED

Includes tracks which are extensive throughout study area (Plate 20 & 22). Heavily disturbed vegetation with very few native species (Plates 18, 21 & 22). Occasional Shrubs or Trees over weeds (Plates 17 & 19).



Plate 17 VT-B. MN03. Sept. Weedy Grassland **Bromus diandrus* and **Ehrharta longiflora*. Degraded (D) to Completely Degraded (CD).



Plate 18 VT-B. South of MN39. Sept. Weeds and domestic rubbish, tracks in bush. D-CD.



Plate 19 VT-B. MN22. Sept. Collapsed VT A3. Remnant native overstorey over grassy weeds and forbs. D.



Plate 20 VT-B. MN25. Oct. Track through weedy remnant vegetation. D-CD.



Plate 21 VT-B. Localised Degraded patch near RC01. Oct. Grassland **Lagurus ovatus* (Hare's Tail Grass).



Plate 22 VT-B. MN36. Oct. **Schinus terebinthifolia* over weeds **Avena barbata* and **Sixalix atropurpurea*. D-CD.

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Legend

- Survey Area
- Cadastre
- Contour (mAHD)
- Quadrat (10 x 10 m)
- Releve

Priority Flora

- *Austrostipa mundula* (P3)
- *Conostylis pauciflora subsp. pauciflora* (P4)

Caveats: Vegetation is a complex and fine scale mosaic in places, with a substantial disturbance history. Boundaries are indicative only. There are intergrades between vegetation types. Condition is very patchy, with localised areas both in better or worse condition than the overall classifications. Interpret in conjunction with full report (One Tree Botanical Pty Ltd, 2024).

Source: Cadastre - Landgate
Orthophoto - Nearmaps, 06.12.23

A:	QUINDALUP DUNES (BEACH RIDGE PLAINS COMPLEX AND COASTAL DUNES INTERFACE)
A1	Tall Closed to Open Forest *Eucalyptus gomphocephala* (Tuart) over weedy Grassland and Forbland. Occasional native Shrubs to Sparse Shrubland *Acacia rostellifera* (Summer-scented Wattle), *Spyridium globulosum* (Basket Bush), *Xanthorrhoea preissii* (Grasstree). Dry sands over limestone, soils becoming moister at east extremity. Good, Degraded to Degraded.
A2	Low to Tall Closed Shrubland *Acacia rostellifera* (Summer-scented Wattle) thickets over weedy Grassland and Forbland. Isolated native Shrubs and Forbs. Dry sands over limestone at various stages of regrowth. Degraded-Good to Degraded.
A3	Low to Tall Shrubland of *Acacia rostellifera* (Summer-scented Wattle), *A. saligna* (Orange Wattle), *Hakea prostrata* (Harsh Hakea) over weedy Grassland and Forbland. Isolated native Shrubs, Sedges and Forbs. More open and diverse than A2. Dry calcareous sands over limestone. Good-Degraded to Degraded.
A4	Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* (Chenille Honeymyrtle) and *Acacia rostellifera* (Summer-scented Wattle) over weedy Grassland and Forbland. Isolated to Sparse native Shrubs and Forbs. Calcareous sands over limestone, becoming moister. Good-Degraded to Degraded.
A5	Tall Shrubland to Closed Shrubland *Melaleuca huegelii* subsp. *huegelii* (Chenille Honeymyrtle) and/or *Melaleuca rhaphiophylla* (Swamp Paperbark) over Occasional Sedges to Sedgeland *Gahnia trifida* (Coast Saw-sedge) in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.
A6	Mid Shrubland to Closed Shrubland Grasstrees *Xanthorrhoea preissii* (Grasstree) in swales. Calcareous sands with more clay over limestone, seasonally damp. Good-Degraded to Degraded.
B:	DEGRADED TO COMPLETELY DEGRADED
	Tracks. Extensive throughout study area from a history of use by rough sleeper camps and recreation.
	Heavily disturbed vegetation retaining very few native species. Some occasional overstorey native Shrubs or Trees. Understorey almost entirely Forb and/or Grass weeds with some woody Tree and Shrub weeds.

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N

0 12.5 25 50 75 100 m

Scale: 1:2,750 @ A3
GDA2020 MGA Zone 50

FIGURE 3

VEGETATION TYPES OF THE CARGILL CRUX PROJECT ROCKINGHAM STUDY AREA

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6.3 VEGETATION CONDITION

The condition of the vegetation will be a primary factor when assessing the conservation significance of the vegetation in the study area. In particular the extremely marginal condition in some areas, including areas that would otherwise represent TECs and PECs.

The study area clearly has a history of some kind of sustained disturbance, resulting in high weed cover and diversity and a loss of native species diversity.

Historical aerial photography from the 1950's indicates some kind of clearing that didn't involve wholesale removal of vegetation. Likely the result of too frequent burning or grazing, or selective clearing. Very large old trees of *Eucalyptus gomphocephala* (Tuart), *Melaleuca rhaphiophylla* (Freshwater Paperbark) and *Xanthorrhoea preissii* (Grasstrees) were present in the study area, to support the idea that clearing wasn't wholesale. As previously mentioned, DEC (2011) states that much of the beach ridge plains were used for grazing of horses and cattle in the early days of settlement and historically as sources of peat. They also state subsequently by off-road vehicle and motor bike circuits and have been impacted by management activities e.g. firebreaks.

In recent years the study area has been left to regenerate, as best it can considering the large legacy of weeds left by those historical activities and from ongoing disturbance. This has mainly been overstorey species such as *Acacia rostellifera* (Summer-scented Wattle) and new generations of *Eucalyptus gomphocephala* (Tuart). The understorey is still dominated by weeds, in particular annual grassy species such as **Ehrharta longiflora* (Annual Veldt Grass), **Bromus diandrus* (Giant Brome), **Avena barbata* (Wild Oats) and **Lagurus ovatus* (Hare's Tail Grass). These species form covers of up to 90% in many areas. Even in areas where weeds are at a lower cover, this is due to them being shaded out or suppressed by leaf litter, or heavier soils. The native flora does not flourish in these areas either, apart from occasional resilient native Shrubs, Forbs, Grasses and Sedges at low densities.

The majority of the study area was in Good-Degraded, Degraded and Degraded-Completely Degraded condition. There were very localised areas approaching Good condition, usually where quadrats have been placed (Figure 3)(excluding RC08).

Areas approaching Good condition were prioritised for quadrat establishment. However these areas were difficult to find. Some Degraded areas were chosen to complete quadrats *Eucalyptus gomphocephala* (Tuart) Forest, as no better sites were available. A minimum number of quadrats was required in Tuart vegetation, as the status of Tuart communities onsite was the main concern expressed in commissioning this study. The DoEECC (2019) diagnostic and other criteria used to assess *'Tuart Woodlands and Forests of the SCP'* TEC requires quadrat data.

Surprisingly, the statistical analysis of quadrat data returned relatively strong results, that made ecological and biogeographical sense. This is possibly due to the fact that much of the vegetation in the Quindalup Dunes is naturally low in species diversity, and has all been impacted by weeds more than other vegetation on the SCP. The weed frequency in the study area quadrats however, was higher than the regional dataset quadrats (Gibson *et al.,* 1994) and the species richness lower on average.

The study area has been a hub for people living rough. Based on historical photography, there has been a substantial clean up in recent years. During the survey, many large and small camps were still seen. These are not visible on aerial photography as they are hidden deep in thickets of *Acacia rostellifera* and *Melaleuca huegelii* subsp. *huegelii* (Vegetation Type A2 and A4), particularly where they interface the Tuart Forest (Vegetation Type A1). Smaller individual camps usually consisting of swags and tents were frequently

seen, appearing to have been present less than a year but now abandoned. It appeared that these might be summer camps that had been abandoned during colder months.

Signs of recreation are also present, whether this is to do with the camps or due to weekend users, or both, is unclear. Vehicles were observed using the site during the surveys, one driver stated that he was 'testing his new 4wd'. Others withdrew on seeing others onsite.

There was frequent dumping of small piles of domestic and perhaps industrial rubbish, particularly in the southern half of the study area. Including the introduction of garden plants, which is another potential new source of environmental weeds. Localised rubbish dumping is not necessarily a large threat to ecosystems, however the ongoing introduction of garden pests and weeds can have an impact in the long run. The tracks required to access these areas for the purpose of rubbish dumping can be the biggest impact, however a substantial track network was already present in the study area, with unimpeded access from multiple points from public roads.

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Legend

- Survey Area
- Cadastre
- Contour (mAHD)

Priority Flora

- *Austrostipa mundula* (P2)
- *Conostylis pauciflora* ssp (P4)

Vegetation Condition

- Good to Degraded
- Degraded
- Degraded to Completely Degraded

Caveats: Vegetation is a complex and fine scale mosaic in places, with a substantial disturbance history. Boundaries are indicative only. There are intergrades between vegetation types. Condition is very patchy, with localised areas both in better or worse condition than the overall classifications. Interpret in conjunction with full report (One Tree Botanical Pty Ltd, 2024).

Source: Cadastre - Landgate
Orthophoto - Nearmaps, 06.12.23

Condition		EPA (2016) Condition Scale
P	Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
E	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
VG	Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
D	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
CD	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

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N

0 12.5 25 50 75 100 m

Scale: 1:2,750 @ A3
GDA2020 MGA Zone 50

FIGURE 4

VEGETATION CONDITION OF THE CARGILL CRUX PROJECT ROCKINGHAM STUDY AREA

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6.3.1 Statistical Analysis

Vegetation Type Assignment

An analysis was completed using quadrat and selected relevé data collected during this survey (Figure 5).

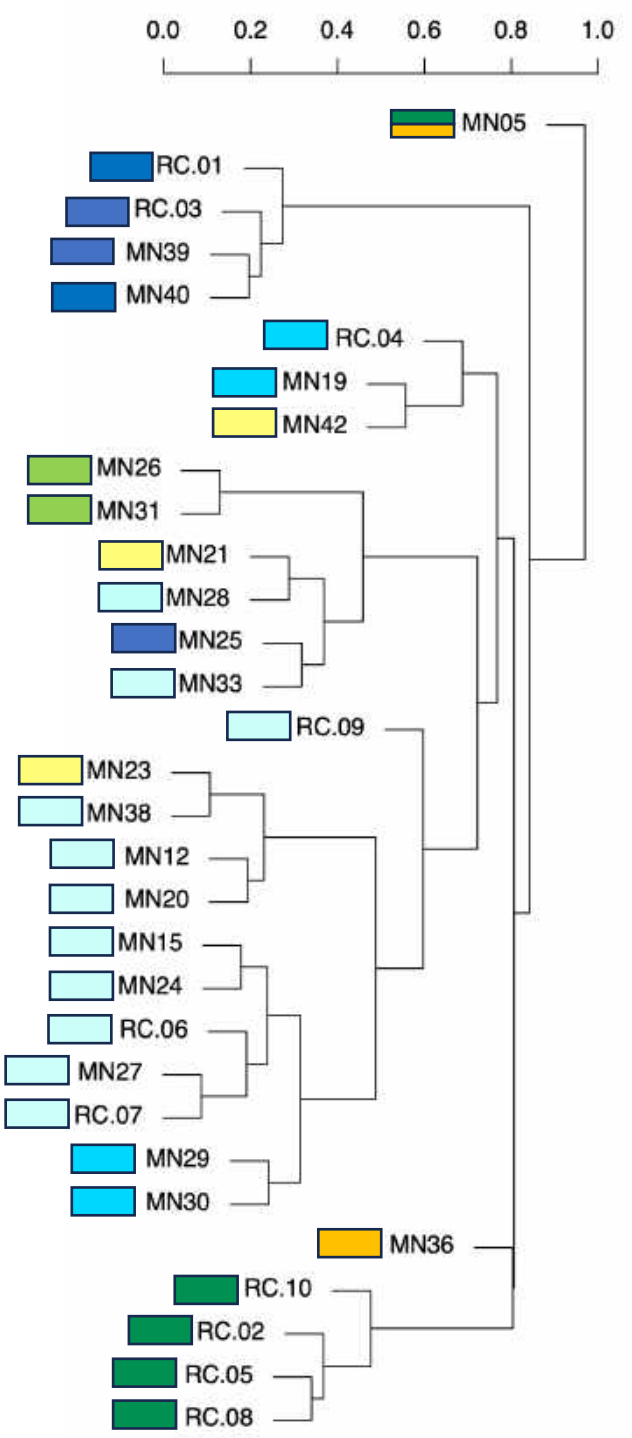


Figure 5: Statistical Analysis - Relationship Between Study Area Quadrats and Selected Relevés. (Bray, Average weighted with NVIS cover classes). Colours link to vegetation types (Figure 3) (orange=Degraded-Completely Degraded).

Relevés are not usually used in statistical analysis, but this study area did not contain enough vegetation in Good or better condition to warrant quadrat surveys in many areas. Only those relevés thought to be have a minimum data quality were used in the analysis.

This along with other similar statistical analysis results were used to aid in defining vegetation types. A number of different methods were used, however these all returned similar results. Bray-Curtis ordination with Average clustering, weighted by NVIS cover classes has been presented in Figure 5 as a typical result.

The results show strong clustering of Vegetation Type A1: Forest of *Eucalyptus gomphocephala* (Tuart)(grey) and Vegetation Type A6: Shrubland *Xanthorrhoea preissii* in Swales (aqua). The remainder form groupings or disjunct groupings within a larger branch of the dendrogram. This is likely due to the fine scaled mosaiced nature of much of the beach ridge plains complex.

Floristic Community Type (FCT) (Gibson et al., 1994) Statistical Analysis

Figure 6 presents the results from comparing all the quadrat data in the study area, to the Gibson *et al.* (1994) dataset.

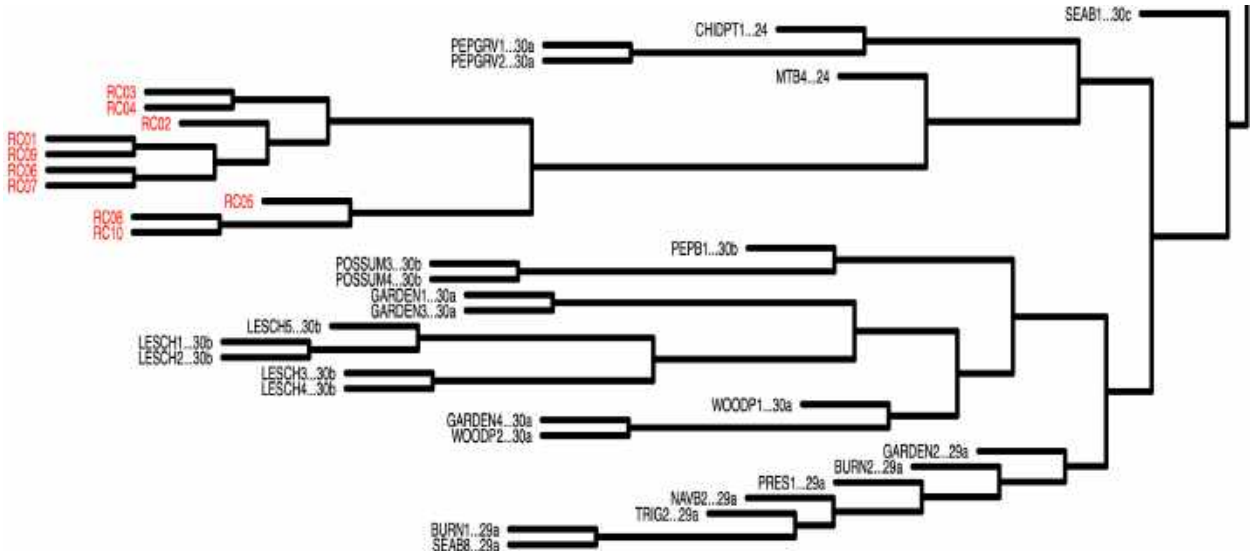


Figure 6: Multivariate Analysis showing Relationship Between Study Area Quadrats.
(Bray Curtis, Average, presence-absence/floristics analysis only).

Gibson *et al.* (1994) was the study used to first identify and define many of the PECs and TECs currently listed under state and commonwealth legislation and guidance.

As the original dataset was not large enough for the geographical scope (southern SCP), adding new quadrats often results in both a study area coming out separate to the original dataset, and the clustering of the original dataset being upset. Figure 6 demonstrates this effect, however it does provide an indication of the broad affiliations present in the study area. The study area quadrats cluster with a broader group that includes Gibson *et al.* (1994) quadrats from FCT24 (Mt Brown, Henderson and Chidley Point Nedlands) and FCT30a (Peppermint Grove limestones on the Swan River). There are secondary influences with FCT29a (Garden Island, Preston, Naval Base, Trigg, Burns Beach, Seabird), FCT30a (Woodman Point, Garden Island) and FCT30b (Leschenault Inlet, Peppermint Beach). Interestingly FCT30c is known from Seabird and Mt Henry only and is a poorly known community (see also RC06, Table 16).

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Figures 7-16 present the results of the single-site insertion method, comparing study area quadrats one at a time to the Gibson *et al.* (1994) dataset. Single site insertion method is less likely to upset the original clustering. This is not ideal from the perspective of the science but is an inescapable legacy of how FCTs have been entrenched as legal concepts.

See Table 16 for a summary of these results.

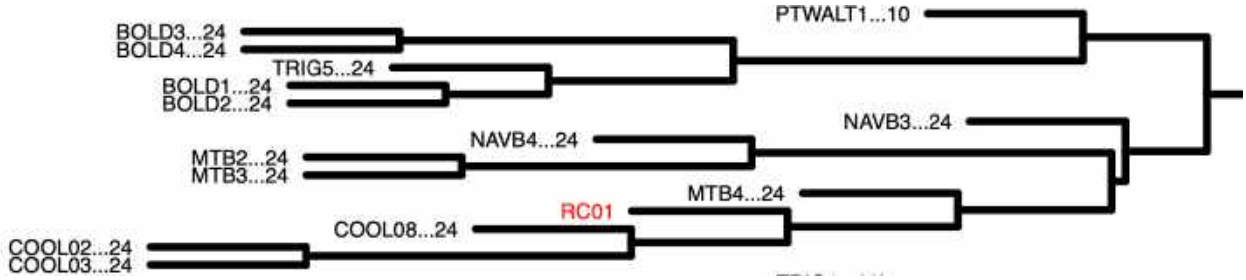


Figure 7: Multivariate Analysis Comparing RC01 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

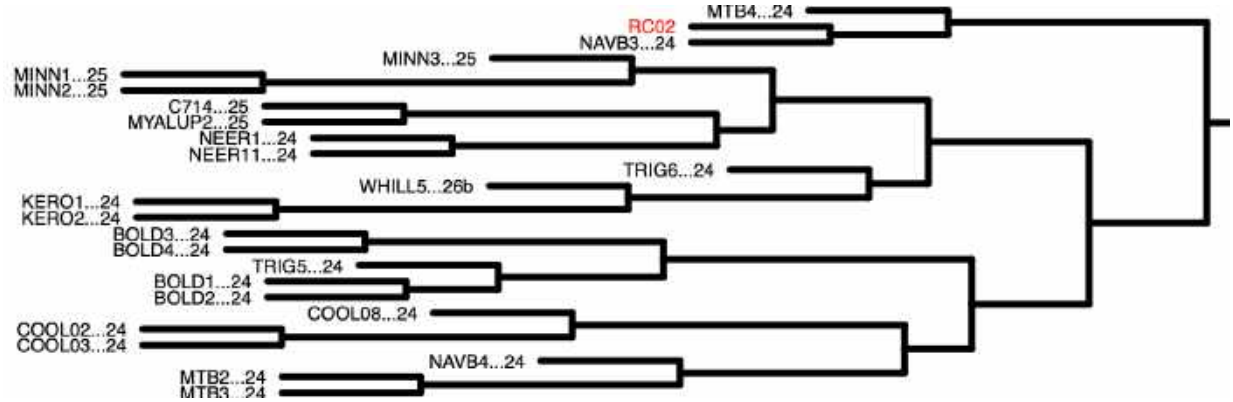


Figure 8: Multivariate Analysis Comparing RC02 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

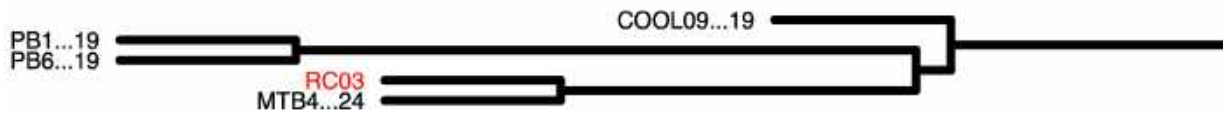


Figure 9: Multivariate Analysis Comparing RC03 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

Outlier to large group of Speawood Dunes FCTs (FCT29a, 29b, 24, 25, 26a, 26b, 27, 28, 30a-c). RC03 and RC04 very proximally close to each other, even though vegetation structure is different.

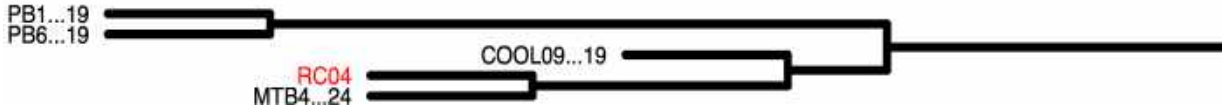


Figure 10: Multivariate Analysis Comparing RC04 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

Outlier to large group of Speawood Dunes FCTs (FCT29a, 29b, 24, 25, 26a, 26b, 27, 28, 30a-c). RC03 and RC04 very proximally close to each other, even though vegetation structure is different.

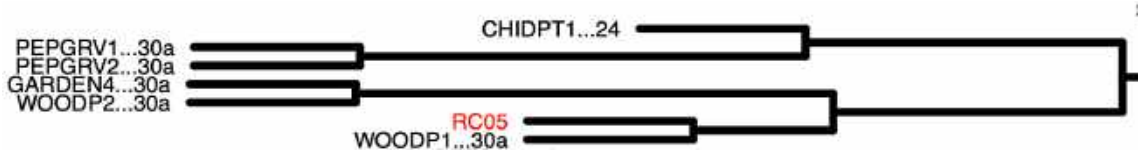


Figure 11: Multivariate Analysis Comparing RC05 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

In a broader cluster including FCT29a, 30a, 30b.

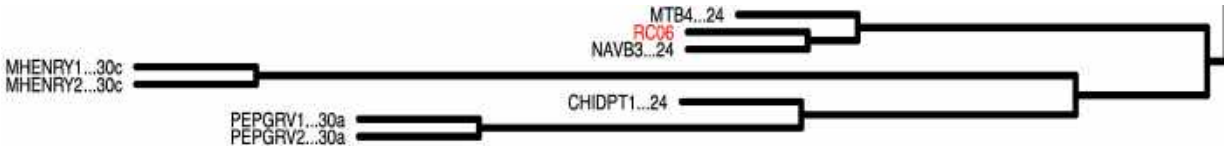


Figure 12: Multivariate Analysis Comparing RC06 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

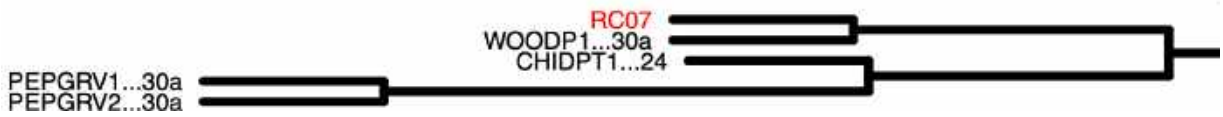


Figure 13: Multivariate Analysis Comparing RC07 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

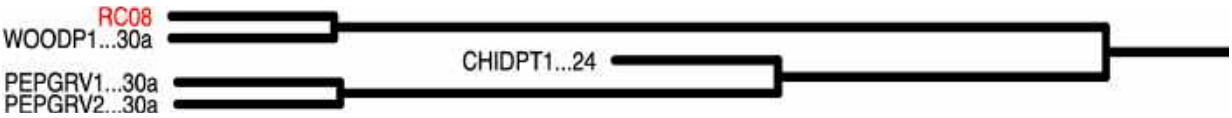


Figure 14: Multivariate Analysis Comparing RC08 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

In a broader cluster with FCT29a, 30a and 30b.



Figure 15: Multivariate Analysis Comparing RC09 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

In a broader cluster with FCT29a, 30a and 30b.

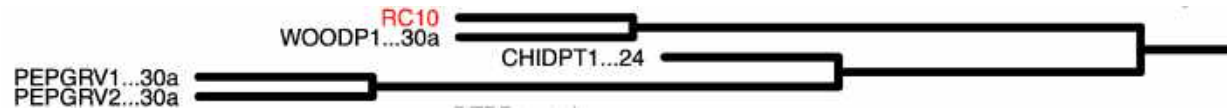


Figure 16: Multivariate Analysis Comparing RC10 to Gibson *et al.* (1994) dataset. Kulczynski, Average.

In addition each of the quadrats were analysed against the Keighery *et al.* (2020) dataset using the single site insertion method.

The results are summarised in Table 16.

See Section 6.3.2 for a discussion of the TEC/PEC status of the FCTs identified in the conclusion.

Table 16: Results of Statistical Analysis FCTs (Gibson *et al.*, 1994) (Keighery *et al.*, 2020)

Quadrat	Gibson et al (1994)	Locality	Keighery et al (2020)	Locality	Conclusion
RC01	COOL08 (FCT24)	Lake Cooloongup	rich02 (FCT29a)	Lake Richmond	FCT24. (Likely to be a drier or transitional version of FCT19).
	COOL02 (FCT24)	Lake Cooloongup	COOL08 (FCT24)	Lake Cooloongup	
	COOL03 (FCT24)	Lake Cooloongup	COOL02 (FCT24)	Lake Cooloongup	
	MBT4 (FCT24)	Mt Brown Henderson	COOL03 (FCT24)	Lake Cooloongup	
	NAVB4 (FCT24)	Naval Base (suburb)	NAVB4 (FCT24)	Naval Base (suburb)	
	MBT2 (FCT24)	Mt Brown Henderson	MBT2 (FCT24)	Mt Brown Henderson	
	MBT3 (FCT24)	Mt Brown Henderson	MBT3 (FCT24)	Mt Brown Henderson	
RC02	NAVB3 (FCT24)	Naval Base (suburb)	TR06 (S11)	Trigg	FCT24.
	MBT4 (FCT24)	Mt Brown Henderson	NAVB4 (FCT24)	Naval Base (suburb)	
	NAVB4 (FCT24)	Naval Base (suburb)	MBT2 (FCT24)	Mt Brown Henderson	
	MBT2 (FCT24)	Mt Brown Henderson	MBT3 (FCT24)	Mt Brown Henderson	
	MBT3 (FCT24)	Mt Brown Henderson			
RC03	MBT4 (FCT24)	Mt Brown Henderson	MBT4 (FCT24)	Mt Brown Henderson	FCT19/FCT24 (Likely to be a drier or transitional version of FCT19).
	COOL09 (FCT19)	Lake Cooloongup	NAVB2 (FCT29a)	Naval Base (suburb)	
	PB1 (FCT19)	Port Kennedy	rich02 (FCT29a)	Lake Richmond	
	PB6 (FCT19)	Port Kennedy	COOL08 (FCT24)	Lake Cooloongup	
			COOL02 (FCT24)	Lake Cooloongup	
			COOL03 (FCT24)	Lake Cooloongup	
RC04	MBT4 (FCT24)	Mt Brown Henderson	PB1 (FCT19)	Port Kennedy	FCT19 (Likely to be a drier or transitional version of FCT19).
	COOL09 (FCT19)	Lake Cooloongup	PB6 (FCT19)	Port Kennedy	
	PB1 (FCT19)	Port Kennedy			
	PB6 (FCT19)	Port Kennedy			
RC05	WOODP1 (FCT30a)	Woodman Point	WOODP1 (FCT30a)	Woodman Point	FCT30a Non-climax community version FCT30a? (Structurally dissimilar).
	WOODP2 (FCT30a)	Woodman Point	WOODP2 (FCT30a)	Woodman Point	
	GARDEN4 (FCT30a)	Garden Island	GARDEN4 (FCT30a)	Garden Island	
	CHIDPT1 (FCT24)	Chidley Pt Nedlands	CHIDPT1 (FCT24)	Chidley Pt Nedlands	
	PEPGRV1 (FCT30a)	Peppermint Grove	PEPGRV1 (FCT30a)	Peppermint Grove	
	PEPGRV2 (FCT30a)	Peppermint Grove	PEPGRV1 (FCT30a)	Peppermint Grove	
RC06	NAVB4 (FCT24)	Naval Base (suburb)	much04 (FCT25)*	Muchea	FCT24/FCT30a. However with secondary associations i.e. FCT25.
	MBT4 (FCT24)	Mt Brown Henderson	vines01 (FCT25)*	Ellenbrook	
	CHIDPT1 (FCT24)	Chidley Pt Nedlands	exbeer01 (FCT24)*	Beermullah	
	PEPGRV1 (FCT30a)	Peppermint Grove	exbeer02 (FCT18)*	Beermullah	
	PEPGRV1 (FCT30a)	Peppermint Grove			
RC07	WOODP1 (FCT30a)	Woodman Point	WOODP1 (FCT30a)	Woodman Point	FCT24/FCT30a. Non-climax community version FCT30a?
	MBT4 (FCT24)	Mt Brown Henderson	rott3 (S12)	Rottnest Island	
	PEPGRV1 (FCT30a)	Peppermint Grove	NAVB1 (FCT16)	Naval Base (suburb)	
	PEPGRV2 (FCT30a)	Peppermint Grove	PRES1 (FCT29a)	Preston Beach	
			rott6 (S12)	Rottnest Island	
			rott4 (S12)	Rottnest Island	
			rott5 (FCT16)	Rottnest Island	
RC08	WOODP1 (FCT30a)	Woodman Point	WOODP1 (FCT30a)	Woodman Point	FCT24/FCT30a. S11: Northern *Acacia rostellifera-Melaleuca systena* shrublands
	CHIDPT1 (FCT24)	Chidley Pt Nedlands	m4601 (S11)	Bold Park	
	PEPGRV1 (FCT30a)	Peppermint Grove	m4602 (S11)	Bold Park	
	PEPGRV2 (FCT30a)	Peppermint Grove	bold05 (S11)	Bold Park	

Quadrat	Gibson et al (1994)	Locality	Keighery et al (2020)	Locality	Conclusion
			bold06 (FCT30a2)	Bold Park	Non-climax community version FCT30a? (Structurally dissimilar).
RC09	MBT4 (FCT24)	Mt Brown Henderson	MBT4 (FCT24)	Mt Brown Henderson	FCT24
	NAVB4 (FCT24)	Naval Base (suburb)	NAVB2 (FCT29a)	Naval Base (suburb)	
	COOL08 (FCT24)	Lake Cooloongup	rich02 (FCT29a)	Lake Richmond	
	COOL02 (FCT24)	Lake Cooloongup	COOL08 (FCT24)	Lake Cooloongup	
	COOL03 (FCT24)	Lake Cooloongup	COOL02 (FCT24)	Lake Cooloongup	
			COOL03 (FCT24)	Lake Cooloongup	
RC10	WOODP1 (FCT30a)	Woodman Point	WOODP1 (FCT30a)	Woodman Point	FCT24/FCT30a. Non-climax community version FCT30a? (Structurally dissimilar).
	CHIDPT1 (FCT24)	Chidley Pt Nedlands	GARDEN4 (FCT30a)	Garden Island	
	PEPGRV1 (FCT30a)	Peppermint Grove	WOODP2 (FCT30a)	Woodman Point	
	PEPGRV1 (FCT30a)	Peppermint Grove	CHIDPT1 (FCT24)	Chidley Pt Nedlands	
			PEPGRV1 (FCT30a)	Peppermint Grove	
			PEPGRV2 (FCT30a)	Peppermint Grove	

* These affiliations appear to be with eastern SCP limestone communities.

While the results overwhelmingly indicate an association with FCT19, FCT24 and/or FCT30a, there are also secondary links in the Keighery *et al.* (2020) results to other Quindalup Dune original and supplementary FCTs. These were:

S11 Northern *Acacia rostellifera-Melaleuca acerosa (systena)* shrublands (Bold Park)
S12 Rottnest Island *Melaleuca lanceolata* and/or *Callitris preissii* forests and woodlands.
FCT29a Coastal shrublands of shallow sands.

There were also some weak links to other wetland FCTs. These were:

FCT16 Highly saline seasonal wetlands (Rottnest and Naval Base) (RC07, RC09)

There is also an unexplained association with FCT25: Southern *Eucalyptus gomphocephala/Agonis flexuosa* woodlands quadrats from Muchea and Ellenbrook. These sites may be associated with Muchea limestone communities. However it also may be an FCT assignation error in Keighery *et al.* (2020), the northern natural extent of *Agonis flexuosa* is the Swan River, however as this study shows, the floristics do not always rely on one or two specific flora species.

6.3.2 Conservation Significant Vegetation

Table 16 indicates that the vegetation in the study area has the closest and most consistent associations to FCT19, FCT24 and FCT30a.

FCT19 represents the commonwealth (Endangered) listed TEC *'Sedgelands of the Holocene Dune Swales'*. FCT19 also represents state-listed (Critically Endangered) TEC: *'SCP19b: Woodlands over Sedgelands in Holocene dune swales of the southern SCP (FCT19 as originally described in Gibson et al. 1994)'*

FCT24 represents state-listed PEC (P3) SCP24: *'Northern Spearwood shrublands and woodlands'.*

FCT30a represents state-listed (Critically Endangered) TEC: *'SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP (FCT30a as originally described in Gibson et al. 1994)'*

There is also a secondary association with SCP29a: *'Coastal shrublands on shallow sands, southern SCP'* (FCT29a), which is a state-listed PEC (P3).

There is a disconnect however between some of the floristics and structural forms in the study area. This is possibly due to the vegetation being of a rare type and a complex mosaic, particularly in the southern portion of the core area, and with a long disturbance history. Despite these factors however, the statistical analysis returned surprisingly strong results, particularly considering the condition of the vegetation.

'Sedgelands of the Holocene Dune Swale (FCT19)

FCT19 represents the state and federally listed TEC *'Sedgelands of the Holocene Dune Swales'*. There is a known occurrence of this TEC in the study area that was identified in the DBCA Species and Communities database search. It has been allocated to subtype 19b: *'Woodlands over sedgelands in Holocene dune swales'*. This subtype occurs in older swales and has an overstorey of woodland species that are more moisture tolerant, such as *Banksia littoralis, Eucalyptus gomphocephala, Eucalyptus rudis* subsp. *rudis, Melaleuca rhaphiophylla*. All of which were recorded at various points from in the beach ridge plains in the study area (Vegetation Types A3-A6, Figure 3).

As of 2021, there was 200 hectares of *'Sedgelands of the Holocene Dune Swales'*, 10% of which is protected in reserves. 60% (120 hectares) of which is subtype FCT19a and 40% of which is FCT19b (80 hectares) (DoCCEE, 2023a).

It has been assumed that the study area occurrence has been included in DoCCEE (2023a) under 'Industrial Park 14 Rockingham', which is listed as being 60 hectares in size in total. This represents the largest remaining occurrence of this TEC. The next largest is 41 hectares at Lake Cooloongup and Lake Walyungup. DEC (2011) states that the occurrences in the RIZ are 5,000-6,000 years old, the second oldest section of the beach ridge plains (Lakes Cooloongup and Walyungup are the oldest at >6,000 years old).

DoCCEE (2023a) and DEC (2011) state that the threats to this TEC have included clearing, inappropriate fire regimes, weed invasion, rubbish dumping, declining rainfall and groundwater, nutrient loading, grazing by native and feral animals, diseases and recreation such as off-road vehicle use and camping, amongst others. More specifically for Occurrence 33 (IP14-01) (DEC, 2011) that the study area is a part of, the main threats are described as weed invasion, recreational activities and inappropriate fire regimes.

DEC (2011) states that there is no quadrat data for Occurrence 33 (IP14-01). It may be of value to allow the quadrat data in this report to be forwarded to the DBCA Species and Communities Branch. While the study area is in poor condition, the quadrat data is of high quality and provides a representation of the state of the TEC at this site.

SCP24: Northern Spearwood shrublands and woodlands ('FCT24')

'Northern Spearwood shrublands and woodlands ('floristic community type 24')' is a Priority 3 PEC in Western Australia. It is described by DBCA as qualifying as a TEC on the occasions when it is a component of the *'Banksia Woodlands of the SCP'* TEC. This principle would also apply to the *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* TEC.

Not much is known about state listed PECs. This is a reason why many have not been assessed for TEC status. This is particularly true of Priority 3 ecological communities, many of which are awaiting assessment as TECs.

The Priority Flora list is managed by the DBCA, and they describe this PEC as *'Heaths with scattered Eucalyptus gomphocephala occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include Dryandra sessilis, Calothamnus quadrifidus, and Schoenus grandiflorus.'*.

This FCT was originally described by Gibson *et al.* (1994), mapped as occurring from Safety Bay northwards. It is a complex of many different vegetation types. While it is described as being a Spearwood Dunes ecological community, Spearwood extends directly to the coast in many areas e.g. Mt Brown, Henderson and Naval Base approximately 10km to the north of the study area, where extensive FCT24 is known to occur. Floristically it typically supports many near-coastal flora species. The study area is the widest section of Quindalup Dunes in the PMR. It extends further inland and is on more consolidated soil than is usually typical of Quindalup Dunes.

The examples of FCT19 in the study area appear possibly to be drying out, and FCT24 is a drier community than FCT19 usually is. Perhaps this is why FCT19 and FCT24 are interlinked in the study area.

The presence of a Forest *Eucalyptus gomphocephala* (Tuart) in the study area needs to be explained. The statistical analysis indicated that the Tuart quadrats in the study area were almost equally and strongly related to FCT30a and FCT24. Usually a slightly unexpected statistical analysis result can be put down to issues with quadrat data and/or poor vegetation condition. However the strength of the results, supported by geographical context was too obvious to ignore in this case.

Tuart is a component of FCT24 (present in 24% of quadrats in Gibson *et al.,* 1994) and FCT30a (29%). Only FCT25 has a higher frequency at 82%. There were weak influences only from FCT25 in the study area (Table 16, RC06).

SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP (FCT30a)

As discussed above, various analyses indicated that there were strong floristic associations with FCT30a in the study area.

'SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP (FCT30a as originally described in Gibson et al. 1994)' is a TEC (Critically Endangered) under the Western Australian *BC Act*.

However, neither *Callitris preissii* or *Melaleuca lanceolata* were recorded in the study area.

There are extensive stands of both species in the near-coastal dunes at Rockingham and Kwinana Beaches (K. McCreery pers. obs.). These are less than 1km west of the study area, extending intermittently along the coast for a few kilometres. A stand of both species can be seen in dunes to the south of the CBH Grain Terminal. Interestingly, these records were not on the DBCA database search (the closest known records of

FCT30a were at Garden Island and Woodman Point). Tuart stands and *Acacia rostellifera* thickets also co-occur through these areas.

Relatively speaking *Melaleuca lanceolata* and *Callitris preissii* are not common plants on the southern SCP. They are fire sensitive species, and as the Perth region is now a more fire prone landscape than it was prior to settlement, they are becoming less common. Long unburnt examples elsewhere form tall dense closed forests and woodlands, similar to what can be seen on Rottnest Island.

Beard (1979) stated that in the Rockingham System (including Rottnest and Garden Islands) *Callitris preissii-Melaleuca lanceolata* communities are the climax community to *Acacia rostellifera* thickets. He states taller thickets to low forests can form in dune systems, but these are frequently destroyed by fire, with taller species including *"Callitris preissii (now uncommon and possibly the apex community) and Acacia rostellifera (most common)".*

The TEC *'SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP'* was originally defined by the Gibson *et al.* 1994 study. Since that time there has been significant review into this ecological community. Much of the speculation however has been in the opposite direction, that the presence of *Callitris preissii* and/or *Melaleuca lanceolata* does not necessarily indicate the presence of FCT30a but of other FTCs (in particular FCT29a, 30c2, S13) (DPW, 2014)

DPW (2014) also refers to the variety of subtypes:

> *'Prior to European impacts it is considered that the vegetation composition in the Callitris preissii community on Rottnest, would have been more similar to other areas such as Garden Island. Therefore the Rottnest examples, and other areas of native vegetation that naturally contain Callitris preissii in appropriate habitat near Perth are considered to represent types and sub-types of the Callitris preissii (or Melaleuca lanceolata) forests and woodlands.'*

DPW (2014) also outlines the requirement for further studies into the structural and floristic variation in this TEC. This ambiguity is likely why this community is not also listed under the *EPBC Act*.

As discussed, the statistical analyses still showed a strong and persistent link to FCT30a. In particular to quadrats on Garden Island and at Woodman Point, as well as examples on Rottnest Island and Peppermint Grove.

While it seems unlikely, it has to be considered that in particular Forest *Eucalyptus gomphocephala* (Tuart) (Vegetation Type A1, Figure 3) and Tall Shrubland *Acacia rostellifera* thickets (Vegetation Type A2, Figure 3) may represent disturbed manifestations and/or variants of the state-listed *'SCP30a: Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the SCP'* TEC.

Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP

As discussed in the previous two sections, there is good evidence to suggest that the Forest *Eucalyptus gomphocephala* (Tuart) (Vegetation Type A1, Figure 3) in the study area is representative of an ecological sub-type closely related to FCT24 and/or FCT30a.

There is a strong and consistent link between study area quadrats (RC02, RC05, RC08, RC10) and Gibson *et al.* (1994) and Keighery *et al*. (2020) FCT24 and FCT30a quadrats that occur at Bold Park, Peppermint Grove and Nedlands; Naval Base, Henderson and Woodman Point. Also Lake Cooloongup 4km to the south east and Garden Island 10km to the north west of the study area. These areas constitute an approximate 30km

range in a narrow near-coastal band from Bold Park to Rockingham (including estuarine areas of the Swan River).

While the statistical analysis was useful to establish what kind of sub-type of Tuart community was present in the study area, the listing of *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* TEC under the *EPBC Act* is based on much broader diagnostic questions than listed ecological communities previously have been.

The Approved Conservation and Listing Advice for *'Tuart (Eucalyptus gomphocephala) woodlands and forests of the SCP'* (DoEE, 2019) provides a framework for establishing whether this community is protected under the *EPBC Act*. These have been applied here in Table 17 (Key Diagnostic Questions), Table 18 (Other Diagnostic Questions) and Table 19 (Condition Categories and Thresholds). These criteria also apply to the Western Australian Priority 3 listing of this community.

To summarise the findings of this exercise the area of Forest *Eucalyptus gomphocephala* (Tuart) (Vegetation Type A1, Figure 3) within the study area is too small to bypass condition thresholds (a patch needs to be >5 hectares in size to be protected regardless of condition).

Within its patch size category of 2-5 hectares, it qualifies for protection marginally on the basis of condition.

There are issues with some of these criteria from a botanical perspective. These are discussed in Table 19, and are mainly related to how condition thresholds are set lower for this community compared to other ecological communities. Four native species per quadrat for example, is a very low bar, considering 30-40 species or more would be expected from a moderately intact examples of Tuart communities. There are obviously other considerations for this community type e.g. the scarcity of intact examples and their value as habitat.

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Table 17: Key Diagnostic Questions for 'Tuart Woodlands and Forests of the SCP' TEC (modified DoEE, 2019)

KEY DIAGNOSTIC QUESTIONS The national ecological community is limited to patches of vegetation (with their associated biota) that meet each of the following key diagnostic characteristics	RESPONSE
Key Diagnostic Questions: Occurs in the Swan Coastal Plain Bioregion within the state of Western Australia**; AND**	**Yes.** The project area is in the Swan Coastal Plain IBRA region of Western Australia.
Key Diagnostic Questions: Primarily occurs on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands. It occurs below the Darling and Whicher escarpments where they define a plateau to the east of the Swan Coastal Plain**; AND**	**Yes.** The project area is on the Quindalup Dune system.
Key Diagnostic Questions: Most often occurs as a woodland but can occur in a variety of structural forms, including closed forest, open forest, woodland, open woodland, closed mallee forest, open mallee forest, mallee woodland and open mallee woodland.	**Yes.** The project area contained Tuart *Eucalyptus gomphocephala* Forest to Woodland.
Key Diagnostic Questions: The dominant canopy species is tuart (*Eucalyptus gomphocephala*) being the most abundant tree species in the canopy It may occur either as a single stemmed tree or occasionally as a mallee. While other tree species may be present in the canopy, they are less abundant than tuart.	**Yes.** The dominant canopy species where it occurs (Vegetation Type A1, Figure 3) is Tuart *Eucalyptus gomphocephala*.
Key Diagnostic Questions: For a patch of vegetation to be identified as the ecological community, there must be established tuart trees present, meeting the patch definition. A patch is defined as: • A discrete and mostly continuous area of the ecological community. • It contains a minimum of three established (> 15cm diameter at breast height) tuart trees, with no greater than 40m between the outer edges of their canopies. • 20m beyond the outer edge of the canopy of individual tuart trees where the understorey consists of native vegetation. • Possibly containing areas in different states of condition. In assessing the patch note any areas that are either significantly higher or lower in quality, and the condition classes that would apply across these different parts of the site.	**Yes**. The study area has one main 'patch' (see polygon in which RC-02, RC-05 and RC-08 occurs, Vegetation Type A1, Figure 3) that had 'A minimum of three established Tuart trees, with no greater than 40m between the edges of their canopies'. This area is dense Tuart Forest with hundreds of trees of varying age, some very old and large with Diameter at Breast Height (DBH) over 1m, another growth stage with DBH around 40cm, through to a crop of recent saplings (Appendix D). Most of this main polygon is in Degraded Condition. The best condition example is a small area around RC-02 (Figure 3) and along the interface with Vegetation Type A4, which is in Good and Good-Degraded condition. This area is well under 0.5 hectares in size (approximately 0.1-0.2 hectares). A number of outlier polygons on of Vegetation Type A1 (Figure 3) are Degraded or Degraded-Completely Degraded (mainly individuals or clumps of Tuart over scattered native shrubs and weedy ground stratum).

Table 18: Further Information to Determine Presence of 'Tuart Woodlands and Forests of the SCP' TEC (DoEE, 2019)

OTHER DIAGNOSTIC QUESTIONS The national ecological community is limited to patches of vegetation (with their associated biota) that meet each of the following key diagnostic characteristics	RESPONSE
Other Diagnostic Questions: Other tree species frequently present in the canopy or sub-canopy are: *Agonis flexuosa* and *Banksia grandis* (both in the southern part of the range); *Banksia attenuata*, *Eucalyptus marginata*; less commonly, *Corymbia calophylla*.	No other tree species were present in this 'patch'.
Other Diagnostic Questions: An understorey of native plants, which may include grasses, herbs and shrubs, is typically present. The composition and structure of this understorey varies across the range of the ecological community.	Very few native species remain in the understorey. Scattered Shrubs, Forbs, Grasses, Sedges remain in places, slightly more frequently in areas in Good and Good-Degraded condition. Tall Shrubs *Acacia saligna, A. cyclops, A. rostellifera, Spyridium globulosum, Melaleuca h.* ssp. *huegelii* and/or *Xanthorrhoea preissii*. Low Shrubs *Leucopogon parviflorus, Lysiandra calycina* and *Rhagodia b.* ssp. *baccata.* Occasional native grasses *Austrostipa flavescens* and *Poa porphyroclados* and native Sedge *Lepidosperma calcicola.* Vines *Clematis linearifolia, Cassytha r.* forma *racemosa, Hardenbergia comptoniana, Muehlenbeckia adpressa.* Very few native Forbs were seen apart from some species known to be resilient in disturbed areas e.g. *Caladenia latifolia, Dianella revoluta* var. *divaricata.* Weed cover was high, up to 90% typically Grassland of **Ehrharta longiflora* (Annual Veldt Grass), **Bromus diandrus* (Great Brome), **Lagurus ovatus* (Hare's Tail Grass), **Lolium perenne* (Rye Grass) and/or **Avena barbata* (Wild Oats). See Section 6.2.1 for full Vegetation Type A1 description.
Other Diagnostic Questions: Relationship with other ecological communities The range of the ecological community overlaps and interacts with other ecological communities of the Swan Coastal Plain, including some listed under the *EPBC Act 1999*. At some locations more than one ecological community may be present. The following considerations apply to the identification of the ecological community where it is likely to overlap with some other listed ecological communities (See DoEE, 2019 p. 23 and Appendix F3 for full list): • *Sedgelands in Holocene Dune Swales* – this ecological community occurs in linear damplands, typically waterlogged in winter. Characteristic species include shrubs *Acacia rostellifera* (Summer-scented Wattle), *Acacia saligna* (Orange Wattle), *Xanthorrhoea preissii* (Grass Tree) and sedges and grasses. Typically more open structure than Tuart woodlands and forests, but a closer tree canopy may develop, including Tuart or *Banksia littoralis* (swamp Banksia), which may meet the diagnostic characteristics for the Tuart woodlands and forests ecological community. Not common and most likely in areas between dunes on the Quindalup formation.	**Yes.** The main 'patch' of Tuart Forest intergrades with a known occurrence of *'Sedgelands in Holocene Dune Swales'* TEC at its eastern and southern boundaries. See Figure 3 where Vegetation Type A1 and A6 intersect. Vegetation Type A4 also has some affiliations with *'Sedgelands in Holocene Dune Swales'.* There is a complex mosaic of vegetation types in this area, which are further complicated by poor condition (low diversity and high weed cover). See Section 6.2.1 for a full description of these Vegetation Types (mainly A5 and A6). All the species listed under the description are present; *Acacia rostellifera, A. saligna, Xanthorrhoea preissii* and very occasionally *Banksia littoralis* and *Eucalyptus gomphocephala* (Tuart). However the Tuart in Vegetation Types other than A1, were never abundant enough to come close to meeting patch thresholds.
Revegetated areas and areas of regrowth Revegetated or replanted sites (or areas of regrowth) may be part of the nationally protected ecological community, provided that the patch meets the key diagnostic characteristics and minimum condition class above	No revegetation is present. It is likely that some kind of non-wholescale clearing has occurred in the past (fire, grazing style of 'clearing'). In recent decades the Tuart understorey in particular and surrounding vegetation has regrown, as well as it can considering the dominance of weeds.

OTHER DIAGNOSTIC QUESTIONS The national ecological community is limited to patches of vegetation (with their associated biota) that meet each of the following key diagnostic characteristics	RESPONSE
Sampling protocol Thorough and representative on-ground surveys are essential to accurately assess the extent and condition of the ecological community e.g. *Keighery (1994)*.	The Keighery (1994) methodology (equivalent to Gibson *et al.* (1994) and EPA (2016) methodology) was used to assess vegetation type and condition, including placing four 10m x 10m quadrats in areas with Tuart Forest (RC02, RC05, RC08 and RC10), even though the condition was sub-optimal for quadrat surveys. See Section 5 for detail on survey methodology.
Timing of surveys and seasonal variation Timing of surveys is an important consideration because the ecological community can vary in its appearance through the year and between years, depending on climatic conditions. Ideally, surveys should be held in more than one season to maximise the chance of detecting all species present. Many species are easiest to detect or identify in spring when many are flowering and reproducing.	The timing of the survey was optimal, 12-15th September 2023, with a follow up late spring survey on the 17-19th October 2023. Rainfall was suboptimal in spring of 2023 (Section 3.2). This meant a very short growing period and did not appear to severely effect survey results to a great degree. Some moisture sensitive species may have been absent, particularly during the second survey.

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Regardless of how the area of Forest *Eucalyptus gomphocephala* (Tuart) Vegetation Type A1 (Figure 3) present in the study area is calculated, the 'patch' or 'patches' in the study area fall within the patch size category of 2-5 hectares.

Table 19: Condition Categories and Thresholds 'Tuart Woodlands and Forests of the SCP' TEC (DoEE, 2019)

Biotic Thresholds	'Tuart Woodlands and Forests of the SCP' For Patches 2-5 Hectares	Response
Very high condition Category 1: ≥80 % of all understorey^ vegetation cover is native#. **OR** Category 2: At least 12 native understorey^ species per 0.01 ha (10 m x 10 m plot)	Medium sized patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	NA (Moderate Condition, Criteria 2) (Poor Condition, Criteria 1)
High condition Category 1: ≥60 % of all understorey^ vegetation cover is native#. **OR** Category 2: At least 8 native# understorey^ species per 0.01 ha (10 m x 10 m plot)	Medium sized patches with high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	NA (Moderate Condition, Criteria 2) (Poor Condition, Criteria 1)
Moderate condition Category 1: ≥50 % of all understorey^ vegetation cover is native#. **OR** Category 2: At least 4 native# understorey^ species per 0.01 ha (10 m x 10 m plot)	Medium sized patches with moderate condition understorey. **AND** That either: have an important landscape role (≤100 m to native vegetation)* **OR** have a habitat role (≥2 very large trees per 0.5 ha)* **OR** show regeneration (≥15 seedlings and/or saplings per 0.5 ha)* PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Qualifies as part of the protected ecological community under this category. Doesn't qualify under Category 1, as there are few if any areas where native understorey is >50% cover, and where it is these are mid-storey cover (the ground layers are dominated by weeds). Qualifies under Category 2 (See Figure 3 for quadrat locations): Quadrat RC02 (18 natives, 23 weeds in understorey) Quadrat RC05 (10 natives, 16 weeds) Quadrat RC10 (7 natives, 16 weeds). Note: quadrats were placed in the very best condition vegetation that could be found. These areas were highly localised and hard to find. Four native species is a low threshold, when a subset of native species are disturbance species, or are otherwise resilient in the face of ecosystem collapse. Qualifies under habitat role as there are more than 2 very large DBH >50cm Tuart trees per hectare in study area. There are trees of many growth ages present, from saplings with ca. 10cm DBH through to trees with over 1m DBH.

Biotic Thresholds	'Tuart Woodlands and Forests of the SCP' For Patches 2-5 Hectares	Response
Poor Category 1: Minimal-no native# cover/species richness: <50% of all understorey^ vegetation cover is native#. **AND** Category 2: Less than 4 native# understorey^ species per 0.01ha (10m x10m plot)	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)	Qualifies for this category in places. Quadrat RC08 (3 native species, 12 weeds) (Figure 3). Less than 50% cover of native species is typical. Where this isn't the case, the native cover is often from tall shrubs, or spreading shrubs (a single shrub e.g. *Spyridium globulosum, Acacia rostellifera, A. cyclops, Melaleuca huegelii,* can have 25% cover).

'Native' refers to species naturally occurring in southwest WA.

^ Understorey vegetation cover includes annual and perennial vascular plant species of both the ground layer and the shrub layer up to 3 m in height.

* Indicators of important landscape, habitat or regeneration features:

Landscape – the patch occurs ≤100m to another patch of native vegetation of >1 ha in size. Can be other patches and/or other vegetation where ≥50 % of the vegetation cover in all layers is native flora.

OR

Habitat – patch contains a mean of ≥2 very large trees (≥50 cm DBH) per half hectare of any species native to southwest Western Australia.

OR

Regeneration – patch displays evidence of natural regeneration of eucalypts naturally occurring in southwest WA, seedlings, saplings or other sub-mature stages (<15 cm DBH) with at least a mean of 15 per half hectare.

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6.4 CONCLUSIONS

To summarise, the vegetation in the study area in its original state would have had exceptional ecological value.

A long history of what appears to be too frequent fire and/or grazing and recreational activities, has reduced the condition of the vegetation in the study area to marginal.

'Good' condition is generally considered to be the threshold for vegetation to have a chance of retaining long term viability. Even 'Good' condition vegetation has significant disturbance. In the past, this category was called 'Poor'. This was changed as it implies it has no value, when there can be some value to vegetation in this condition e.g. habitat, buffers. On top of which, there were only localised areas in 'Good' condition in the study area, usually indicated by where quadrats were placed (Figure 3). Most of the vegetation was in Good-Degraded, Degraded or Degraded-Completely Degraded condition (Figure 4).

To restore the vegetation in the study area would take intensive management. Restoration is a much more difficult task than is often acknowledged, if not impossible. These systems are too complex to recreate. And extensive and ongoing disturbances such as weeds, hydrological changes and inappropriate fire regimes can prevent them from naturally regenerating.

6.5 LIMITATIONS

EPA (2016) provides a framework for identifying the limitations that may apply to a survey (Table 20).

Table 20: Limitations of the Assessment (modified from EPA, 2016)

Limitation	Comment
Competency/experience of the consultant carrying out the survey e.g. degree of expertise in plant identification to taxon level and experience in bioregion.	Kelli McCreery has been involved in baseline botanical surveys for EIA on the SCP since 1996 including flora identifications. The Duty Botanist Michael Hislop at the WAH confirmed identifications of Priority Flora.
Scope (what flora groups were sampled and were some sampling methods not able to be employed because of constraints).	The survey was a Detailed Survey (EPA, 2016) including quadrats, relevés, opportunistic collections, condition rating and traverses (10m), across a two season (mid and late-spring). All vascular flora seen were sampled and/or recorded.
Proportion of flora collected and identified (based on sampling, timing and intensity).	129 (54 or 41.9% native) taxa were recorded from approximately 20 hectares. Difficult to estimate however it is likely that this represents >70% of the expected flora. While coastal vegetation is less species rich than other areas on the SCP, 55 native flora species is quite low, particularly for a study area with a relatively high concentration of different habitat and vegetation types. Particularly Low Shrubs and Forb strata were depauperate, mainly due to the disturbance history at the site. Spring of 2023 had an unusually short growing season due to sporadic and low rainfall. Some species may have been absent due to this, however it is often the case that species are less vigorous and/or abundant rather than absent in these conditions.
Mapping reliability.	Vegetation type and condition is always more complex and fine scale than can feasibly be mapped. This site has both complex vegetation and an extensive disturbance history. Mapping boundaries are indicative of the broad values present, with some natural localised variation occurring within each mapping polygon.

Limitation	Comment
The proportion of the task achieved and further work which might be needed.	This report satisfies the requirements of a Detailed Flora and Vegetation Survey.
Timing/weather/season/cycle.	The spring surveys were completed at optimal times for the location (mid-Sept. and mid-Oct. 2023). However the seasonal conditions for a botanical survey in spring 2023 were moderate only. While there was nearly 500mm of rain preceding the surveys, there were prolonged dry spells, particularly in August and October (Figure 2). The growing period was very short, with very extreme drying off occurring in the four weeks between the early and later spring surveys. Many species were still present but not as vigorous as usual. Extra care was taken to look for diminutive versions of expected species. A small number of annuals and geophytes including weeds were likely to have been missed however.
Disturbances affecting results.	None that appeared to affect survey results. There were no recent burns or clearing in the study area.
Completeness of survey. Remoteness or access issues, intensity of survey.	The intensity was appropriate to the task. The study area was covered on foot over early and late spring. No access issues, although some sections of (Degraded) *Acacia rostellifera* thickets were impenetrable.
Availability of contextual (e.g. biogeographic) information on the region.	Contextual information is high level and patchy across WA, particularly for vegetation. This affects all botanical studies. What contextual information was available has been incorporated into Section 3.0 and throughout this report where appropriate.

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7. ACRONYMS AND ABBREVIATIONS

AVH	Australian Virtual Herbarium
BAM Act	Biosecurity and Agriculture Management Act 2007
BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
DAFWA	Department of Agriculture and Food Western Australia
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCLM	Department of Conservation and Land Management
DPIRD	Department of Primary Industries and Regional Development
DMIRS	Department of Mines, Industry Regulation and Safety
DoEE	Department of Environment and Energy
DPW	Department of Parks and Wildlife
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EPBC Act	*Environmental Protection Biodiversity Conservation Act 1999*
ESCAVI	Executive Steering Committee for Australian Vegetation Information
FCT	Floristic Community Type
forma.	Form (taxonomy)
GDA94	Geocentric datum of Australia 1994
GDA2020	Geocentric datum of Australia 2020
GPS	Global Positioning System
IBSA	Index of Biodiversity Surveys for Assessments
IBRA	Interim Biogeographical Regionalisation of Australia
IUCN	International Union for Conservation of Nature
MNES	Matters of National Environmental Significance
NVIS	National Vegetation Information System
PEC	Priority Ecological Community
PF	Priority Flora
PMR	Perth Metropolitan Region
SCP	Swan Coastal Plain
ssp., subsp.	Subspecies (taxonomy)
TEC	Threatened Ecological Community
TF	Threatened Flora
var.	Variety (taxonomy)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WGS84	World Geodetic System 1984
WONS	Weeds of National Significance

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Appendix A: Flora Species List by Family

* = Indicates weed flora.

Family	Species
ANACARDIACEAE	**Schinus terebinthifolia*
APIACEAE	**Foeniculum vulgare*
APOCYNACEAE	*Alyxia buxifolia*
	**Gomphocarpus fruticosus*
ASPARAGACEAE	*Acanthocarpus preissii*
	**Agave americana*
	**Asparagus asparagoides*
	Lomandra maritima
	Thysanotus manglesianus
ASPHODELACEAE	**Trachyandra divaricata*
	**Asphodelus fistulosus*
ASTERACEAE	**Arctotheca calendula*
	**Carduus pycnocephalus*
	**Centaurea melitensis*
	**Conyza bonariensis*
	**Gamochaeta americana*
	**Hypochaeris glabra*
	**Leontodon rhagadioloides*
	**Osteospermum ecklonis*
	**Reichardia tingitiana*
	Senecio condylus
	**Sonchus oleraceus*
	**Urospermum picroides*
BRASSICACEAE	**Brassica tournefortii*
	**Brassica x napus*
CAPRIFOLIACEAE	**Sixalix atropurpurea*
CARYOPHYLLACEAE	**Arenaria leptoclados*
	**Minuartia mediterranea*
	**Petrorhagia dubia*
	**Polycarpon tetraphyllum*
	**Stellaria media*
CASUARINACEAE	**Casuarina* sp. (planted)
CHENOPODIACEAE	*Rhagodia baccata* subsp. *baccata*
CRASSULACEAE	**Aeonium* sp.
	**Crassula glomerata*
CYPERACEAE	*Machaerina juncea*
	Ficinia nodosa
	Gahnia trifida
	Isolepis marginata

Family	Species
CYPERACEAE cont.	*Lepidosperma calcicola*
	Lepidosperma longitudinale
DILLENIACEAE	*Hibbertia racemosa*
ERICACEAE	*Leucopogon parviflorus*
EUPHORBIACEAE	*Adriana quadripartita*
	**Euphorbia peplus*
	**Euphorbia terracina*
	**Ricinus communis*
FABACEAE	*Acacia cyclops*
	Acacia rostellifera
	Acacia saligna
	Hardenbergia comptoniana
	Jacksonia furcellata
	Kennedia prostrata
	**Medicago polymorpha*
	Templetonia retusa
	**Trifolium campestre* var. *campestre*
	**Trifolium scabrum*
	**Vicia sativa*
GENTIANACEAE	**Centaurium pulchellum*
GERANIACEAE	**Erodium botrys*
	Geranium solanderi
	Geranium solanderi
	**Pelargonium capitatum*
HAEMODORACEAE	*Conostylis pauciflora* subsp. *pauciflora* (P4)
HEMEROCALLIDACEAE	*Dianella revoluta var. divaricata*
	Tricoryne elatior
IRIDACEAE	**Freesia leichtlinii X*
	**Romulea rosea*
LAURACEAE	*Cassytha racemosa* forma *racemosa*
MALVACEAE	**Malva parviflora*
	Thomasia cognata
MYRTACEAE	*Agonis flexuosa*
	Calothamnus quadrifidus subsp. *quadrifidus*
	Eucalyptus gomphocephala
	Eucalyptus rudis subsp. *rudis (x camaldulensis?)*
	**Eucalyptus utilis*
	Melaleuca huegelii subsp. *huegelii*
	Melaleuca rhaphiophylla
	Melaleuca systena
	Melaleuca viminea subsp. *viminea*
OLEACEAE	**Olea europaea* var. *europaea*
ORCHIDACEAE	*Caladenia latifolia*

Family	Species
	Cyrtostylis huegelii
	Microtis media var. *media*
OROBANCHACEAE	**Orobanche minor*
OXALIDACEAE	**Oxalis pes-caprae*
PAPAVERACEAE	**Fumaria capreolata*
	**Fumaria muralis* subsp. *muralis*
PHYLLANTHACEAE	*Lysiandra calycina*
	Poranthera microphylla
POACEAE	*Austrostipa mundula* (P3)
	Austrostipa flavescens
	**Avena barbata*
	**Brachypodium distachyon*
	**Briza maxima*
	**Briza minima*
	Bromus arenarius
	**Bromus diandrus*
	**Catapodium rigidum*
	**Cenchrus clandestinus*
	**Cenchrus setaceus*
	**Cynodon dactylon*
	**Ehrharta calycina*
	**Ehrharta erecta*
	**Ehrharta longiflora*
	**Eragrostis curvula*
	**Hordeum leporinum*
	**Hyparrhenia hirta*
	**Lagurus ovatus*
	**Lolium perenne*
	Poa porphyroclados
	**Rostraria cristata*
	**Vulpia fascicularis*
	**Vulpia muralis*
	**Vulpia myuros* forma *myuros*
POLYGONACEAE	*Muehlenbeckia adpressa*
	**Rumex hypogaeus*
PRIMULACEAE	**Lysimachia arvensis*
PROTEACEAE	*Banksia littoralis*
	Grevillea obtusifolia
	Hakea prostrata
	Hakea varia
RANUNCULACEAE	*Clematis linearifolia*
RHAMNACEAE	*Spyridium globulosum*
RUBIACEAE	**Galium murale*

Family	Species
	Opercularia vaginata
SCROPHULARIACEAE	**Verbascum virgatum*
SOLANACEAE	**Solanum laciniatum*
	**Solanum nigrum*
XANTHORRHOEACEAE	*Xanthorrhoea preissii*
	*Garden plant 1 (shrub)
	*Garden plant 2 (bulb)

Appendix B: Species by Site Table

Key:

X	Species outside of quadrat but within 30m x 30m and in same vegetation type.
H	Height in cm.
C	Cover in %.
ssp.	Subspecies.

An MS Excel version of this data was provided along with this report.

SPECIES	QUADRATS																				OPPORTUNISTIC
	RC01		RC02		RC03		RC04		RC05		RC06		RC07		RC08		RC09		RC10		
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	
Acacia cyclops																			300	1	383260 6429894
Acacia rostellifera	90	1	250	4					400	3	X	X	500	8	400	8	400	2	200	3	383009 6430402
Acacia saligna	X	X			120	1	150	0.2			190	0.1					80	0.5	130	0.1	
Acanthocarpus preissii									X	X											383032 6429957
Adriana quadripartita																					383036 6430383, 383049 6429696
**Aeonium* sp.																					
Agave americana																					383011 6429743
Agonis flexuosa					X	X											X	X			383009 6430402, 383053 6429653, 383231 6429877
Alyxia buxifolia																					
**Arctotheca calendula*	10	0.1			X	X					X	X					10	0.2			
**Arenaria leptoclados*	5	0.1	3	5			10	0.1			5	2					3	0.1			
**Asparagus asparagoides*	X	X	100	3	100	0.1	60	0.5	60	0.3	20	0.1	40	1	40	1	40	0.1	40	0.5	
**Asphodelus fistulosus*	40	0.1																			383009 6430402
Austrostipa mundula (P3)	50	0.5																			
Austrostipa flavescens			50	0.5	40	0.5	70	0.1	50	0.5	50	0.2	40	0.1							
**Avena barbata*	70	0.1	70	0.1	60	0.1			70	1	40	0.1	60	0.1	60	10	60	0.1	60	2	383212 6430443
Banksia littoralis																					383152 6429839, 382867 6429802, 382990 6429978,
Machaerina juncea																					
**Brachypodium distachyon*							30	0.5	35	1	20	1	20	0.1							
**Brassica tournefortii*	35	0.1																			383047 6429625
**Brassica x napus*																					
**Briza maxima*																					
**Briza minima*	10	0.1	10	0.1	10	0.2	10	0.2			10	0.1	10	0.2			10	0.1			
Bromus arenarius									30	0.1	20	0.1									
**Bromus diandrus*	25	0.1	20	1	35	0.1	40	0.1	35	5			40	0.1	40	1			40	50	383212 6430443
Caladenia latifolia			20	0.1	20	0.1	X	X			40	1	30	0.1			X	X			
Calothamnus quadrifidus subsp. *quadrifidus*																					383260 6429894
**Carduus pycnocephalus*							25	0.1													383075 6430049
Cassytha racemosa forma *racemosa*			300	3													X	X			
**Casuarina* sp. (planted)																					
**Catapodium rigidum*							10	0.1					10	0.1							
**Cenchrus clandestinus*																					382893 6429905
**Cenchrus setaceus*																					382973 6429695
**Centaurea melitensis*	30	0.1	13	0.1			30	0.1									20	0.1			
**Centaurium pulchellum*	10	0.1	5	0.1	10	0.1	10	0.1			20	0.1	3	0.1			5	0.1			

SPECIES	QUADRATS																				OPPORTUNISTIC
	RC01		RC02		RC03		RC04		RC05		RC06		RC07		RC08		RC09		RC10		
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	
Clematis linearifolia	100	0.3	300	3	200	2	200	5	150	10	200	0.5	300	2	300	2	300	2	10	0.1	
Conostylis pauciflora ssp. *pauciflora* (P4)					X	X					15	0.1									See App XX
**Conyza bonariensis*	10	0.1	70	0.1	10	0.1	45	0.1					10	0.1							
**Crassula glomerata*	3	0.1	3	0.5	3	0.1											3	0.1			382896 6430000
**Cynodon dactylon*																					383075 6430049
Cyrtostylis huegelii																					383052 6429690
Dianella revoluta var. *divaricata*	50	0.2	50	0.1	40	0.1	X	X			50	0.5	50	0.1	X	X	50	0.5	40	0.1	
**Ehrharta calycina*																					
**Ehrharta erecta*							40	0.1													
**Ehrharta longiflora*			60	25	20	0.1	20	0.5	35	10	15	1	30	0.1	30	90			40	20	
**Eragrostis curvula*																					383009 6430402
**Erodium botrys*					10	0.1											10	0.1			383157 6429794, 383113 6429720
Eucalyptus gomphocephala			1200	35			X	X	2000	35					2000	45			1500	70	
Eucalyptus r. ssp. *rudis (x camaldulensis?)*																					383212 6430443
**Eucalyptus utilis*																					383214 6429827, 383053 6429586
**Euphorbia peplus*	10	0.2	10	1	5	1	10	3	10	1	10	0.5	10	2	20	2	10	1	10	0.5	
**Euphorbia terracina*	30	0.2	20	0.1			30	0.2	30	0.3	10	0.1	20	0.1	40	2	20	0.1	35	0.5	
Ficinia nodosa					50	0.1	60	0.1													
**Foeniculum vulgare*																					383114 6429657
**Freesia leichtlinii X*																			20	0.5	
**Fumaria capreolata*															30	0.1					383028 6429615,383105 6430496
**Fumaria muralis* subsp. *muralis*																					
Gahnia trifida	X	X	70	0.1	130	3	120	6	X	X	50	0.1	100	2			80	1	X	X	
**Galium murale*	3	0.5	3	3	3	2	3	15	3	1	3	15	3	3			3	0.5			
**Gamochaeta americana*																					382893 6429905
*Garden plant 1 (shrub)																					383028 6429615
*Garden plant 2 (bulb)																					
Geranium solanderi																					382893 6429905, 383032 6429957
**Gomphocarpus fruticosus*									X	X			30	0.1							383105 6430496
Grevillea obtusifolia					X	X															383146 6429806, 383162 6429759
Hakea prostrata																					383036 6430383, 383146 6429806, 383152 6429839
Hakea varia					X	X															
Hardenbergia comptoniana									70	0.5					X	X			X	X	
**Leontodon rhagadioloides*																					383198 6429892
Hibbertia racemosa	20	0.1																			
**Hordeum leporinum*																					382893 6429905
**Hyparrhenia hirta*																					383212 6430443, 383260 6429894, 383257 6429925

SPECIES	QUADRATS																				OPPORTUNISTIC
	RC01		RC02		RC03		RC04		RC05		RC06		RC07		RC08		RC09		RC10		
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	
**Hypochaeris glabra*	10	2	20	0.1	5	1			1	0.1	5	0.2	15	0.1			10	1			
Isolepis marginata																					
Jacksonia furcellata					350	1															
Kennedia prostrata																	10	0.5			382896 6430000, 383222 6429883
**Lagurus ovatus*	20	0.2	15	0.1	30	0.2	20	0.1	10	2	10	60	10	0.1	30	0.1	20	1	20	1	
Lepidosperma calcicola	20	0.5	50	0.2	35	0.1			35	0.1	40	1	40	0.1			30	2			
Lepidosperma longitudinale							X	X													383096 6429681, 383105 6429700, 383144 6429970
Leucopogon parviflorus			70	0.1					X	X	X	X	120	1	X	X	80	1			
**Lolium perenne*	30	0.2	30	0.1					50	1	50	0.1	20	0.1	40	3	20	0.1	20	1	
Lomandra maritima	50	0.5																			382896 6430000, 383157 6429903, 383222 6429883
Lysiandra calycina	30	0.1	60	0.2					X	X											
**Lysimachia arvensis*	10	0.2	10	0.3	10	0.1	10	0.2	10	1	10	2	10	0.1	60	0.1	10	0.3			
**Malva parviflora*																					
**Medicago polymorpha*									20	0.3							10	0.1	30	0.1	383009 6430402
Melaleuca huegelii	300	3	350	30			500	8	350	3	250	65	500	80	X	X	400	18			
Melaleuca rhaphiophylla					350	3	600	30					500	0.1							383105 6429700, 383176 6429793, 383257 6429900,
Melaleuca systena																					383036 6430383
Melaleuca viminea subsp. *viminea*																					383045 6429685
Microtis media var. *media*																					
**Minuartia mediterranea*	3	0.1																			
Moss	3	15	3	1	3	70					20	70	3	50			3	70			
Muehlenbeckia adpressa			100	0.2			150	3			X	X							X	X	382904 6430209
**Olea europaea* var. *europaea*																					
Opercularia vaginata																					383048 6429681
**Orobanche minor*																					
**Osteospermum ecklonis*																					383191 6429831
**Oxalis pes-caprae*															X	X					383009 6430402
**Pelargonium capitatum*																			X	X	
**Petrorhagia dubia*	20	0.1			10	0.1	20	0.1			20	0.1	20	0.1			5	0.1	20	0.1	
Poa porphyroclados	70	1	70	0.2	60	1	50	0.1	60	0.1	10	0.1					70	0.1			
**Polycarpon tetraphyllum*			3	0.1																	
Poranthera microphylla			7	0.1																	
**Reichardia tingitiana*																					383023 6429619
Rhagodia baccata subsp. *baccata*			X	X			170	3											120	0.2	
**Ricinus communis*																					
**Romulea rosea*	15	0.1			20	0.2			20	0.1	15	0.1	15	0.1			15	0.2	30	1	
**Rostraria cristata*					10	0.1	15	0.1					10	0.1			15	0.1			383172 6429976

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SPECIES	QUADRATS																				OPPORTUNISTIC
	RC01		RC02		RC03		RC04		RC05		RC06		RC07		RC08		RC09		RC10		
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	
**Rumex hypogaeus*																					
**Schinus terebinthifolia*					X	X							5	0.1	20	0.1			120	0.1	382971 6429914, 383166 6429766
Senecio condylus																					382863 6430111
**Sixalix atropurpurea*																			40	0.2	
**Solanum laciniatum*																					
**Solanum nigrum*			10	0.1																	382971 6429914
**Sonchus oleraceus*	10	0.1	10	0.2	10	0.2	10	0.2			10	0.2	10	0.2	20	0.1	10	0.2	10	0.1	
Spyridium globulosum	20	0.1	300	2	300	1	300	2	350	3	250	4	250	3	40	2	200	0.5	250	25	
**Stellaria media*			20	0.3					X	X			10	0.1							
Templetonia retusa																					383022 6429566
Thomasia cognata					40	1	60	2	X	X	35	1					30	2			383222 6429883, 383060 6429926
Thysanotus manglesianus			100	0.1			60	0.1					60	0.1							
**Trachyandra divaricata*									30	0.1									50	1	
Tricoryne elatior	40	0.3									60	0.1	25	0.1			20	0.1			
**Trifolium campestre* var. *campestre*			5	0.1							10	0.1									
**Trifolium scabrum*									10	0.1											
**Urospermum picroides*							10	0.1			10	0.1	20	0.1							
**Verbascum virgatum*																	1	0.1			383186 6429914
**Vicia sativa*																					
**Vulpia fascicularis*					10	0.1											10	0.1			
**Vulpia muralis*					10	1															
**Vulpia myuros* forma *myuros*	10	0.1									7	0.1									
Xanthorrhoea preissii	300	50	100	1.5	350	65	300	6	220	15	200	3	250	8			300	20	X	X	

SPECIES	RELEVES (MN01 - MN15)																											
	MN01		MN02		MN03		MN04		MN05		MN06		MN07		MN08		MN09		MN10		MN11		MN12		MN13		MN14		MN15	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Acacia cyclops			300	0.1							200	0.1							300	0.1										
Acacia rostellifera	400	90					300	90	100	1	200	0.1	500	60-80	600	90	600	70-90	300	0.1			600	1-15	600	10-30	500	80	300	0-5
Acacia saligna					200	0.1			50	0.1	200	0.1													600	0.1				
Acanthocarpus preissii																														
Adriana quadripartita																														
**Aeonium* sp.																														
Agave americana																														
Agonis flexuosa																														
Alyxia buxifolia																														
**Arctotheca calendula*			20	0.1	20	0.1																								
**Arenaria leptoclados*																														
**Asparagus asparagoides*			100	0.1					40	0.1									100	0.1	300	5	150	0.1			200	0.1	100	0.1
**Asphodelus fistulosus*					30	0.1			40	0-1																				
Austrostipa mundula (P3)																														
Austrostipa flavescens																														
**Avena barbata*			50	0.1					40	0.1			30	10									50	1	40	80	50	0.1		
Banksia littoralis																														
Machaerina juncea																														
**Brachypodium distachyon*																														
**Brassica tournefortii*					30	0.1			40	0-1																				
**Brassica x napus*																														
**Briza maxima*			20	20-60																										
**Briza minima*																														
Bromus arenarius																														
**Bromus diandrus*	30	0.1	30	0.1	40	5-50	40	80	40	30-50	60	70	30	40	30	0.1	30	50												
Caladenia latifolia																														
Calothamnus quadrifidus subsp. *quadrifidus*																														
**Carduus pycnocephalus*																														
Cassytha racemosa forma *racemosa*					100	0.1			100	0.1													500	1	400	1-5				
**Casuarina* sp. (planted)																														
**Catapodium rigidum*																														
**Cenchrus clandestinus*																	100	0.1									100	0.1		
**Cenchrus setaceus*																														
**Centaurea melitensis*																														
**Centaurium pulchellum*																														
Clematis linearifolia	300	5									300	0-5	300	10			100	0.1	300	0.1	300	2	500	8	300	??			400	0.1

SPECIES	RELEVES (MN01 - MN15)																											
	MN01		MN02		MN03		MN04		MN05		MN06		MN07		MN08		MN09		MN10		MN11		MN12		MN13		MN14		MN15	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Conostylis pauciflora ssp. *pauciflora* (P4)																			20	0.1										
**Conyza bonariensis*																														
**Crassula glomerata*					3	0.1																								
**Cynodon dactylon*					10	0.1																								
Cyrtostylis huegelii																														
Dianella revoluta var. *divaricata*													30	0.1			30	0.1												
**Ehrharta calycina*																														
**Ehrharta erecta*																														
**Ehrharta longiflora*	35	80	40	0.1	40	5-50							30	40	30	90			20	5	40	70	30	80			30	80	30	0-3
**Eragrostis curvula*																														
**Erodium botrys*																														
Eucalyptus gomphocephala			2000	70	2000	5-50	2000	0-1	1000	0.1	2500	0-40							2500	80	200	60					2000	0.1		
Eucalyptus r. ssp. *rudis* (x *camaldulensis*?)																														
**Eucalyptus utilis*																														
**Euphorbia peplus*	10	0-5	10	0.1	10	0.1			10	2-5			10	1			10	1	10	0.1			10	1-2	10	0-2	10	0.5	10	5-10
**Euphorbia terracina*	30	0.1	40	0.1	30	0.1	60	1	30	0-1	60	1	60	2	60	5	60	3	40	0.1	60	2	40	0.1	70	1	50	0.5		
Ficinia nodosa																														
**Foeniculum vulgare*																														
**Freesia leichtlinii X*																														
**Fumaria capreolata*	20	0.1																					20	0.1						
**Fumaria muralis* subsp. *muralis*					20	0.1																	30	0.1						
Gahnia trifida																													60	0.1
**Galium murale*																													5	5-10
**Gamochaeta americana*																														
*Garden plant 1 (shrub)																														
*Garden plant 2 (bulb)																														
Geranium solanderi																														
**Gomphocarpus fruticosus*					100	0.1			100	0.1													100	0.1						
Grevillea obtusifolia																														
Hakea prostrata			150	0.1																										
Hakea varia																														
Hardenbergia comptoniana			200	0.2																	200	0.1							100	0.1
**Leontodon rhagadioloides*																														
Hibbertia racemosa																														
**Hordeum leporinum*																														
**Hyparrhenia hirta*					50	0.1			50	0.1																				
**Hypochaeris glabra*									10	0.1																			20	0.1

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SPECIES	RELEVES (MN01 - MN15)																											
	MN01		MN02		MN03		MN04		MN05		MN06		MN07		MN08		MN09		MN10		MN11		MN12		MN13		MN14		MN15	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Isolepis marginata																														
Jacksonia furcellata																														
Kennedia prostrata																														
**Lagurus ovatus*			30	0.1					20	0-1							30	20					30	1	20	0-15			20	0.1
Lepidosperma calcicola																							25	0.1					30	0.1
Lepidosperma longitudinale																														
Leucopogon parviflorus	40	0.1	40	0.1																										
**Lolium perenne*			30	0.1	30	0.1																								
Lomandra maritima																														
Lysiandra calycina																														
**Lysimachia arvensis*			10	0.1					10	0.1																			10	0.1
**Malva parviflora*									30	0.1																				
**Medicago polymorpha*			10	0.1					10	0.1									10	0.1										
Melaleuca huegelii																							600	20-50	600	10-30	200	0.1	600	90
Melaleuca rhaphiophylla																													300	0.1
Melaleuca systena																														
Melaleuca viminea subsp. *viminea*																														
Microtis media var. *media*																														
**Minuartia mediterranea*																														
Moss																														
Muehlenbeckia adpressa					100	0.1			100	0.1	150	0.1									200	0.1								
**Olea europaea* var. *europaea*																														
Opercularia vaginata																														
**Orobanche minor*																														
**Osteospermum ecklonis*																														
**Oxalis pes-caprae*			20	0.1					20	0.1																				
**Pelargonium capitatum*																														
**Petrorhagia dubia*																														
Poa porphyroclados																														
**Polycarpon tetraphyllum*																														
Poranthera microphylla																														
**Reichardia tingitiana*																														
Rhagodia baccata subsp. *baccata*																														
**Ricinus communis*					100	0.1			150	0-1																				
**Romulea rosea*			20	0.1																					20	0.1				
**Rostraria cristata*																														
**Rumex hypogaeus*					10	0.1																								

SPECIES	RELEVES (MN01 - MN15)																											
	MN01		MN02		MN03		MN04		MN05		MN06		MN07		MN08		MN09		MN10		MN11		MN12		MN13		MN14		MN15	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
**Schinus terebinthifolia*			50	0.1	100	0.1			100	0.1			150	0-10					100	0.1							200	0.1		
Senecio condylus																														
**Sixalix atropurpurea*			50	0-3	40	0.1			50	0-1			40	0.1																
**Solanum laciniatum*									50	0.1																				
**Solanum nigrum*																														
**Sonchus oleraceus*																							10	0.1					20	0.1
Spyridium globulosum	300	5-15	400	5-10	100	0.1	300	0-1	100	0.1	400	0-15	300	0-10					400	400	300	1-20	350	1-10	400	1-20	200	0.1	350	0-15
**Stellaria media*																														
Templetonia retusa																														
Thomasia cognata																							20	0.1						
Thysanotus manglesianus																														
**Trachyandra divaricata*					30	0.1			40	0-1																				
Tricoryne elatior																														
**Trifolium campestre* var. *campestre*																														
**Trifolium scabrum*																														
**Urospermum picroides*																														
**Verbascum virgatum*																														
**Vicia sativa*									20	0.1																				
**Vulpia fascicularis*																														
**Vulpia muralis*																														
**Vulpia myuros* forma *myuros*																														
Xanthorrhoea preissii	200	0-5			100	0.1	300	0-1	100	0.1	150	0.1	300	0-2			100	0.1			150	0-2	100	0.1			200	0.1	250	25

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SPECIES	RELEVES (MN16 - MN30)																											
	MN16		MN17		MN18		MN19		MN20		MN21		MN22		MN23		MN24		MN25		MN26		MN27		MN28		MN29		MN30	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Acacia cyclops							300	0.1											300	0.1										
Acacia rostellifera	500	20-70					600	5-20	500	20	300	30-50			400	35	600	2	300	10-40	400	40-90			700	35			20	0-5
Acacia saligna					300	0.1			300	0.1	300	0-2	350	2	300	1			350	1-5										
Acanthocarpus preissii																														
Adriana quadripartita											50	0.1																		
**Aeonium* sp.																														
Agave americana											50	0.1																		
Agonis flexuosa																			350	1										
Alyxia buxifolia																														
**Arctotheca calendula*									10	0.1																				
**Arenaria leptoclados*																														
**Asparagus asparagoides*									100	0.1	100	0.1			50	0.1	100	0.1			100	3	100	0.5	100	0.1	100	0.1		
**Asphodelus fistulosus*											30	0.1																		
Austrostipa mundula (P3)																														
Austrostipa flavescens																	50	0.1											50	0.1
**Avena barbata*											50	2	70	5			50	0-1	40	50	50	5-10			50	0.1			50	0.1
Banksia littoralis																	300	0.1												
Machaerina juncea																											40	0.1		
**Brachypodium distachyon*																													20	0.1
**Brassica tournefortii*																														
**Brassica x napus*																					20	0.1								
**Briza maxima*																														
**Briza minima*																													10	0.1
Bromus arenarius																														
**Bromus diandrus*							20	10-20	30	10-30	20	0.1	30	50	30	1	30	0-1	30	10	30	1	40	1						
Caladenia latifolia																														
Calothamnus quadrifidus ssp. *quadrifidus*																			200	1										
**Carduus pycnocephalus*																														
Cassytha racemosa forma *racemosa*																					100	1								
**Casuarina* sp. (planted)																														
**Catapodium rigidum*																														
**Cenchrus clandestinus*																														
**Cenchrus setaceus*																														
**Centaurea melitensis*																														
**Centaurium pulchellum*																													10	0.1
Clematis linearifolia			150	0-5	200	1-5	40	15	400	2-10	300	0.1			400	1-5	300	5			150	5	100	0.1	200	5	250	1-15	300	3

SPECIES	RELEVES (MN16 - MN30)																											
	MN16		MN17		MN18		MN19		MN20		MN21		MN22		MN23		MN24		MN25		MN26		MN27		MN28		MN29		MN30	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Conostylis pauciflora ssp. *pauciflora* (P4)			20	0.1																								
**Conyza bonariensis*																												
**Crassula glomerata*					3	3			3	0.1																		
**Cynodon dactylon*											10	0.1																
Cyrtostylis huegelii																												
Dianella revoluta var. *divaricata*											20	0.1			20	0.1	30	0.1			30	0.1					30	0.1
**Ehrharta calycina*											40	0.1																
**Ehrharta erecta*																												
**Ehrharta longiflora*							20	10-20							30	1	20	1-5			30	5-10	30	80				
**Eragrostis curvula*											100	0.1													100	0.1		
**Erodium botrys*																												
Eucalyptus gomphocephala																	600	0-10										
Eucalyptus r. ssp. *rudis (x camaldulensis?)*																												
**Eucalyptus utilis*																												
**Euphorbia peplus*	10	10-20			10	1	10	2	10	0.1	10	5-10			10	2-5	10	5-10					10	1-20	10	1	10	0.1	10	1-2
**Euphorbia terracina*							30	0.1	30	0.1	30	0.1	30	3	30	0.5							30	0.3	30	0.1				
Ficinia nodosa																												
**Foeniculum vulgare*																												
**Freesia leichtlinii X*																												
**Fumaria capreolata*									30	0-1																		
**Fumaria muralis* subsp. *muralis*																												
Gahnia trifida			100	0.1			80	1-10									100	1					100	0.1	100	5	100	0-5	100	0-5
**Galium murale*							5	0.5			5	1					3	1									3	1	3	1
**Gamochaeta americana*																												
*Garden plant 1 (shrub)																												
*Garden plant 2 (bulb)															20	0.1												
Geranium solanderi																												
**Gomphocarpus fruticosus*																			100	0.1								
Grevillea obtusifolia																			200	1								
Hakea prostrata													200	1														
Hakea varia																												
Hardenbergia comptoniana							150	0.1									100	0.1					100	0.1				
**Leontodon rhagadioloides*																												
Hibbertia racemosa																												
**Hordeum leporinum*																												
**Hyparrhenia hirta*									100	0.1	100	0.1							100	3								
**Hypochaeris glabra*					10	1-2					20	0.1			10	1												

SPECIES	RELEVES (MN16 - MN30)																											
	MN16		MN17		MN18		MN19		MN20		MN21		MN22		MN23		MN24		MN25		MN26		MN27		MN28		MN29		MN30	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Isolepis marginata																	3	0.1												
Jacksonia furcellata																														
Kennedia prostrata																														
**Lagurus ovatus*					20	0.1			30	0.1	20	50-70			30	70	30	0-1	30	5	20	1	30	1-5						
Lepidosperma calcicola	40	3	20	0.1	30	0.1					20	0.1	30	3											20	0.2			20	0.1
Lepidosperma longitudinale																									50	0.1	40	0-0.2		
Leucopogon parviflorus			40	0.1																							50	0.1		
**Lolium perenne*																	30	0.1	30	1	30	1	40	1						
Lomandra maritima																														
Lysiandra calycina																														
**Lysimachia arvensis*					10	0.1					10	0.1			10	1	10	0.1			10	2							10	0.1
**Malva parviflora*																														
**Medicago polymorpha*									10	0.1					10	0.1														
Melaleuca huegelii			300	60					700	10-30					600	35	600	50-80			400	0-20	600	80	600	0-5	700	50-70	500	50
Melaleuca rhaphiophylla							1500	30-60											300	1			400	0.1			700	5-10	700	0-15
Melaleuca systena																														
Melaleuca viminea subsp. *viminea*																													100	0-1
Microtis media var. *media*																														
**Minuartia mediterranea*																														
Moss					3	50																								
Muehlenbeckia adpressa							150	0-1	100	0.1							100	0.1											100	0.1
**Olea europaea* var. *europaea*																														
Opercularia vaginata																													200	0.1
**Orobanche minor*																														
**Osteospermum ecklonis*																														
**Oxalis pes-caprae*									10	0.1	10	0.1																		
**Pelargonium capitatum*									20	0.1																				
**Petrorhagia dubia*					10	0.1																								
Poa porphyroclados																											80	0.1		
**Polycarpon tetraphyllum*																														
Poranthera microphylla																														
**Reichardia tingitiana*																														
Rhagodia baccata subsp. *baccata*																														
**Ricinus communis*																														
**Romulea rosea*																														
**Rostraria cristata*									10	0.1																				
**Rumex hypogaeus*																														

SPECIES	RELEVES (MN16 - MN30)																													
	MN16		MN17		MN18		MN19		MN20		MN21		MN22		MN23		MN24		MN25		MN26		MN27		MN28		MN29		MN30	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
**Schinus terebinthifolia*									100	0-20	100	0.1			500	0-10														
Senecio condylus																														
**Sixalix atropurpurea*									50	0.1	50	0.1	30	0-2	50	0.1														
**Solanum laciniatum*																														
**Solanum nigrum*							20	0.1																						
**Sonchus oleraceus*					10	0.1	10	0.1			10	0.1					10	0.1			30	0.1	30	0.2	20	0.2	30	0.1	20	0.1
Spyridium globulosum	300	5-15	300	5-10	300	0.1	300	50-80	300	0-10	300	0-5	200	2-15	300	10-15	200	2			300	0-1			300	0.1	300	0.1	300	1-3
**Stellaria media*							10	0.1																						
Templetonia retusa																														
Thomasia cognata											30	0.1																	20	0.1-3
Thysanotus manglesianus																														
**Trachyandra divaricata*																														
Tricoryne elatior																									30	0.1			20	0.1
**Trifolium campestre* var. *campestre*																													10	0.1
**Trifolium scabrum*															10	0.1														
**Urospermum picroides*																														
**Verbascum virgatum*																									50	0.1				
**Vicia sativa*																														
**Vulpia fascicularis*																														
**Vulpia muralis*																														
**Vulpia myuros* forma *myuros*																														
Xanthorrhoea preissii	300	5-15	300	5-10	250	80	250	5-10	250	0-2	250	0-15			300	0-5	100	10-30	200	0.1	150	0-1	300	8	200	1-10	350	10	300	5-10

SPECIES	RELEVES (MN31 - MN44)																											
	MN31		MN32		MN33		MN34		MN35		MN36		MN37		MN38		MN39		MN40		MN41		MN42		MN43		MN44	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Acacia cyclops																												
Acacia rostellifera	600	90	350	60-80	700	30-50	300	100	700	60-90	200	0-5			400	10-40	300	0-10	300	1-3	300	1-90	200	1-5	300	10		
Acacia saligna																					300	1-2						
Acanthocarpus preissii															30	0.1												
Adriana quadripartita																					50	0.1						
**Aeonium* sp.													20	0.1														
Agave americana																												
Agonis flexuosa																											300	0.1
Alyxia buxifolia															50	0.1												
**Arctotheca calendula*																												
**Arenaria leptoclados*																			3	0.1								
**Asparagus asparagoides*	100	1			100	0.1	100	0.1	100	1	100	0.1	150	1			100	0.1					200	0.1				
**Asphodelus fistulosus*											30	0.1									30	0.1						
Austrostipa mundula (P3)																												
Austrostipa flavescens	50	0.1	300	0.1							50	0.1			50	0.1	50	0.1										
**Avena barbata*	50	0-5	200	3	50	1	50	1	50	2	50	60	70	3	50	60	50	0.1	50	0.1	50	60	50	50				
Banksia littoralis																												
Machaerina juncea																												
**Brachypodium distachyon*	30	1-10					30	1	20	0.1					30	0.1	30	0.1					20	10				
**Brassica tournefortii*																												
**Brassica x napus*																												
**Briza maxima*													20	0.1														
**Briza minima*																			20	0.1								
Bromus arenarius																			20	0.1								
**Bromus diandrus*	30	0.1	30	3	30	1	30	1	30	1	30	5-10			30	0-10			30	0.1	30	5-10			30	80		
Caladenia latifolia																												
Calothamnus quadrifidus ssp. *quadrifidus*																											150	0.1
**Carduus pycnocephalus*																												
Cassytha racemosa forma *racemosa*					100	0.1									400	2												
**Casuarina* sp. (planted)																											400	0.1
**Catapodium rigidum*																												
**Cenchrus clandestinus*																												
**Cenchrus setaceus*																												
**Centaurea melitensis*																												
**Centaurium pulchellum*																	10	0.1										
Clematis linearifolia	100	2-5	300	1-10	100	3	300	5-10	100	0.1	100	1	300	5	200	2-10	200	0.1	100	0.1			200	25	300	20		

SPECIES	RELEVES (MN31 - MN44)																									
	MN31		MN32		MN33		MN34		MN35		MN36		MN37		MN38		MN39		MN40		MN41		MN42		MN43		MN44	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Conostylis pauciflora ssp. *pauciflora* (P4)																												
**Conyza bonariensis*																												
**Crassula glomerata*	3	0.1																										
**Cynodon dactylon*											10	0.1																
Cyrtostylis huegelii																												
Dianella revoluta var. *divaricata*					30	0.1					30	0.1			30	0.1	30	0.1			30	0.1	30	0.1				
**Ehrharta calycina*	50	0.1																										
**Ehrharta erecta*																												
**Ehrharta longiflora*	30	1-60	30	10-50	30	40	30	50	30	70	30	0-5	30	10-30	30	0-10			30	0.1			30	1-20	30	0.1		
**Eragrostis curvula*																					100	0.1						
**Erodium botrys*																												
Eucalyptus gomphocephala													3000	80									500	0.1	2000	25	1000	0.1
Eucalyptus r. ssp. *rudis (x camaldulensis?)*																												
**Eucalyptus utilis*																												
**Euphorbia peplus*	10	1-5	10	1-10	10	1	10	5-10	10	2-5	10	2	10	5	10	5	10	0-1	10	0.3	10	??	10	1				
**Euphorbia terracina*	30	0-1	30	0.1	40	1	40	1	30	2-5	30	1			30	3			30	0.1			30	0.1	40	2		
Ficinia nodosa																												
**Foeniculum vulgare*																												
**Freesia leichtlinii X*																									30	0.1		
**Fumaria capreolata*					30	0.1	30	0.1							30	0.1												
**Fumaria muralis* subsp. *muralis*																												
Gahnia trifida																	100	0.2										
**Galium murale*															3	0.1	3	0-1	3	0.1								
**Gamochaeta americana*																												
*Garden plant 1 (shrub)																												
*Garden plant 2 (bulb)																												
Geranium solanderi																												
**Gomphocarpus fruticosus*			100	0.1							80	0.1			200	0.1	100	0.1					100	0.1				
Grevillea obtusifolia																											200	0.1
Hakea prostrata											300	1																
Hakea varia																												
Hardenbergia comptoniana													100	0.1														
**Leontodon rhagadioloides*																												
Hibbertia racemosa																												
**Hordeum leporinum*																												
**Hyparrhenia hirta*																					100	2						
**Hypochaeris glabra*											10	0.1							10	0.1								

SPECIES	RELEVES (MN31 - MN44)																									
	MN31		MN32		MN33		MN34		MN35		MN36		MN37		MN38		MN39		MN40		MN41		MN42		MN43		MN44	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
Isolepis marginata																										
Jacksonia furcellata																										
Kennedia prostrata																										
**Lagurus ovatus*			30	3	30	1					20	1	30	5	30	1	30	0.1	30	0.1	30	15	30	10				
Lepidosperma calcicola															30	0.1	20	0.1										
Lepidosperma longitudinale																												
Leucopogon parviflorus	50	0.1													50	0.1												
**Lolium perenne*	20	1-5	30	1			30	0.1	30	1	30	0.1	30	1					30	0.1	30	0.1	30	0.1				
Lomandra maritima															30	0.1					30	0.1						
Lysiandra calycina															50	0.1												
**Lysimachia arvensis*													10	0.1	10	0.1	10	0-1	10	0.1			10	0.1				
**Malva parviflora*																												
**Medicago polymorpha*																							10	0.1				
Melaleuca huegelii					700	8-10			700	0-1					300	10-40	300	0-3					700	0-5				
Melaleuca rhaphiophylla																	300	0-0.1										
Melaleuca systena																												
Melaleuca viminea subsp. *viminea*																												
Microtis media var. *media*																												
**Minuartia mediterranea*																												
Moss																			1	60								
Muehlenbeckia adpressa															200	0.1							200	0.1				
**Olea europaea* var. *europaea*													100	0.1														
Opercularia vaginata																												
**Orobanche minor*	20	0.1																										
**Osteospermum ecklonis*																												
**Oxalis pes-caprae*									20	0.1																		
**Pelargonium capitatum*																					30	0.1						
**Petrorhagia dubia*													20	0.1			20	0.1	20	0.1								
Poa porphyroclados																	50	0.1										
**Polycarpon tetraphyllum*																												
Poranthera microphylla																												
**Reichardia tingitiana*																												
Rhagodia baccata subsp. *baccata*																												
**Ricinus communis*																												
**Romulea rosea*																	10	0.1										
**Rostraria cristata*							10	0.1									10	0.1										
**Rumex hypogaeus*																												

SPECIES	RELEVES (MN31 - MN44)																									
	MN31		MN32		MN33		MN34		MN35		MN36		MN37		MN38		MN39		MN40		MN41		MN42		MN43		MN44	
	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
**Schinus terebinthifolia*	100	0.1									500	1	100	0.1							100	0.1	200	0.1				
Senecio condylus																												
**Sixalix atropurpurea*											50	5	60	1							50	0.1	50	0.1				
**Solanum laciniatum*																												
**Solanum nigrum*																												
**Sonchus oleraceus*	10	10			10	0.1	30	0.1	30	0-20	10	0.1					30	0.1	30	0.1								
Spyridium globulosum	300	0-1	300	1-5	300	5			300	0-5	300	0-10	350	5-20	300	5-15	300	0-5	300	0.1	200	1	400	35	300	5-10		
**Stellaria media*																												
Templetonia retusa																											100	0.1
Thomasia cognata															20	0.1												
Thysanotus manglesianus																												
**Trachyandra divaricata*																												
Tricoryne elatior																			30	0.1								
**Trifolium campestre* var. *campestre*														0.1	0.1													
**Trifolium scabrum*																												
**Urospermum picroides*																												
**Verbascum virgatum*																												
**Vicia sativa*																												
**Vulpia fascicularis*																												
**Vulpia muralis*																												
**Vulpia myuros* forma *myuros*																	20	0.1	20	0.1								
Xanthorrhoea preissii	200	0-3	200	1-5	200	0.1			100	0.1	200	1	150	0.1	250	0-2	300	50-70	300	50-90			300	2-5	200	1		

Appendix C: Quadrat Data

Quadrat RC-01

Survey 1:	12 September 2023	**Condition:**	Good
Survey 2:	17 October 2023	**Details:**	Weeds 2-20% cover.
Area:	10m x 10m (100m^2)	**Fire History:**	5-10 years?
Surveyor:	Kelli McCreery	**Leaf Litter:**	20% cover; <1-5cm depth.
Location NW:	50H 383229 6429929	**Landform:**	Swale in beach ridge plain.
Datum:	GDA94	**Soil Type:**	Grey consolidated sand.
Accuracy:	3m (0.5m)	**Aspect:**	S
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
M1	Grasstree >2m	30-70%	*Xanthorrhoea preissii.*
M2	Shrub >2m	0.25-5%	*Melaleuca huegelii* subsp. *huegelii.*
G1	Forb <0.5m	10-30%	*Lomandra maritima*, *Dianella revoluta* var. *divaricata, Tricoryne elatior, *Galium murale, *Hypochaeris glabra,* weeds mixed spp.
G2	Grass <0.5m	10-30%	*Poa porphyroclados, Austrostipa mundula*, **Lolium perenne, *Lagurus ovatus,* weeds mixed spp.
G3	Sedge <0.5m	0.25-5%	*Lepidosperma calcicola.*

Species:

*Acacia rostellifera, *Arctotheca calendula, *Arenaria leptoclados, *Asphodelus fistulosus, Austrostipa mundula* (P3), **Avena barbata, *Brassica tournefortii, *Briza minima, *Bromus diandrus, *Centaurea melitensis, *Centaurium pulchellum, Clematis linearifolia, *Conyza bonariensis, *Crassula glomerata, Dianella revoluta* var. *divaricata, *Euphorbia peplus, *Euphorbia terracina, *Galium murale, Hibbertia racemosa, *Hypochaeris glabra, *Lagurus ovatus, Lepidosperma calcicola, *Lolium perenne, Lomandra maritima, Lysiandra calycina, *Lysimachia arvensis, Melaleuca huegelii* subsp. *huegelii, *Minuartia mediterranea, *Petrorhagia dubia, Poa porphyroclados, *Romulea rosea, *Sonchus oleraceus, Spyridium globulosum, Tricoryne elatior, *Vulpia myuros* forma *myuros, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): *Acacia saligna, *Asparagus asparagoides, Gahnia trifida*.

Photo NW Corner:



Quadrat RC-02

Survey 1:	12 September 2023	**Condition:**	Good
Survey 2:	17 October 2023	**Details:**	Weeds 25-40% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years.
Surveyor:	Kelli McCreery	**Leaf Litter:**	95% cover; <1-20cm depth.
Location NW:	50H 383178 6429950	**Landform:**	Undulating dunes
Datum:	GDA94	**Soil Type:**	Grey sand.
Accuracy:	3m (0.5m)	**Aspect:**	W
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree 10-30m	30-70%	*Eucalyptus gomphocephala*
M1	Shrub >2m	30-70%	*Acacia rostellifera, Melaleuca huegelii subsp. huegelii, Spyridium globulosum, , Muehlenbeckia adpressa, *Asparagus asparagoides.*
M2	Vines >2m	10-30%	*Clematis linearifolia, Cassytha racemosa* forma *racemosa*
G1	Forbs <0.5m	10-30%	**Crassula glomerata, *Galium murale, *Lysimachia arvensis,*Stellaria media*, weeds mixed.
G2	Grasses <0.5m	10-30%	**Ehrharta longiflora*, weeds mixed.

Species:

*Acacia rostellifera, *Arenaria leptoclados, *Asparagus asparagoides, Austrostipa flavescens, *Avena barbata, *Briza minima, *Bromus diandrus, Caladenia latifolia, Cassytha racemosa* forma *racemosa, *Centaurea melitensis, *Centaurium pulchellum, Clematis linearifolia, *Conyza bonariensis, *Crassula glomerata, Dianella revoluta* var. *divaricata, *Ehrharta longiflora, Eucalyptus gomphocephala, *Euphorbia peplus, *Euphorbia terracina, Gahnia trifida, *Galium murale, *Hypochaeris glabra, *Lagurus ovatus, Lepidosperma calcicola, Leucopogon parviflorus, *Lolium perenne, Lysiandra calycina, *Lysimachia arvensis, Melaleuca huegelii subsp. huegelii, Moss, Muehlenbeckia adpressa, Poa porphyroclados, *Polycarpon tetraphyllum, Poranthera microphylla, *Solanum nigrum, *Sonchus oleraceus, Spyridium globulosum, *Stellaria media, Thysanotus manglesianus, *Trifolium campestre* var. *campestre, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): *Rhagodia baccata* subsp. *baccata*.

Photo NW Corner:



Quadrat RC-03

Survey 1:	14 September 2023	**Condition:**	Good
Survey 2:	19 October 2023	**Details:**	Weeds 5-10% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	3% cover; <1-2cm depth.
Location NW:	50H 383157 6429794	**Landform:**	Dune swale.
Datum:	GDA94	**Soil Type:**	Grey clayey sand.
Accuracy:	3m (0.5m)	**Aspect:**	S
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree <10m	0.25-5%	*Melaleuca rhaphiophylla.*
M1	Grasstree >2m	30-70%	*Xanthorrhoea preissii, Jacksonia furcellata, Spyridium globulosum, Acacia saligna.*
M2	Sedge 1-2m	5-10%	*Gahnia trifida.*
G1	Forbs <0.5m	10-30%	**Galium murale, *Hypochaeris glabra, *Euphorbia peplus,* weeds mixed.
G2	Grasses <0.5m	0.25-5%	*Poa porphyroclados, Austrostipa flavescens,* weeds mixed.

Species:

*Acacia saligna, *Asparagus asparagoides, Austrostipa flavescens, *Avena barbata, *Briza minima, *Bromus diandrus, Caladenia latifolia, *Centaurium pulchellum, Clematis linearifolia, *Conyza bonariensis, *Crassula glomerata, Dianella revoluta* var. *divaricata, *Ehrharta longiflora, *Erodium botrys, *Euphorbia peplus, Ficinia nodosa, Gahnia trifida, *Galium murale, *Hypochaeris glabra, Jacksonia furcellata, *Lagurus ovatus, Lepidosperma calcicola, *Lysimachia arvensis, Melaleuca rhaphiophylla,* Moss*, *Petrorhagia dubia, Poa porphyroclados, *Romulea rosea, *Rostraria cristata, *Sonchus oleraceus, Spyridium globulosum, Thomasia cognata, *Vulpia fascicularis, *Vulpia muralis, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): **Arctotheca calendula, *Schinus terebinthifolia, Agonis flexuosa, Conostylis pauciflora* subsp. *pauciflora* (P4), *Grevillea obtusifolia, Hakea varia.*

Photo NW Corner:



Quadrat RC-04

Survey 1:	14 September 2023	**Condition:**	Good
Survey 2:	17 October 2023	**Details:**	Weeds 15-20% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	90% cover; <1-15cm depth.
Location NW:	50H 383186 6429796	**Landform:**	Dune swale.
Datum:	GDA94	**Soil Type:**	Grey consolidated sand (clayey patches).
Accuracy:	3m (0.5m)	**Aspect:**	NE
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree <10m	30-70%	*Melaleuca rhaphiophylla, Melaleuca huegelii* subsp. *huegelii.*
M1	Grasstree >2m	5-10%	*Xanthorrhoea preissii*
M2	Vines 1-2m	10-30%	*Clematis linearifolia, Muehlenbeckia adpressa.*
M3	Sedge 1-2m	5-10%	*Gahnia trifida.*
G1	Forbs <0.5m	10-30%	**Euphorbia peplus, *Euphorbia terracina, *Galium murale, *Sonchus oleraceus* and mixed weeds.
G2	Grass <0.5m	10-30%	**Brachypodium distachyon, *Briza minima, *Ehrharta longiflora* and mixed weeds.

Species:

*Acacia saligna, *Arenaria leptoclados, *Asparagus asparagoides, Austrostipa flavescens, *Brachypodium distachyon, *Briza minima, *Bromus diandrus, *Carduus pycnocephalus, *Catapodium rigidum, *Centaurea melitensis, *Centaurium pulchellum, Clematis linearifolia, *Conyza bonariensis, *Ehrharta erecta, *Ehrharta longiflora, *Euphorbia peplus, *Euphorbia terracina, Ficinia nodosa, Gahnia trifida, *Galium murale, *Lagurus ovatus, *Lysimachia arvensis, Melaleuca huegelii* subsp. *huegelii, Melaleuca rhaphiophylla, Muehlenbeckia adpressa, *Petrorhagia dubia, Poa porphyroclados, Rhagodia baccata* subsp. *baccata, *Rostraria cristata, *Sonchus oleraceus, *Sonchus oleraceus, Spyridium globulosum, Thomasia cognata, Thysanotus manglesianus, *Urospermum picroides, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): *Caladenia latifolia, Dianella revoluta* var. *divaricata, Eucalyptus gomphocephala, Lepidosperma longitudinale.*

Photo NW Corner:



Quadrat RC-05

Survey 1:	14 September 2023	**Condition:**	Good-Degraded
Survey 2:	18 October 2023	**Details:**	Weeds 20-60% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	90% cover; <1-20cm depth.
Location NW:	50H 383060 6429926	**Landform:**	Consolidated dune over limestone (shallow here).
Datum:	GDA94	**Soil Type:**	Grey sand with organic matter stain.
Accuracy:	3m (0.5m)	**Aspect:**	S
Other:		**Altitude:**	2m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree 10-30m	30-70%	*Eucalyptus gomphocephala*
M1	Shrub >2m	30-70%	*Acacia rostellifera, Melaleuca huegelii* subsp. *huegelii.*
M2	Grasstree >2m	5-10%	*Xanthorrhoea preissii.*
M3	Vines 1-2m	5-10%	*Clematis linearifolia, Hardenbergia comptoniana.*
G1	Forbs <0.5m	10-30%	**Euphorbia peplus, *Euphorbia terracina, *Galium murale, *Lysimachia arvensis* and weeds mixed.
G2	Grass <0.5m	30-70%	**Bromus diandrus, *Ehrharta longiflora, *Lagurus ovatus, *Lolium perenne, *Avena barbata, *Brachypodium distachyon* and weeds mixed. Occasional *Austrostipa flavescens* and *Poa porphyroclados.*

Species: *Acacia rostellifera, *Asparagus asparagoides, Austrostipa flavescens, *Avena barbata, *Brachypodium distachyon, Bromus arenarius, *Bromus diandrus, Clematis linearifolia, *Ehrharta longiflora, Eucalyptus gomphocephala, *Euphorbia peplus, *Euphorbia terracina, *Galium murale, Hardenbergia comptoniana, *Hypochaeris glabra, *Lagurus ovatus, Lepidosperma calcicola, *Lolium perenne, *Lysimachia arvensis, *Medicago polymorpha, Melaleuca h.* ssp. *huegelii, Poa porphyroclados, *Romulea rosea, *Sonchus oleraceus, Spyridium globulosum, *Trachyandra divaricata, *Trifolium scabrum, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): *Gahnia trifida, Thomasia cognata, Leucopogon parviflorus, Lysiandra calycina, *Stellaria media, *Gomphocarpus fruticosus, Acanthocarpus preissii.*

Photo NW Corner:



Quadrat RC-06

Survey 1:	14 September 2023	**Condition:**	Good-Degraded
Survey 2:	17 October 2023	**Details:**	Weeds 10-30% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years.
Surveyor:	Kelli McCreery	**Leaf Litter:**	30% cover; <1-3cm depth. Moss 70%.
Location NW:	50H 383174 6429857	**Landform:**	Consolidated dune (over limestone?)
Datum:	GDA94	**Soil Type:**	Grey sand.
Accuracy:	3m (0.5m)	**Aspect:**	SE
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
M1	Shrub >2m	70-100%	*Melaleuca huegelii* subsp. *huegelii.*
M2	Grasstree >2m	0.25-5%	*Xanthorrhoea preissii.*
G1	Shrub <0.5m	0.25-5%	*Thomasia cognata*
G2	Forbs <0.5m	10-30%	**Galium murale, *Lysimachia arvensis, *Arenaria leptoclados, *Euphorbia peplus*, weeds mixed. Caladenia latifolia, *Dianella revoluta* var. *divaricata*
G3	Grasses <0.5m	10-30%	**Lagurus ovatus, *Ehrharta longiflora*, weeds mixed.
G4	Sedges <0.5m	0.25-5%	*Lepidosperma calcicola*

Species:

*Acacia saligna, *Arenaria leptoclados, *Asparagus asparagoides, Austrostipa flavescens, *Avena barbata, *Brachypodium distachyon, *Briza minima, Bromus arenarius, Caladenia latifolia, *Centaurium pulchellum, Clematis linearifolia, Conostylis pauciflora* subsp. *pauciflora* (P4), *Dianella revoluta* var. *divaricata, *Ehrharta longiflora, *Euphorbia peplus, *Euphorbia terracina, Gahnia trifida, *Galium murale, *Hypochaeris glabra, *Lagurus ovatus, Lepidosperma calcicola, *Lolium perenne, *Lysimachia arvensis, Melaleuca huegelii* subsp. *huegelii, Moss, *Petrorhagia dubia, Poa porphyroclados, *Romulea rosea, *Sonchus oleraceus, Spyridium globulosum, Thomasia cognata, Tricoryne elatior, *Trifolium campestre var. campestre, *Urospermum picroides, *Vulpia myuros* forma *myuros, Xanthorrhoea preissii.*

Outside quadrat (30m x 30m): *Acacia rostellifera, Leucopogon parviflorus, Muehlenbeckia adpressa, *Arctotheca calendula.*

Photo NW Corner:



Quadrat RC-07

Survey 1:	14 September 2023	**Condition:**	Good
Survey 2:	18 October 2023	**Details:**	Weeds 5-10% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years.
Surveyor:	Kelli McCreery	**Leaf Litter:**	90% cover; <1-15cm depth. Moss 50%.
Location NW:	50H 383062 6429672	**Landform:**	Dune swale. Beach ridge plain.
Datum:	GDA94	**Soil Type:**	Grey sand.
Accuracy:	3m (0.5m)	**Aspect:**	NE
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
M1	Shrub >2m	70-100%	*Melaleuca h.* ssp. *huegelii, Acacia rostellifera, Spyridium globulosum.*
M2	Grasstree >2m	5-10%	*Xanthorrhoea preissii*.
M3	Vines >2m	0.25-5%	*Clematis linearifolia, *Asparagus asparagoides.*
G1	Sedge 0.5-1m	0.25-5%	*Gahnia trifida.*
G2	Shrub 0.5-1m	0.25-5%	*Leucopogon parviflorus.*
G3	Forbs <0.5m	5-10%	**Galium murale, *Euphorbia peplus* and mixed weeds.

Species:

*Acacia rostellifera, *Asparagus asparagoides, Austrostipa flavescens, *Avena barbata, *Brachypodium distachyon, *Briza minima, *Bromus diandrus, Caladenia latifolia, *Catapodium rigidum, *Centaurium pulchellum, Clematis linearifolia, *Conyza bonariensis, Dianella revoluta* var. *divaricata, *Ehrharta longiflora, *Euphorbia peplus, *Euphorbia terracina, Gahnia trifida, *Galium murale, *Gomphocarpus fruticosus, *Hypochaeris glabra, *Lagurus ovatus, Lepidosperma calcicola, Leucopogon parviflorus, *Lolium perenne, *Lysimachia arvensis, Melaleuca huegelii* subsp. *huegelii, Melaleuca rhaphiophylla, Moss, *Petrorhagia dubia, *Romulea rosea, *Rostraria cristata, *Schinus terebinthifolia, *Sonchus oleraceus, Spyridium globulosum, *Stellaria media, Thysanotus manglesianus, Tricoryne elatior, *Urospermum picroides, Xanthorrhoea preissii*.

Outside quadrat (30m x 30m):

Photo NW Corner:



Quadrat RC-08

Survey 1:	14 September 2023	**Condition:**	Degraded
Survey 2:	17 October 2023	**Details:**	Weeds 95% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	90% cover; <1-10cm depth.
Location NW:	50H 382842 6429906	**Landform:**	Consolidated dune slope.
Datum:	GDA94	**Soil Type:**	Grey sand.
Accuracy:	3m (0.5m)	**Aspect:**	SE
Other:		**Altitude:**	4-6m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree 10-30m	30-70%	*Eucalyptus gomphocephala*
M1	Vines >2m	0.25-5%	*Clematis linearifolia*
M2	Shrub >2m	5-10%	*Acacia rostellifera*
G1	Forbs <0.5m	0.25-5%	**Euphorbia peplus, *Euphorbia terracina* and mixed weeds.
G2	Grasses <0.5m	70-100%	**Ehrharta longiflora, *Avena barbata* and mixed weeds.

Species:

*Acacia rostellifera, *Asparagus asparagoides, *Avena barbata, *Bromus diandrus, Clematis linearifolia, *Ehrharta longiflora, Eucalyptus gomphocephala, *Euphorbia peplus, *Euphorbia terracina, *Fumaria capreolata, *Lagurus ovatus, *Lolium perenne, *Lysimachia arvensis, *Schinus terebinthifolia, *Sonchus oleraceus, Spyridium globulosum.*

Outside quadrat (30m x 30m): *Dianella revoluta var. divaricata, Leucopogon parviflorus, Melaleuca huegelii subsp. huegelii, Hardenbergia comptoniana, *Oxalis pes-caprae.*

Photo NW Corner:



Quadrat RC-09

Survey 1:	15 September 2023	**Condition:**	Good
Survey 2:	17 October 2023	**Details:**	Weeds 10-20% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	50% cover; <1-10cm depth.
Location NW:	50H 383113 6429720	**Landform:**	Consolidated dune.
Datum:	GDA94	**Soil Type:**	Grey sand (with some clay).
Accuracy:	3m (0.5m)	**Aspect:**	SW
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
M1	Shrub >2m	30-70%	*Melaleuca huegelii subsp. huegelii, Acacia rostellifera.*
M2	Grasstree >2m	10-30%	*Xanthorrhoea preissii*
M3	Vines >2m	0.25-5%	*Clematis linearifolia*
G1	Shrub <0.5m	0.25-5%	*Leucopogon parviflorus, Thomasia cognata.*
G2	Forbs <0.5m	10-30%	**Euphorbia peplus, *Galium murale, *Hypochaeris glabra, *Lysimachia arvensis,* mixed weeds. *Dianella revoluta* var. *divaricata.*
G3	Sedge <0.5m	5-10%	*Gahnia trifida, Lepidosperma calcicola.*
G4	Grasses <0.5m	0.25-5%	**Lagurus ovatus* and mixed weeds.

Species:

*Acacia rostellifera, Acacia saligna, *Arctotheca calendula, *Arenaria leptoclados, *Asparagus asparagoides, *Avena barbata, *Briza minima, *Centaurea melitensis, *Centaurium pulchellum, Clematis linearifolia, *Crassula glomerata, Dianella revoluta* var. *divaricata, *Erodium botrys, *Euphorbia peplus, *Euphorbia terracina, Gahnia trifida, *Galium murale, *Hypochaeris glabra, Kennedia prostrata, *Lagurus ovatus, Lepidosperma calcicola, Leucopogon parviflorus, *Lolium perenne, *Lysimachia arvensis, *Medicago polymorpha, Melaleuca huegelii* subsp. *huegelii, Moss, *Petrorhagia dubia, Poa porphyroclados, *Romulea rosea, *Rostraria cristata, *Sonchus oleraceus, Spyridium globulosum, Thomasia cognata, Tricoryne elatior, *Verbascum virgatum , *Vulpia fascicularis, Xanthorrhoea preissii*.

Outside quadrat (30m x 30m): *Caladenia latifolia, Agonis flexuosa, Cassytha racemosa* forma *racemosa*.

Photo NW Corner:



Quadrat RC-10

Survey 1:	15 September 2023	**Condition:**	Degraded
Survey 2:	18 October 2023	**Details:**	Weeds 90% cover.
Area:	10m x 10m (100m$^{2)}$	**Fire History:**	>10 years
Surveyor:	Kelli McCreery	**Leaf Litter:**	90% cover; <1-20cm depth.
Location NW:	50H 382913 6430042	**Landform:**	Consolidated dune.
Datum:	GDA94	**Soil Type:**	Grey sand.
Accuracy:	3m (0.5m)	**Aspect:**	S
Other:		**Altitude:**	2-4m

Vegetation NVIS:

Stratum	Form	Cover	Dominant Species
U1	Tree 10-20m	30-70%	*Eucalyptus gomphocephala.*
M1	Shrub >2m	30-70%	*Acacia cyclops, Acacia rostellifera, Spyridium globulosum.*
G1	Grasses <0.5m	70-100%	**Bromus diandrus, *Ehrharta longiflora, *Avena barbata, *Lagurus ovatus, *Lolium perenne* and mixed weeds.
G2	Forbs <0.5m	5-10%	**Romulea rosea*Euphorbia peplus, *Euphorbia terracina, *Trachyandra divaricata* and mixed weeds.

Species: *Acacia cyclops, Acacia rostellifera, Acacia saligna, *Asparagus asparagoides, *Avena barbata, *Bromus diandrus, Clematis linearifolia, Dianella revoluta* var. *divaricata, *Ehrharta longiflora, Eucalyptus gomphocephala, *Euphorbia peplus, *Euphorbia terracina, *Freesia leichtlinii X, *Lagurus ovatus, *Lolium perenne, *Medicago polymorpha, *Petrorhagia dubia, Rhagodia baccata* subsp. *baccata, *Romulea rosea, *Schinus terebinthifolia, *Sixalix atropurpurea, *Sonchus oleraceus, Spyridium globulosum, *Trachyandra divaricata.*

Outside quadrat (30m x 30m): *Gahnia trifida, Xanthorrhoea preissii, Hardenbergia comptoniana, Muehlenbeckia adpressa, *Pelargonium capitatum*.

Photo NW Corner:



Appendix D: Points of Interest

Please note that Tuart *Eucalyptus gomphocephala* Diameter at Breast Height (DBH) measurements in this section, do not represent an exhaustive survey of trees in the study area. These measurements would represent well under 10% of the trees present. These measurements are only designed to provide an indication of the age and size range of trees present.

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Category	Name	No.	Position (GDA94)
Releve	MN-01		50 H 382882 6429837
Releve	MN-02		50 H 382921 6429894
Releve	MN-03		50 H 383036 6430041
Releve	MN-04		50 H 382956 6430118
Releve	MN-05		50 H 383092 6430004
Releve	MN-06		50 H 383100 6429965
Releve	MN-07		50 H 382923 6430087
Releve	MN-08		50 H 382950 6429978
Releve	MN-09		50 H 382866 6429986
Releve	MN-10		50 H 382888 6429935
Releve	MN-11		50 H 382784 6429952
Releve	MN-12		50 H 383024 6429834
Releve	MN-13		50 H 383090 6429869
Releve	MN-14		50 H 382804 6429900
Releve	MN-15		50 H 383059 6429631
Releve	MN-16		50 H 383150 6429760
Releve	MN-17		50 H 383195 6429894
Releve	MN-18		50 H 383106 6429776
Releve	MN-19		50 H 383004 6429599
Releve	MN-21		50 H 383095 6430515
Releve	MN-22		50 H 383040 6430420
Releve	MN-23		50 H 382963 6430287
Releve	MN-24		50 H 383146 6429934
Releve	MN-25		50 H 383253 6429879
Releve	MN-26		50 H 383111 6429825
Releve	MN-27		50 H 383056 6429620
Releve	MN-28		50 H 383114 6429694
Releve	MN-29		50 H 383099 6429697
Releve	MN-30		50 H 383013 6429657
Releve	MN-31		51 H 382920 6429729
Releve	MN-32		50 H 382928 6430106
Releve	MN-33		50 H 382958 6429817
Releve	MN-34		50 H 382938 6429711
Releve	MN-35		50 H 382775 6429918
Releve	MN-36		50 H 382850 6430129
Releve	MN-37		50 H 382946 6429913
Releve	MN-38		50 H 383018 6429870
Releve	MN-39		50 H 383095 6429782
Releve	MN-40		50 H 383084 6430517
Releve	MN-41		50 H 383090 6430486
Releve	MN-42		50 H 382922 6430236
Releve	MN-43		50 H 382916 6430055
Releve	MN-44		50 H 383053 6429586
Quadrat	RC01 NE		50 H 383239 6429928
Quadrat	RC01 NW		50 H 383229 6429929
Quadrat	RC01 SE		50 H 383239 6429919
Quadrat	RC01 SW		50 H 383229 6429919
Quadrat	RC02 NE		50 H 383188 6429950
Quadrat	RC02 NW		50 H 383178 6429950
Quadrat	RC02 SE		50 H 383188 6429941
Quadrat	RC02 SW		50 H 383178 6429941
Quadrat	RC03 NE		50 H 383167 6429794
Quadrat	RC03 NW		50 H 383157 6429794
Quadrat	RC03 SE		50 H 383167 6429784

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Category	Name	No.	Position (GDA94)
Quadrat	RC03 SW		50 H 383157 6429783
Quadrat	RC04 NE		50 H 383195 6429797
Quadrat	RC04 NW		50 H 383186 6429796
Quadrat	RC04 SE		50 H 383195 6429787
Quadrat	RC04 SW		50 H 383186 6429787
Quadrat	RC05 NE		50 H 383069 6429926
Quadrat	RC05 NW		50 H 383060 6429926
Quadrat	RC05 SE		50 H 383068 6429915
Quadrat	RC05 SW		50 H 383059 6429915
Quadrat	RC06 NE		50 H 383185 6429856
Quadrat	RC06 NW		50 H 383174 6429857
Quadrat	RC06 SE		50 H 383185 6429847
Quadrat	RC06 SW		50 H 383174 6429846
Quadrat	RC07 NE		50 H 383072 6429672
Quadrat	RC07 NW		50 H 383062 6429672
Quadrat	RC07 SE		50 H 383072 6429662
Quadrat	RC07 SW		50 H 383063 6429663
Quadrat	RC08 NE		50 H 382852 6429907
Quadrat	RC08 NW		50 H 382842 6429906
Quadrat	RC08 SE		50 H 382852 6429898
Quadrat	RC08 SW		50 H 382843 6429897
Quadrat	RC09 NE		50 H 383122 6429721
Quadrat	RC09 NW		50 H 383113 6429720
Quadrat	RC09 SE		50 H 383121 6429711
Quadrat	RC09 SW		50 H 383112 6429711
Quadrat	RC10 NE		50 H 382921 6430041
Quadrat	RC10 NW		50 H 382913 6430042
Quadrat	RC10 SE		50 H 382921 6430032
Quadrat	RC10 SW		50 H 382912 6430032
Priority Flora	*Austrostipa mundula* (P3)	1	50 H 383229 6429929
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 382888 6429935
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383195 6429894
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383004 6429955
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383053 6429653
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383097 6429769
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383131 6429872
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383154 6429884
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383157 6429903
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383168 6429881
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383170 6429780
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383171 6429773
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	2	50 H 383176 6429821
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383177 6429819
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383186 6429865
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383186 6429914
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383195 6429836
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383198 6429892
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383198 6429915
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383202 6429895
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383157 6429794
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383174 6429857
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383174 6429857
Priority Flora	*Conostylis pauciflora* subsp. *pauciflora* (P4)	1	50 H 383174 6429857
Declared Pest	**Gomphocarpus fruticosus*		50 H 383036 6430041

Category	Name	No.	Position (GDA94)
Declared Pest	**Gomphocarpus fruticosus*		50 H 383092 6430004
Declared Pest	**Gomphocarpus fruticosus*		50 H 383024 6429834
Declared Pest	**Gomphocarpus fruticosus*		50 H 383272 6429917
Declared Pest	**Gomphocarpus fruticosus*		50 H 382928 6430106
Declared Pest	**Gomphocarpus fruticosus*		50 H 382850 6430129
Declared Pest	**Gomphocarpus fruticosus*		50 H 383076 6429904
Declared Pest	**Gomphocarpus fruticosus*		50 H 383095 6429782
Declared Pest	**Gomphocarpus fruticosus*		50 H 382922 6430236
Declared Pest	**Gomphocarpus fruticosus*		50 H 383105 6430496
Declared Pest	**Gomphocarpus fruticosus*		50 H 383060 6429926
Declared Pest	**Gomphocarpus fruticosus*		50 H 383062 6429672
Declared Pest	**Asparagus asparagoides*		50 H 382921 6429894
Declared Pest	**Asparagus asparagoides*		50 H 383092 6430004
Declared Pest	**Asparagus asparagoides*		50 H 382888 6429935
Declared Pest	**Asparagus asparagoides*		50 H 382784 6429952
Declared Pest	**Asparagus asparagoides*		50 H 383024 6429834
Declared Pest	**Asparagus asparagoides*		50 H 382804 6429900
Declared Pest	**Asparagus asparagoides*		50 H 383059 6429631
Declared Pest	**Asparagus asparagoides*		50 H 383194 6430463
Declared Pest	**Asparagus asparagoides*		50 H 383169 6430490
Declared Pest	**Asparagus asparagoides*		50 H 382963 6430287
Declared Pest	**Asparagus asparagoides*		50 H 383160 6429972
Declared Pest	**Asparagus asparagoides*		50 H 383111 6429825
Declared Pest	**Asparagus asparagoides*		50 H 383056 6429620
Declared Pest	**Asparagus asparagoides*		50 H 383097 6429684
Declared Pest	**Asparagus asparagoides*		50 H 383099 6429697
Declared Pest	**Asparagus asparagoides*		50 H 382958 6429817
Declared Pest	**Asparagus asparagoides*		50 H 382938 6429711
Declared Pest	**Asparagus asparagoides*		50 H 382775 6429918
Declared Pest	**Asparagus asparagoides*		50 H 382850 6430129
Declared Pest	**Asparagus asparagoides*		50 H 382951 6429942
Declared Pest	**Asparagus asparagoides*		50 H 383095 6429782
Declared Pest	**Asparagus asparagoides*		50 H 382922 6430236
Declared Pest	**Asparagus asparagoides*		50 H 383229 6429929
Declared Pest	**Asparagus asparagoides*		50 H 383178 6429950
Declared Pest	**Asparagus asparagoides*		50 H 383157 6429794
Declared Pest	**Asparagus asparagoides*		50 H 383186 6429796
Declared Pest	**Asparagus asparagoides*		50 H 383060 6429926
Declared Pest	**Asparagus asparagoides*		50 H 383174 6429857
Declared Pest	**Asparagus asparagoides*		50 H 383062 6429672
Declared Pest	**Asparagus asparagoides*		50 H 382842 6429906
Declared Pest	**Asparagus asparagoides*		50 H 383113 6429720
Declared Pest	**Asparagus asparagoides*		50 H 382913 6430042
Rubbish	Fibreboard		50 H 382879 6430146
Rubbish	Fibreboard		50 H 382967 6429916
Rubbish	Fibreboard. Fencing ca. 10 sheets.		50 H 382971 6429914
Rubbish	Fibreboard 1 sheet.		50 H 383095 6429727
Rubbish	Fibreboard		50 H 383105 6430496
Tuart DBH	*Eucalyptus gomphocephala*	75CM	50 H 382834 6429894
Tuart DBH	*Eucalyptus gomphocephala*	80CM	50 H 382834 6429902
Tuart DBH	*Eucalyptus gomphocephala*	60CM	50 H 382847 6429899
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 382852 6429889
Tuart DBH	*Eucalyptus gomphocephala*	80CM	50 H 382855 6429898
Tuart DBH	*Eucalyptus gomphocephala*	45CM	50 H 382859 6429882

Category	Name	No.	Position (GDA94)
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 382864 6429906
Tuart DBH	*Eucalyptus gomphocephala*	40CM	50 H 382865 6429901
Tuart DBH	*Eucalyptus gomphocephala*	45CM	50 H 382866 6429904
Tuart DBH	*Eucalyptus gomphocephala*	90CM	50 H 382867 6429914
Tuart DBH	*Eucalyptus gomphocephala*	30CM	50 H 382869 6429902
Tuart DBH	*Eucalyptus gomphocephala*	59CM	50 H 382871 6429888
Tuart DBH	*Eucalyptus gomphocephala*	30CM	50 H 382871 6429898
Tuart DBH	*Eucalyptus gomphocephala*	90CM	50 H 382877 6429910
Tuart DBH	*Eucalyptus gomphocephala*	95CM	50 H 382885 6429916
Tuart DBH	*Eucalyptus gomphocephala*	26CM	50 H 382890 6430026
Tuart DBH	*Eucalyptus gomphocephala*	SAPLING	50 H 382901 6430045
Tuart DBH	*Eucalyptus gomphocephala*	85CM	50 H 382902 6430034
Tuart DBH	*Eucalyptus gomphocephala*	85CM	50 H 382917 6430009
Tuart DBH	*Eucalyptus gomphocephala*	120CM	50 H 382918 6430036
Tuart DBH	*Eucalyptus gomphocephala*	26CM	50 H 382935 6430006
Tuart DBH	*Eucalyptus gomphocephala*	80CM	50 H 382938 6429909
Tuart DBH	*Eucalyptus gomphocephala*	35CM	50 H 382939 6430079
Tuart DBH	*Eucalyptus gomphocephala*	150CM DEAD	50 H 382944 6430055
Tuart DBH	*Eucalyptus gomphocephala*	140CM	50 H 382946 6429992
Tuart DBH	*Eucalyptus gomphocephala*	150CM	50 H 382947 6429920
Tuart DBH	*Eucalyptus gomphocephala*	70CM DEAD	50 H 382948 6430048
Tuart DBH	*Eucalyptus gomphocephala*	31CM	50 H 382951 6430005
Tuart DBH	*Eucalyptus gomphocephala*	35CM	50 H 382951 6430052
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 382953 6429999
Tuart DBH	*Eucalyptus gomphocephala*	22CM	50 H 382958 6430000
Tuart DBH	*Eucalyptus gomphocephala*	70CM	50 H 382960 6430103
Tuart DBH	*Eucalyptus gomphocephala*	15CM	50 H 382962 6430023
Tuart DBH	*Eucalyptus gomphocephala*	80CM	50 H 383017 6429890
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383037 6429919
Tuart DBH	*Eucalyptus gomphocephala*	35CM	50 H 383040 6429940
Tuart DBH	*Eucalyptus gomphocephala*	10CM	50 H 383043 6429927
Tuart DBH	*Eucalyptus gomphocephala*	35CM	50 H 383052 6429939
Tuart DBH	*Eucalyptus gomphocephala*	120CM	50 H 383055 6429911
Tuart DBH	*Eucalyptus gomphocephala*	SAPLING	50 H 383059 6429928
Tuart DBH	*Eucalyptus gomphocephala*	30CM	50 H 383059 6429943
Tuart DBH	*Eucalyptus gomphocephala*	2CM	50 H 383061 6429923
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383068 6429827
Tuart DBH	*Eucalyptus gomphocephala*	100CM	50 H 383072 6429944
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383079 6429925
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383083 6429933
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383088 6429942
Tuart DBH	*Eucalyptus gomphocephala*	10-20CM (5)	50 H 383091 6429938
Tuart DBH	*Eucalyptus gomphocephala*	140CM #1508	50 H 383132 6429952
Tuart DBH	*Eucalyptus gomphocephala*	15CM	50 H 383191 6429783
Tuart DBH	*Eucalyptus gomphocephala*	20CM	50 H 383203 6429791

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Appendix 6
Contamination Assessment

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Douglas PARTNERS

GROUNDED EXPERTISE

Report on Baseline Contamination Investigation

Proposed Crux Project

Part of Lot 108 Port Road, Kwinana Beach, WA

Prepared for Cargill Australia Pty Ltd

Project 224972.01

6 September 2024

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author	6 September 2024
Reviewer	6 September 2024

Executive Summary

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a baseline contamination investigation (BCI) undertaken for the proposed Crux Project located on Part of Lot 108 Port Road, Kwinana Beach, WA (the site).

Douglas understands that the proposed Crux Project will comprise the construction of a canola crushing plant facility, which will include grain handling logistics equipment such as grain storage and load-out facilities, a canola crushing line and other various production components, canola oil storage tanks, a wastewater treatment plant, compressed air station, fire-fighting facility, weighbridges, office building, laboratory, maintenance and utilities facilities, and truck parking areas.

As part of the leasing arrangement for the site, Cargill are required to conduct a BCI prior to commencement of their lease. Furthermore, as a condition of the lease, the BCI must be approved/endorsed by an Auditor accredited under Section 69 of the Contaminated Sites Act 2003. As such, Cargill have engaged Mr Peter Alderson from Australian Environmental Auditors to complete the Audit components required as a condition of the leasing agreement.

With reference to the National Environment Protection (Assessment of Site Contamination) Measure (2013) Schedule B2 Guideline on Site Characterisation (the 'NEPM', 2013) and the Department of Water and Environmental Regulation (DWER) Assessment and management of contaminated sites (DWER, 2021), the objectives of the BCI were to:

- Identify potential sources of contamination and establish associated contaminants of potential concern (CoPC) at the site;
- Identify areas of potential contamination at the site;
- Identify potential human and ecological receptors that may be impacted by the CoPC;
- Identify potentially affected media (soil, sediment, groundwater);
- Provide soil and groundwater contamination data prior to commencement of the lease;
- Provide a reference for direct comparison at the end of the lease term;
- Where contamination is found to be present, assess whether contamination poses an unacceptable ecological and/or human health risk under the proposed commercial industrial land use; and
- If required, inform the need for further investigations to address data gaps and/or the need for remediation and/or management of identified contamination.

Based on the results of the BCI, a number of PAEC's were identified and subsequently investigated via a programme of soil sampling and analysis. Following investigation and based on the updated CSM (refer to Section 14), these PAECs are considered to pose a low risk of presenting harm to human health and environmental receptors under the proposed commercial/industrial land use subject to the recommendations outlined below.

Douglas recommends that all surface PACM/ACM observed during the site walkover should be removed from the site by a suitably qualified contractor and disposed in accordance with regulatory requirements prior to any clearing of ground disturbing activities. The completeness

of the removal of known PACM/ACM should be validated by a representative from Douglas. Given that sporadic PACM/ACM has been encountered on the surface of the site and the potential for undiscovered PACM to be present, Douglas recommends that an Unexpected Finds Protocol (UFP) should be developed which outlines the management actions, reporting and safety alert processes in the situation that any unexpected finds (including asbestos) and/or contaminated soil is encountered during redevelopment works associated with the project. In the event of an unexpected find, a suitably qualified contaminated land consultant should be engaged to inspect the find and provide advice on the appropriate course of action.

The information contained in this report provides baseline soil and groundwater contamination data for the site, which is current as of July 2024. The following is recommended to be conducted over the leasing period:

- All existing groundwater monitoring wells should be protected during earthworks and construction of the proposed development to the extent practicable. Monitoring wells which are destroyed during construction should be replaced;
- Periodic groundwater monitoring should be conducted during operation of the facility to allow early detection of groundwater impacts in the vicinity of the monitoring well locations associated with future PAEC4 to PAEC10. An initial monitoring frequency of one monitoring event every two years is suggested. This monitoring frequency should be reviewed on an ongoing basis; and
- At the end of the lease period, the sampling should be repeated to assess for any changes in the contamination status at the previous sampling locations.

Douglas PARTNERS | GROUNDED EXPERTISE

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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Report on Baseline Contamination Investigation
Proposed Crux Project
Part of Lot 108 Port Road, Kwinana Beach, WA

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a baseline contamination investigation (BCI) undertaken for the proposed Crux Project located on Part of Lot 108 Port Road, Kwinana Beach, WA (the site). The investigation was commissioned by way of an executed Services Supply Agreement received on 23 May 2024 from Tuanlong Do of Cargill Australia Pty Ltd (Cargill) and was undertaken in general accordance with Douglas' proposal 224972.01.P.001.Rev1 dated 18 April 2024.

Douglas understands that the proposed Crux Project will comprise the construction of a canola crushing plant facility, which will include grain handling logistics equipment such as grain storage and load-out facilities, a canola crushing line and other various production components, canola oil storage tanks, a wastewater treatment plant, compressed air station, fire-fighting facility, weighbridges, office building, laboratory, maintenance and utilities facilities, and truck parking areas.

As part of the leasing arrangement for the site, Cargill are required to conduct a BCI prior to commencement of their lease. Furthermore, as a condition of the lease, the BCI must be approved/endorsed by an Auditor accredited under Section 69 of the Contaminated Sites Act 2003. As such, Cargill have engaged Mr Peter Alderson from Australian Environmental Auditors to complete the Audit components required as a condition of the leasing agreement.

This investigation was conducted concurrently with a geotechnical investigation, which has been reported under separate cover. The geotechnical investigation report should be read in conjunction with this report.

This report must be read in conjunction with the attached notes and other explanatory information provided in the appendices and should be kept in its entirety without separation of individual pages or sections.

2. Objectives of the Investigation

With reference to the National Environment Protection (Assessment of Site Contamination) Measure (2013) Schedule B2 Guideline on Site Characterisation (the 'NEPM', 2013) and the Department of Water and Environmental Regulation (DWER) Assessment and management of contaminated sites (DWER, 2021), the objectives of the BCI were to:

- Identify potential sources of contamination and establish associated contaminants of potential concern (CoPC) at the site;
- Identify areas of potential contamination at the site;
- Identify potential human and ecological receptors that may be impacted by the CoPC;
- Identify potentially affected media (soil, sediment, groundwater);

- Provide soil and groundwater contamination data prior to commencement of the lease;
- Provide a reference for direct comparison at the end of the lease term;
- Where contamination is found to be present, assess whether contamination poses an unacceptable ecological and/or human health risk under the proposed commercial industrial land use; and
- If required, inform the need for further investigations to address data gaps and/or the need for remediation and/or management of identified contamination.

3. Site Information

3.1 Site Identification

The site encompassing the proposed development is identified as Part of Lot 108 Port Road in Kwinana Beach. A summary of the site identification details is provided in Table 1. A site locality plan and aerial photograph are presented as Drawings 1 and 2, Appendix B.

Table 1: Site Identification Details

Identification	Description
Land Title	Part of Lot 108 on Deposited Plan 400167 Volume/Folio: 2953/177
Address	49 Port Road, Kwinana Beach
Site Area	~12.6 ha
Local Government Area	City of Rockingham (CoR)
Current Zoning[1]	General Industry (Town Planning Scheme 2)
Current Land Use	Undeveloped bushland
Site Co-ordinates (GDA 2020, MGA Zone 50)	North: 382872 mE 6430117 mN West: 382744 mE 6429965 mN South: 383100 mE 6429657 mN East: 383274 mE 6429911 mN

Notes 1. Zoning sourced from City of Rockingham www.rockingham.wa.gov.au

3.2 Surrounding Land Uses

The site is surrounded by the following (refer to Drawing 2, Appendix B):

- West: Kwinana Rail Loop and Kwinana Grain Terminal, beyond which is the Indian Ocean;
- South: Kwinana Rail Loop, undeveloped bushland;
- North: WA Kaolin and Haliburton Australia; and
- East: Patterson Road, Doral Fused Metals (Iwatani), Mt Barker Free Range Chicken, East Rockingham Waste Water Treatment Plant and various other commercial/industrial facilities.

3.3 Proposed Development

The proposed development includes the construction of a canola crushing plant with a production capacity of 2,000TPD. A proposed layout based on "CRUX-00-PP-001-VOT-discuss0516" is provided on Drawing 3, Appendix B. The following areas of the facility are also highlighted on Drawing 3 and generally include areas which are presumed to involve storage of bulk liquids/materials and or management of wastes:

- Canola seed and meal silos;
- Biomass fuel storage, steam boiler and ash treatment
- Oil tank farm;
- Refinery and subsidiary tank farm;
- Maintenance workshop;
- Wastewater treatment and stormwater pit;
- Solvent storage, extraction and recovery which includes underground storage tanks (USTs); and
- Preparation and biofiltration.

4. Existing Environment

4.1 Topography

The site is relatively flat, with surface levels varying between approximately RL 2.9 m relative to the Australian Height Datum (AHD) to RL 4.9 m AHD with some mounds and depressions of less than 1 m in height.

4.2 Geology

The Rockingham 1:50 000 Environmental Geology sheet indicates that the shallow sub surface conditions beneath the site comprise Safety Bay sand, described as calcareous sand, white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin.

4.3 Hydrogeology

The Perth Groundwater Atlas (2004) indicates that in May 2003, the groundwater level was approximately RL 1 m AHD, i.e. between approximately 2.0 m and 4.0 m below the existing surface level. The Atlas also indicates that the groundwater flow direction in May 2003 was in a westerly direction towards the Indian Ocean at an average gradient of approximately 1 in 3,880 m.

4.4 Hydrology

There are no surface water bodies on the site. The closest surface water body to the site is the Indian Ocean located approximately 600 m west of the site.

4.5 Acid Sulfate Soils

The published acid sulfate soil risk mapping indicates that the site is located within an area which is mapped as "no known risk of acid sulfate soils occurring within 3 m of natural soil surface".

4.6 Public Drinking Water Source Areas

The DWER Public Drinking Water Source Area (PDWSA) database indicates that the site is not located within a PDWSA. The nearest PDWSA is located more than 5 km northeast of the site.

4.7 Geomorphic Wetlands

The DWER geomorphic wetlands database indicates that the southern portion of the site and surrounding area to the southwest is located within a Resource Enhancement Wetland (REW) (ID 6227) described as Dampland. With reference to *Position Statement: Wetlands, Waters & Rivers Commission, 2001*, REW are wetlands which have been partially modified but still support substantial ecological attributes and functions. There are no other geomorphic wetlands within 1 km radius of the site.

4.8 Registered Groundwater Bores

A search was undertaken of DWER's Water Register of bore licences (https://maps.water.wa.gov.au/#/webmap/register) and DWER's registered bore database. Based on the results, the following comments can be made:

- There are no licensed or registered wells within the site;
- There are a number of licensed wells hydraulically up-gradient and within close proximity to the site (less than 350 m) including two wells within Patterson Road (Water Corporation), one well within Doral Fused Materials, one well within Haliburton Australia;
- The nearest licensed well down-gradient of the site is located 850 m southwest of the site and is owned by City of Rockingham.
- There are three registered wells (61404897, 61410024, 61404859) located up-gradient within 250 m of the site. These wells are owned by DWER, Water Corporation and Doral Fused Metals and are likely used for monitoring and/or abstraction purposes.

There are two registered wells (61404896 and 61410023) located immediately down-gradient of the site. These wells are owned by DWER and Water Corporation and are likely used for monitoring purposes. As requested by the Auditor, a visual inspection was conducted to assess the presence of the two registered wells, however, they could not be readily located due to presence of thick bush.

The locations of the registered wells are shown on Figure 1 and a copy of the information relating to the registered groundwater bore database is presented in Appendix C.

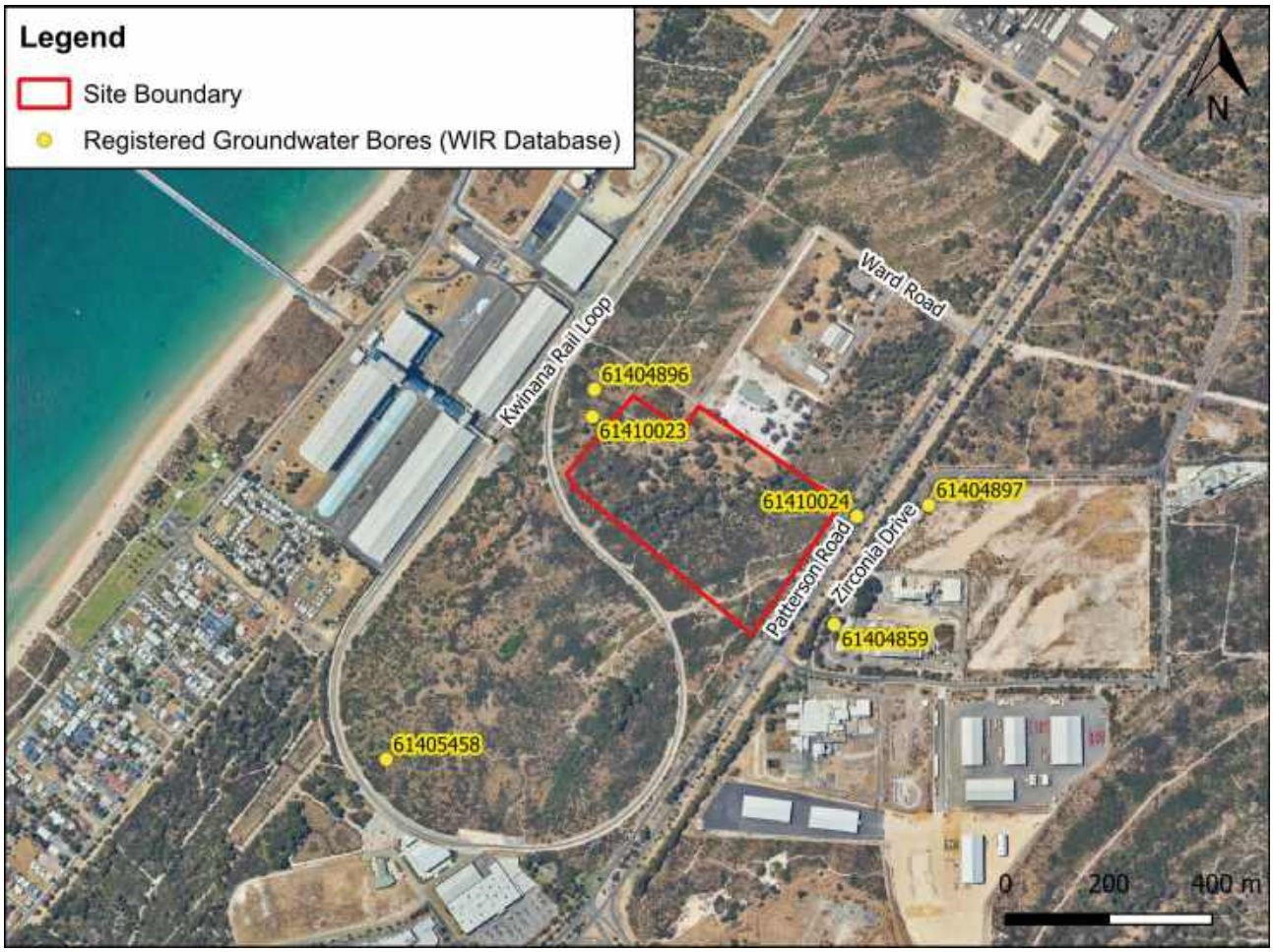


Figure 1: Registered Groundwater Bores (WIR Database)

4.9 Bush Forever

Bush Forever is a Western Australian Government initiative to protect regionally significant bushland on the Swan Coastal Plain of the Perth Metropolitan Region. The Department of Planning, Lands and Heritage (DPLH) Bush Forever database (2022) indicates that the site is not located within a Bush Forever protection area. The closest Bush Forever protection area is located more than 1 km from the site.

5. Site History

5.1 Historical Information Sources

The following sources of information, detailed in Table 2, were accessed to assess the history of the site and the surrounding area.

Table 2: Historical Information Sources

Source	Location of Source	Year or Date of Information Source	Details
Aerial Photographs	Landgate	1955 to 2024	Refer to Section 5.2
Contaminated Sites Database (online) and Basic Summary of Records	DWER	May 2024	Refer to Section 5.3

Other searches including review of historical Certificates of Title (CoT) and Department of Mines Industry Regulation and Safety (DMIRS) for historical storage of dangerous goods were not accessed as part of the site history review for the following reasons:

- Storage of dangerous goods was considered unlikely given that no evidence of historical development has been identified at the site; and
- Given the absence of development and obvious land uses or activities, review of historical CoT's was unlikely to provide any additional or pertinent information to inform site history.

An integrity assessment of the site history information is also provided to assess the quality of the information obtained (see Section 5.4).

5.2 Historical Aerial Photographs

Historical aerial photographs (one per decade) available from Landgate, dated from 1955 to 2024 were reviewed as part of this BCI. A copy of the relevant aerial photographs reviewed are provided in Appendix D.

Based on the review of historical aerial photographs dated between 1955 and present day, the following comments can be made:

- The site has remained undeveloped and comprised bushland since prior to 1955 until present day;
- Other than changes in vegetation density and the appearance of various unsealed tracks through the site, the site has generally remained unchanged since from 1955 until present day; and
- Surrounding areas to the west were developed sometime prior to 1974, whilst areas to the north and east were developed sometime prior to 1991 and 1999 respectively. Areas to the south have remained undeveloped.

5.3 Contaminated Sites Database (Online) and Basic Summary of Records

A search of the DWER online Contaminated Sites Database (CSD) was conducted to assess for the presence of classified properties within a 500 m radius of the site. The CSD holds information on known contaminated sites, ie sites that have been classified by the DWER as:

- *Contaminated - remediation required (CRR);*
- *Contaminated - restricted use (CRU);* and
- *Remediated for restricted use (RRU).*

As of June 2024, there are no properties classified as CRR, CRU or RRU located within a 500 m radius of the site.

A basic summary of records search was submitted to the DWER on 20 May 2024. The BSR search response (DMO 3082) indicated the following:

- The site is part of a larger area (ie Lot 108) which includes nine other land parcels;
- Lot 108 was originally reported to DWER following completion of a preliminary site investigation (completed over a portion of Lot 108) which found evidence of asbestos containing material (ACM) and synthetic mineral fibres (SMF) on the soil surface. It could not be ascertained whether the portion referred to in the BSR historically included any parts of the site; and
- DWER stated the information provided insufficient grounds to indicate that possible contamination of Lot 108 is present from the current or historical land uses. As such, Lot 108 was classified “report not substantiated” on 4 September 2008.

A copy of the DWER response (ref: DMO 13252) is provided in Appendix D.

5.4 Site History Integrity Assessment

The information used to determine the history of the site was sourced from reliable reference documents, many of which were official records held by Government agencies. The databases maintained by various Government agencies can contain high quality information, but some of these do not contain any data.

In particular, aerial photographs can provide high quality information that is generally independent of memory or documentation. They are only available at intervals of several years, so some gaps exist in the information from this source. The observed site features are open to different interpretations and can be affected by the time of day and/or year at which they were taken, as well as specific events such as flooding. Care has been taken to consider different possible interpretations of aerial photographs and to consider them in conjunction with other lines of evidence. Overall, the site history information is considered to provide a relatively reliable indication of past land uses and likely site activities.

6. Site Walkover Inspection

A site walkover conducted by a Douglas senior environmental scientist on 24 May 2024 indicated that:

- The site comprises a rectangular shaped area of approximately 12.6 ha;
- The site was free of any development or buildings and generally comprised a grassed surface with areas of thick bushland and large trees. The site is traversed with numerous sandy tracks;
- A large amount of inert fly-tipping was observed over the site, particularly in close proximity to the sandy tracks. Fly-tipping observed during the walkover mainly included discarded domestic wastes such as clothing, plastic, metal, bottles, furniture and concrete;
- Fly-tipped bonded fragments/sheets of potential asbestos containing materials (PACM) in reasonably good condition were observed at a number of locations (refer to Drawing 4, Appendix B). Representative samples (denoted ASB1, ASB2 and ASB3) were sampled and submitted to a National Association of Testing Authorities (NATA) accredited laboratory for analysis of asbestos (presence/absence). The results confirmed that sampled fragment ASB1 and ASB2 did not contain asbestos, whilst ASB3 contained Chrysotile (white) asbestos. A copy of the laboratory report is provided in Appendix G. Given the presence of thick surface vegetation, the potential for undiscovered flytipped PACM cannot be entirely ruled out; and
- A groundwater monitoring well was observed just outside the site boundary to the southwest;
- There were no obvious indications to suggest the presence of widespread fill over the site, which is generally supported by the historical aerial photograph review.

A selection of photographs from the site walkover is provided in Appendix B.

7. Potential Areas of Environmental Concern

Based on the review of site history information, site walkover and the proposed future development, the following PAEC (historical, existing and future) and associated CoPC for the site are summarised in Table 3.

Table 3: Summary of Potential Areas of Environmental Concern and Contaminants of Potential Concern

Source	Potential Area of Environmental Concern	Contaminants of Potential Concern
Existing/Historical	Fly-tipping **(PAEC1:):** The site walkover identified numerous areas fly tipping which mainly included household domestic refuge, including clothes and discarded items. Surface fragments of PACM were observed at a number of locations.	Bonded asbestos
Off-site	WA Kaolin **(PAEC2):** This facility is located immediately adjacent to the northeastern boundary (ie cross-gradient of groundwater flow) and could potentially present an off-site source of soil (with respect to wind borne dust) and groundwater contamination.	Metals/metalloids (ie aluminium)
	Doral Fused Metals (Iwatani), East Rockingham Waste Water Treatment Plant **(PAEC3):** These two facilities are located hydraulically up-gradient and could potentially present an off-site source of groundwater contamination.	Metals/metalloids, TRH, BTEX, PAH, VOC, nutrients, PFAS, naturally occurring radioactive materials (NORM)
Future (under proposed development)	Oil Tank Farm **(PAEC4)**	Metals/metalloids, TRH, nutrients
	Refinery and Subsidiary Tank Farm **(PAEC5)**	Metals/metalloids, TRH, nutrients
	Maintenance Workshop **(PAEC6)**	Metals/metalloids, TRH, BTEX, PAH, VOC
	Wastewater Treatment Plan and Stormwater pit **(PAEC7)**	Metals/metalloids, TRH, nutrients
	Biomass Fuel Storage, Steam Boiler and Ash Treatment **(PAEC8)**	Metals/metalloids, TRH, PAH, nutrients
	Solvent Storage, Extraction and Recovery including UST's **(PAEC9)**	TRH, BTEX (possibly present as impurities), VOC (hexane) PFAS (potentially used in fire-fighting foams in case of a solvent fire)
	Preparation and Biofiltration **(PAEC10)**	Metals/metalloids, TRH, nutrients

8. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a theoretical representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site may become contaminated and how potential receptors may be exposed to contamination either in the present or the future ie. it enables an assessment of the potential source – pathway – receptor linkages (complete pathways).

Potential Sources (S)

Based on the current investigation, the following potential sources of contamination and associated contaminants of potential concern (CoPC) have been identified (refer to Table 4).

S1: Fly-tipping;

S2: Off-site sources associated with PAEC2 and PAEC3; and

S3: Future land use associated with PAEC4 to PAEC10.

Potential Receptors (R)

The following potential human receptors have been identified:

R1: Current users [unauthorised access by members of the public];

R2: Construction and maintenance workers;

R3: End users [commercial/industrial]; and

R4: Adjacent site users [commercial/industrial].

The following potential environmental receptors have been identified:

R5: On-site local flora and fauna;

R6: Off-site native ecological receptors;

R7: Groundwater.

Potential Pathways (P)

The following potential pathways have been identified:

P1: Ingestion and dermal contact;

P2: Inhalation of dust, fibres and/or vapours;

P3: Lateral migration of groundwater providing base flow to water bodies;

P4 Leaching of contaminants and vertical migration into groundwater; and

P5: Contact with terrestrial ecology.

Summary of Potentially Complete Exposure Pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways (P1 to P5) between the above sources (S1 to S3) and receptors (R1 to R7) are provided in Table 4.

Table 4: Summary of Potentially Complete Exposure Pathways

Source and CoPC	Transport Pathway	Receptor	Risk Management Action
S1: Fly-tipping;	P2: Inhalation of dust/fibres	R1: Current users [undeveloped bushland] R2: Construction and maintenance workers R3: End users [commercial/industrial] R4: Adjacent site users [commercial/industrial].	Removal of all known surface PACM and validation prior to commencement of earthworks. Preparation of an unexpected finds protocol (UFP). This is discussed further in Section 15.
S2: Off-site sources associated with PAEC2 and PAEC3; and S3: Future land use associated with PAEC4 to PAEC10.	P1: Ingestion and dermal contact P2: Inhalation of dust and/or vapours P3: Leaching of contaminants and vertical migration into groundwater P4: Lateral migration of groundwater providing base flow to water bodies P5: Contact with terrestrial ecology	R1: Current users [undeveloped bushland land] R2: Construction and maintenance workers R3: End users [commercial/industrial] R4: Adjacent site users [commercial/industrial]. R5: On-site local flora and fauna R6: Off-site native ecological receptors R7: Groundwater	An intrusive soil investigation is recommended to assess for the presence of possible contamination.

9. Sampling and Analysis Quality Plan

9.1 Overview

A Sampling and Analysis Quality Plan (SAQP) was prepared by Douglas and was provided to the Auditor on 11 June 2024. The SAQP was reviewed and a number of comments regarding data gaps were outlined by the Auditor by way of a letter (Ref EA1119-C1) dated 17 June 2024. A copy of the SAQP and Auditor letter are provided in Appendix D.

The soil and groundwater sampling programme described herein is based on the SAQP and includes additional investigative information to address the data gaps identified by the Auditor.

9.2 Relevant Published Guidelines

The primary published guidelines relevant to this BCI are as follows:

- ANZG (2018), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018*, Australian and New Zealand Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand;
- Department of Environment Regulation (2021) Assessment and management of contaminated sites (DWER, 2021);
- Department of Health (May, 2021) Guidelines for the Assessment, remediation and management of asbestos-contaminated sites in Western Australia, (DoH, 2021);
- Heads of EPAs Australia and New Zealand (HEPA), *PFAS National Environmental Management Plan* (PFAS NEMP), Version 2.0, January 2020 (HEPA, 2020);
- Heads of EPAs Australia and New Zealand (HEPA), *Draft PFAS National Environmental Management Plan* Version 3.0 for Public Consultation (HEPA, 2022);
- National Health and Medical Research Council (NHMRC) *National water quality management strategy, Australian drinking water guidelines 6 2011 Version 3.8 Updated September 2022*, National Health and Medical Research Council and National Resource Management Ministerial Council, Australia (NHMRC, 2022);
- National Environment Protection Council (1999 – amended 2013) National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1 - Guidelines on investigation levels for soil and groundwater; (NEPC, 2013a); and
- National Environment Protection Council (1999 – amended 2013) National Environment Protection (Assessment of Site Contamination) Measure, Schedule B2 - Guideline on site characterisation (NEPC, 2013b).

9.3 Data Quality Objectives

The BCI was prepared with reference to the seven-step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013a). The DQO process is outlined as follows:

(1) State the Problem

(2) Identify the Decision/Goal of the Study

(3) Identify Information Inputs

(4) Define the Study Boundaries

(5) Develop the Analytical Approach (or decision rule)

(6) Specify the Performance or Acceptable Criteria

(7) Optimise the design for obtaining data

Each of the above steps is detailed in Appendix I.

9.4 Soil Sampling Strategy and Rationale (Chemical and Asbestos)

In order to assess the identified PAEC outlined in Table 3 and to provide baseline soil contamination data, a program of judgemental and targeted soil sampling and analysis was conducted.

A total of 39 test pits (TP39 to TP77) locations were considered appropriate to achieve the objectives of the investigation and were selected on the basis of the following:

- Collection of baseline data from judgemental and targeted locations from PAEC4 to PAEC10 together with general site coverage;
- Support the apparent absence of widespread fill over site; and
- To achieve the objectives of the geotechnical investigation which was conducted concurrently.

The soil sampling was conducted concurrently with a geotechnical investigation which has been reported under a separate cover. In this regard, the geotechnical investigation included additional test locations including cone penetration tests and deeper boreholes. The CPT and borehole information, where relevant to this investigation, has been included in this report.

The soil sampling locations (TP39 to TP77) are presented on Drawing 5, Appendix B.

9.5 Soil Sampling Methodology

Soil sampling from test pits TP39 to TP77 was undertaken between 18 and 20 June 2024 by a geo-environmental scientist from Douglas. The test pits were excavated using an 8-tonne backhoe fitted with a 450 mm wide toothed bucket to depths of between 0.3 m and 3.0 m.

Ground conditions were logged in accordance with Australian Standard (AS 1726, 2017) by an experienced geotechnical engineer from Douglas Partners. Perth sand penetrometer testing was carried out in accordance with Australian Standard (AS 1289.6.3.3, 1997) adjacent to each test

pit, to assess the in-situ density of the shallow soils. Coordinates for each location were recorded using a differential global positioning system (dGPS) with a reported vertical and horizontal accuracy of greater than +/- 0.1m. The test pit logs are provided in Appendix F.

Soil samples were collected at broadly regular intervals based on observed changes in strata and upon obvious signs of potential contamination such as odours or staining. The minimum number of samples collected from each location was:

- One surface sample i.e., 0.0 m – 0.1 m depth;
- Sample at 0.5 m intervals through encountered filling material; and
- One sample of natural material immediately below any encountered filling material (where met).

For each primary sample, a field replicate soil sample was collected in a sealed zip-lock bag. These samples were screened in the field with a pre-calibrated photo-ionisation detector (PID) to screen for the possible presence of volatile organic compounds (VOCs) in the soil. A copy of the calibration certificate is provided in Appendix F.

All soil samples were recorded on Douglas chain of custody sheets, and the general sampling procedure (for the assessment of chemical contamination) comprised:

- Collection of samples directly from the excavator bucket;
- Sampler wearing disposable nitrile gloves that were changed prior to the collection of each sample;
- Transfer of samples for non PFAS testing into laboratory-prepared glass jars;
- Transfer of samples for PFAS testing into laboratory-prepared plastic jars (i.e., no Teflon);
- Additional samples collected per the above sampling procedure for QC purposes;
- Labelling of sample containers with individual and unique identification details, including project number and sample location; and
- Placement of the sample jars into ice-cooled, insulated, and sealed containers for transport to the laboratory.

Soil sampling for the assessment of subsurface bonded ACM was conducted with due consideration of Section 5.7.1 of the DoH (2021) guidelines and included:

- Collection of one bulk (~10 L) soil sample per metre depth of potentially impacted strata (i.e., uncontrolled filling material) per test pit location;
- Screening of each bulk sample through a ≤7 mm aperture sieve;
- Weighing of all retrieved PACM fragments (where encountered); and
- Calculation of the asbestos % weight for weight (w/w) in soil, as per DoH (2021) guidelines.

9.6 Soil Analytical (Chemical) Programme

Forty-one primary soil samples were submitted to a NATA accredited laboratory, within the recommended holding times, for analysis of the following CoPC's identified in Table 3:

- Metals/metalloids including aluminium, arsenic, boron, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, mercury, nickel lead, selenium and zinc;

- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethyl benzene, xylene and naphthalene (BTEXN);
- Polycyclic aromatic hydrocarbons (PAH); and
- Per-and polyfluoroalkyl substances (PFAS).

In addition, two background soil samples were also analysed for % iron, cation exchange capacity (CEC), pH and total organic carbon (TOC) to establish site-specific ecological investigation levels (EILs). The % clay in shallow soils was assessed based on results of particle size distribution laboratory testing (PSD) conducted as part of the geotechnical investigation.

Five intra-laboratory replicate soil samples and three trip spike samples were analysed by MPL for quality control (QC) purposes. Five inter-laboratory replicate soil samples were also analysed by Eurofins. Both laboratories are accredited by NATA for all analyses conducted.

9.7 Groundwater Sampling Strategy and Rationale

In order to provide baseline groundwater contamination data and allow assessment of groundwater flow direction, the following was conducted (refer to Drawing 6, Appendix B):

- Installation and sampling of two groundwater monitoring wells (MW103 and MW104)) positioned hydraulically up-gradient of the proposed development. The results were used to inform groundwater quality entering the site and to assess potential contamination migrating over the site boundary from potential offsite sources (associated with PAEC3);
- Installation and sampling of one groundwater monitoring well (MW101) positioned down-gradient of the proposed development to assess groundwater quality exiting the site;
- Sampling of groundwater monitoring well (BH1) installed as part of the geotechnical investigation which was positioned down-gradient of the proposed development to assess groundwater quality exiting the site;
- Sampling of groundwater monitoring well (BH7) installed as part of the geotechnical investigation which was positioned adjacent to the northeast boundary to assess groundwater quality down-gradient of the WA Kaolin facility (associated with PAEC2);
- Installation and sampling of two groundwater monitoring wells (MW102 and MW105) which were positioned down-gradient of the solvent storage, extraction and recovery area including USTs (associated with PAEC9) and workshop/waste water treatment plant and stormwater drain associated PAEC6 and PAEC7) respectively; and
- The ‘existing monitoring well’ (located off-site between the site and Kwinana Rail Loop) together with BH1, BH7 and BH8 and proposed monitoring wells MW101 to MW105 were surveyed and gauged in order to assess groundwater flow direction.

The groundwater monitoring well locations are shown on Drawing 6, Appendix B.

9.8 Monitoring Well Installation and Construction Methodology and Survey

Groundwater monitoring wells MW101 to MW105 were installed on 28 June 2024 by Direct Push Probing (DPP) in the presence of an environmental scientist from Douglas. The boreholes were drilled through the soils using push probe methods to a depth of 5.0 m below the existing surface level. Groundwater monitoring wells BH1 and BH7 were installed as part of the geotechnical investigation between 27 May and 17 June 2024. The drilling was conducted using a combination of HQ coring and mud rotary. The boreholes were logged by a representative from Douglas in general accordance with test procedures outlined in AS 1726:2017.

The wells were constructed of Class 18 UPVC screen and blank sections. The joints were screw threaded to prevent the use of glues which may contaminate the well. To allow for the presence of any light non-aqueous phase liquid (LNAPL) to be measured, the screened interval of the monitoring wells intersected and extended above the standing water table. The screened section was backfilled with a washed sand filter pack to 0.5 m above the screened interval. The well was completed with a hydrated bentonite plug at least 0.5 m thick and the annulus was subsequently backfilled with the drilling returns.

Following installation, the wells were developed by continuous pumping until the water was visual free of sediment and to facilitate the hydraulic connection of the well to the local groundwater regime.

Given the anticipated low groundwater gradient, the monitoring well casings of all newly installed groundwater wells including the existing groundwater well, were surveyed by BCE Surveying Pty Ltd (BCE). A copy of the survey results is provided in Appendix F.

The well construction details are presented on the respective borehole logs in Appendix F.

9.9 Groundwater Sampling Methodology

Groundwater sampling was undertaken on 23 July 2024 and was performed in general accordance with standard operating procedures outlined in the Douglas Field Procedures Manual. Groundwater samples were collected using a low flow pump in order to minimise aeration of the sample and disturbance to the water column. The sampling method is described as follows:

- Measurement of the static water level using an electronic interface probe and recording of the thickness of any LNAPL (if encountered);
- The low flow pump was fitted with bore dedicated tubing (suitable for PFAS) and lowered into the well at a level estimated to be at the midpoint of the water column within the screened section of the monitoring well;
- Physical parameters (pH, temperature, dissolved oxygen, electrical conductivity, redox and total dissolved solids) were measured by continuously passing the purged water through a flow cell; and
- Following stabilisation of the parameters (nominally +/- 10%), sampling commenced and the appropriate laboratory prepared sample bottles were filled; and
- Samples collected for analysis of dissolved metals were field filtered through a bore dedicated inline 45 µcm filter.

9.10 Groundwater Analytical Programme

Primary groundwater samples were submitted to a NATA accredited laboratory, within the recommended holding times, for analysis of the following CoPC's identified in Table 3:

- Metals/metalloids including aluminium, arsenic, boron, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, mercury, nickel lead, selenium and zinc;
- TRH;
- BTEXN;
- VOC;s
- PAH;
- PFAS;
- Nutrients including total nitrogen, nitrate as N, nitrite as N, Ammonia as N, total Kjeldahl nitrogen (TKN), total phosphorus;
- Gross Alpha Beta (MW103 and MW104 only);
- Hardness; and
- Major cations and anions.

One intra-laboratory replicate groundwater sample, one trip blank sample and one trip spike sample were analysed by MPL for QC purposes. One inter-laboratory replicate groundwater sample was also analysed by Eurofins. Both laboratories are accredited by NATA for all analyses conducted.

9.11 Data Quality Control Programme

Data QC comprised an integral component of the BCI. A review of the adopted QC procedures and results was used to establish whether the DQIs were met and whether the data is suitable to fulfil the aims of the BCI. The following field QC samples were collected:

- One intra-laboratory replicate sample per 20 primary samples for analysis of CoPCs (except PFAS);
- One inter-laboratory replicate sample per 20 primary samples for analysis of CoPCs (except PFAS;
- One intra-laboratory replicate sample per 10 primary samples for analysis of PFAS (as per NEMP, 2020);
- One inter-laboratory replicate sample per 10 primary samples for analysis of PFAS (as per NEMP, 2020);
- One trip blank per sampling day; and
- One trip spike per sampling day.

The analytical laboratory is required to carry out in house QC procedures. Laboratory QC samples and procedures included the use of:

- Laboratory duplicates;
- Laboratory control samples;

- Method blanks; and
- Matrix spikes.

The methodologies adopted and the results of the above outlined field and laboratory QC procedures are detailed in Appendix I.

10. Site Assessment Criteria (SAC)

10.1 Soils

The adopted Soil Assessment Criteria (SAC) are derived from Health Investigation Levels (HILs), Health Screening Levels (HSLs) and Environmental Investigation Levels (EILs) from Schedule B1 of the National Environment Protection Council (NEPC) National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 – amended 2013) [NEPC, 2013] Schedule B1 – Guidelines on investigation levels for soil and groundwater.

The health investigation levels (HILs) are scientifically based, generic assessment criteria designed to be used in the first stage of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use scenarios. Given the proposed land use, HIL-D commercial/industrial has been adopted.

Consideration of HSLs has also been given with regard to evaluating vapour intrusion risks associated with any hydrocarbon contaminated soil. The HSL-D criteria for a sand soil type and the contaminant depth for relevant soil samples have been adopted.

In addition to appropriate consideration and application of the HSLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formulation of observable LNAPL;
- Fire and explosion hazards; and
- Effects on buried infrastructure *e.g.,.* penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. The following site-specific data and assumptions have been used to determine the Management Limits:

- The Management Limits will apply to any depth within the soil profile; and
- “Coarse” soil texture has been adopted as a conservative screen.

The use of Ecological Investigation Levels (EILs) is discussed in NEPC (2013) for selected metals and organic compounds, and they are applicable for assessing risk to terrestrial ecosystems. Ecological Screening Levels (ESLs) are used to assess the risk to terrestrial ecosystems of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene. EILs and ESLs apply to the top 2 m of the soil profile, which essentially corresponds to the root zone and habitation zone of many species. Generic EILs for different land use settings are available in NEPC (2013) for arsenic and naphthalene. Soil-specific EILS for Cu, Cr (III), Ni, Pb and Zn, EILs were used during this assessment and are determined using the following formula:

EIL = ABC + ACL, where

ABC = Ambient Background Concentration

ACL = Added Contaminant Limit

The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminant concentrations that have been introduced from diffuse or non-point sources (eg motor vehicle emissions). The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al. (1995) or Hamon et al. (2004). ACLs are based on the soil characteristics of pH, cation exchange capacity (CEC) and clay content.

As part of the BCI, samples of natural soils were collected from locations TP69 (0.05 m- 0.1 m) and TP70 (0.05 m-0.15 m) to allow calculation of site specific EILs. The following site-specific data has been used to establish the EILs:

- A protection level of 60% (commercial/industrial) has been adopted;
- The EILs apply to the top 2 m of the soil profile;
- pH of 8.9 (based on pH for TP70 (0.05 – 0.1);
- Clay content of 3% (based on particle size distribution test ie particles <0.075 mm at) TP68 (0.5 m);
- Cation exchange capacity of 5.3 meq/100g (based on average result from TP69 (0.05 – 0.1) and TP70 (0.05 – 0.1);
- Total organic carbon content of 1% (based on result for TP69 (0.05 – 0.1);
- Total iron of 0.25% based on result for TP70 (0.05 – 0.1);
- The ABCs for old suburbs in low traffic areas in South Australia, as derived from Olszowy et al. (1995), and presented in Schedule B5c of NEPC (2013) have been used; and
- Given the length of time the surrounding sites have been developed (>20 years), "*aged*" EILs were adopted.

PFAS assessment criteria comprised the guidelines presented in the PFAS NEMP 2.0 (HEPA, 2020) and Draft NEMP 3.0 (HEPA, 2022). The PFAS NEMP guidelines are broadly consistent with the NEPM HIL/HSL and EIL/ESL categories including consideration of site land use. The following NEMP criteria were adopted for this investigation:

- Human Health Investigation Level (HHIL) – commercial/industrial use;
- Ecological Guideline Value for Direct Exposure (EGV-DE) – Applicable to all land uses;
- Ecological Guideline Value for Indirect Exposure (EGV-IE) – Applicable to all land uses;

The adopted SAC are presented in Table G-1, Appendix G, together with the soil analytical results. Additionally, a copy of the EIL calculation sheets is provided in Appendix G.

10.2 **Groundwater**

The Groundwater Investigation levels (GILs) adopted for the assessment are largely taken from the DWER (2021) *Assessment and management of contaminated sites* guidelines, which are based on:

- ANZG (2018), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018*, Australian and New Zealand Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand.
- DoH (2014) *Contaminated Sites Ground and Surface Water Chemical Screening Guidelines - Non-potable groundwater use*.
- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 – amended 2013) Schedule B1 - Guidelines on investigation levels for soil and groundwater*, National Environment Protection Council.
- NHMRC (2022), *National water quality management strategy, Australian drinking water guidelines 6 2011 Version 3.8 Updated September 2022*, National Health and Medical Research Council and National Resource Management Ministerial Council, Australia;
- HEPA PFAS National Environmental Management Plan 2.0 (NEMP) (HEPA, 2020); and
- HEPA Draft PFAS National Environmental Management Plan 3.0 for Public Consultation (HEPA, 2022).

The DWER (2021) guidelines stipulate that where groundwater quality is being assessed, the most appropriate assessment level depends on the beneficial use of groundwater at the site, including the possible presence of groundwater dependent ecosystems, as well as that at the discharge location.

In accordance with this guidance the potential uses of groundwater at, or down-gradient of the site, and beneficial uses based on identified exposure scenarios, have been considered. Potential uses at, or down-gradient, of the site include:

- Potential non-potable uses; and
- Groundwater discharge to water bodies sustaining aquatic ecosystems.

Consequently, the following criteria have been adopted:

- Slightly-moderately disturbed ecosystems protection levels, for protection of 95% of marine water species (ANZG, 2018). It should be noted that the groundwater criteria for metals will be corrected based on the factors outlined in Table 3.4.4 (ANZECC, 2000) and reported hardness;
- Non-potable uses of groundwater (NPUG) criteria from DWER (2021) and DoH (2014);
- HEPA *PFAS National Environmental Management Plan 2.0 (NEMP)* (HEPA, 2020);
- Consideration of the Health Screening Levels (HSLs) presented in NEPC (2013) has also been given with respect to evaluating vapour intrusion risks associated with hydrocarbon contaminated groundwater.

As the site will be serviced by integrated water supply under a future proposed development and noting that the site is not located within a PDWSA, adoption of the drinking water assessment criteria has not been considered further.

The adopted GILs are presented in Table H-1, Appendix H, together with the groundwater analytical results.

11. Field Work Results - Soils

11.1 Subsurface Conditions

Logs of the ground conditions and results of the field tests are presented in Appendix F, and should be read in conjunction with the notes defining descriptive terms and classification methods provided in Appendix A.

A summary of the general ground conditions encountered in the test pits (TP39 to TP77) is given below:

- **Unit 0: FILL / SAND SP with organics** – apparently clean sand fill (inferred to comprise disturbed soils sourced from the site) with a variable organic content was encountered at TP53, TP60 to TP63 and TP65, generally less than 0.5 m thick, however 0.8 m thick at TP65.
- **Unit 1: Topsoil (SAND SP) –** dark grey-brown sand with silt, rootlets and occasional roots was encountered at ground surface in most test pits, except pits which encountered fill at the surface, where the topsoil was underlying the fill. Topsoil was generally between 100 mm to 200 mm thick.
- **Unit 2: Safety Bay Sand: SAND SP / LIMESTONE –** the shallow Safety Bay Sands were generally medium dense or denser, with some loose to medium dense zones near the surface and becoming lithified from depths generally shallower than 1.0 m depth. The Safety Bay Sand comprised pale grey, fine to coarse grained sand with a minor silt component and was encountered below the topsoil in most test pits to depths of between 1.8 m and greater than the test pitting depth (between 1.0 m and 3.0 m). Exceptions were test pits TP50, TP58, TP65, TP66, TP69 and TP77, which encountered “LIMESTONE” at between 0.2 m and 1.7 m depth. The LIMESTONE essentially comprises calcreted Safety Bay Sand, which was lithified to the extent that it caused refusal when using an 8 tonne backhoe.

  Some limestone gravels were locally encountered in the lithified component of the Safety Bay Sand (test pits TP53 and TP61).

Other than trace glass and plastic at location TP53, no other non-soil foreign inclusions (including PACM) were observed in the encountered fill profiles.

Further reference should be made to the geotechnical report prepare for the site which includes detailed descriptions of ground conditions and engineering comments.

11.2 PID Screening

All PID readings for VOCs in sampled soils were recorded below 5 ppm, which indicates that significant VOCs were unlikely to the present.

11.3 Bulk Soil Sample Screening (Asbestos)

Bulk soil samples were collected from all test pit locations (ie TP39 to TP77) between 0-0.2 m depth and screened for the presence of PACM. Bonded fragments of PACM were not observed in any of the screened bulk samples. A summary of the bulk screening where foreign-non soil inclusions were noted is summarised in Table 5. Observations in all other screened bulk samples was limited to combinations of organics and/or limestone gravel and did not include any non-soil foreign inclusions.

Table 5: Summary of Bulk Soil Screening (Bonded ACM)

Test Location	Sample Depth	Fill/Natural	Observations
TP49	0 – 0.1	Natural	Plastic, paper
TP53	0 – 0.2	Fill	One glass fragment
TP54	0 - 0.15	Natural	One glass fragment
TP58	0 – 0.2	Natural	Three glass fragments
TP74	0 – 0.15	Natural	Trace glass fragments, plastic

11.4 Soil Analytical Results (Chemical)

The soil analytical results summarised in Table G-1, Appendix G shows that the targeted CoPC were reported at concentrations below the adopted SAC for commercial/industrial land uses, for most analysed samples except for the following exceedances of the adopted ecological based criteria:

- Nickel concentrations of 78 mg/kg, 70 mg/kg and 74 mg/kg at locations TP66 (0.05-0.10), TP72 (0.1-0.2) and TP74 (0.05 – 0.15) respectively, were either equal to, or exceeded the adopted EIL of 70 mg/kg (commercial/industrial); and
- Perfluorooctanesulfonic acid (PFOS) concentration of 16 µg/kg at location TP58 (0.05 – 0.15) exceeded the adopted ecological criteria for indirect exposure of 10 µg/kg.

11.5 Discussion of Soil Results

The results also were not indicative of widespread fill over the site. Sand fill, inferred to comprise disturbed soils sourced from the site, were encountered at locations TP53, TP60 to TP63 and TP65. Other than trace glass and plastic at location TP53, which was likely sourced from surface flytipping, no other non-soil foreign inclusions (including PACM) were observed in the encountered fill profiles.

Results of chemical testing at the PAEC (refer to Table 3), showed that concentrations of chemical contaminants in the analysed samples were below the adopted SAC and/or unlikely to present an unacceptable risk to ecological receptors. The apparent absence of broadscale chemical contamination is in general agreement with the site history which suggested that the site has been historically utilised for low-risk activities. A number of exceedances of ecological based criteria were reported for nickel and PFOS and are discussed further below.

In view of the recorded EIL exceedance for nickel, the 95% UCL mean concentration was calculated using the 39 results for near surface samples (ie <0.2 m depth). The 95% UCL mean concentrations was calculated to be 37 mg/kg for nickel (using 95% Chebyshev UCL) which is below the adopted EIL of 70 mg/kg. The standard deviation was calculated to be 23 mg/kg which is below 50% of the EIL criterion of 70 mg/kg. Additionally, no individual nickel concentrations (in the data set) were greater than 250% of the EIL criterion. A copy of the UCL calculation sheet is provided in Appendix G. Based on the above discussion and in light of the statistical analysis, the elevated nickel in excess of the adopted EIL is not considered to be significant and unlikely to present an unacceptable risk to ecological receptors.

Low detections of PFAS were reported in the majority of the analysed soil samples, with a comparatively higher concentration reported for PFOS reported at TP58 (0.05 – 0.15) which exceeded the adopted ecological criteria for indirect exposure of 10 µg/kg. Given the site's history and surrounding land uses, the source(s) of the trace PFAS in soil and in particular, the elevated PFOS at location TP58, is unclear. One possibility is the use and scattering of many discarded domestic items observed over the surface of the site which include common sources of PFAS.

Regarding the exceedance of the adopted ecological criteria for indirect exposure for PFOS, HEPA, 2020 notes that for intensively developed sites with no secondary consumers and minimal potential for indirect ecological exposures, a high criterion for PFOS of up to 140 µg/kg may be appropriate. With reference to HEPA, 2020, relevant considerations for adopting higher criterion could include:

- The site is intensively developed with greater than 80% of each hectare covered by hard surfaces – Under the proposed development, approximately 70% of the total site area will be developed;
- Secondary consumers are effectively absence from the site – under the proposed future development, secondary consumers are unlikely to be present in sealed and operational areas;
- The site is situated in an extensively built up urban setting. Under the future development, the site and surrounding areas are extensively developed for commercial/industrial uses; and
- The site is not in close proximity to waterways, drainage networks or groundwater – The site not located in proximity to drainage networks or groundwater. The Indian Ocean is located approximately 600 m west.

As such, there is a reasonable basis for adopting a higher criterion for this site to at least 50% of the maximum criterion (i.e 70 µg/kg) suggested by HEPA, 2020. In this regard, the reported concentration of PFOS of 16 µg/kg is well below the revised criteria and is therefore unlikely to present an unacceptable risk to indirect ecological receptors under the proposed future commercial/industrial development.

12. Field Works Results – Groundwater

12.1 Groundwater Levels and Flow Direction

Depth to groundwater was initially measured on 4 July 2024 to confirm groundwater flow direction and the appropriateness of the installed groundwater monitoring well network. Following confirmation of the groundwater flow direction, depth to groundwater was also measured on 23 July 2024 prior to groundwater sampling. A summary of the measurements are provided in Table 6.

Based on the recorded groundwater levels, the groundwater flow beneath the site has been gauged to be approximately northwest, which is in general agreement with the published mapping. The interpolated groundwater contours for 4 and 23 July 2024 are presented on Figures 2 and 3 respectively.

It should be noted that groundwater levels are affected by climatic conditions, land usage, soil permeability, tides and will therefore vary spatially, and over time.

Table 6: Summary of Recorded Groundwater Levels

Monitoring Well	Top of Casing Level (m, AHD)[1]	4 July 2024		23 July 2024	
		Groundwater Depth (m, btoc)[2]	Groundwater Level (m, AHD)	Groundwater Depth (m, btc)[2]	Groundwater Level (m, AHD)
MW101	4.320	3.45	0.870	3.315	1.005
MW102	4.472	3.50	0.972	3.45	1.022
MW103	4.353	3.27	1.083	3.22	1.133
MW104	4.195	3.12	1.075	3.07	1.125
MW105	4.149	3.20	0.949	3.13	1.019
BH01	4.372	3.49	0.882	3.43	0.942
BH07	4.674	3.73	0.944	3.605	1.069
Existing Well	4.931	3.99	0.941	3.935	0.996

Notes: 1. Surveyed by BCE.
2. Measured by Douglas using an electronic water depth metre. m, btc = metres below the top of casing

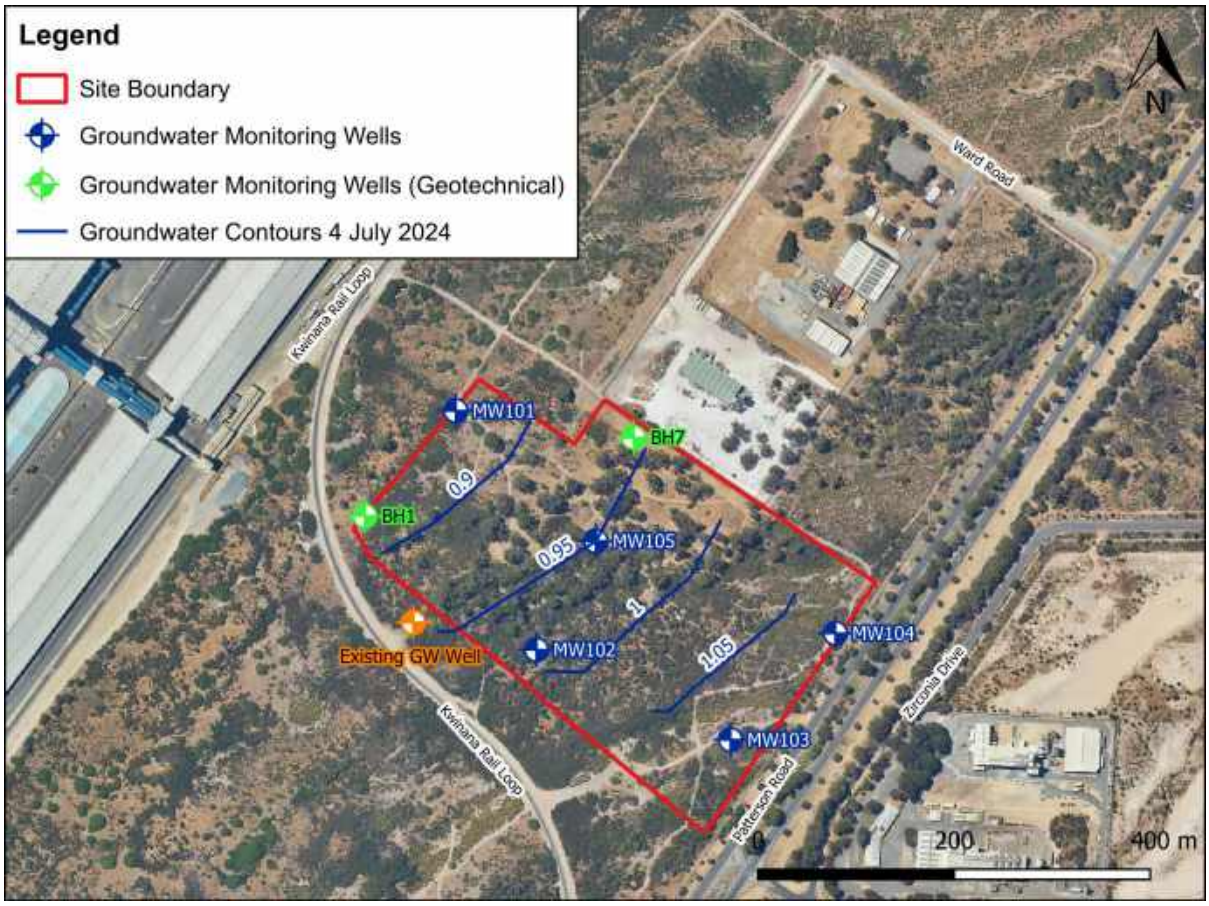


Figure 2: Groundwater Contours (4 July 2024)

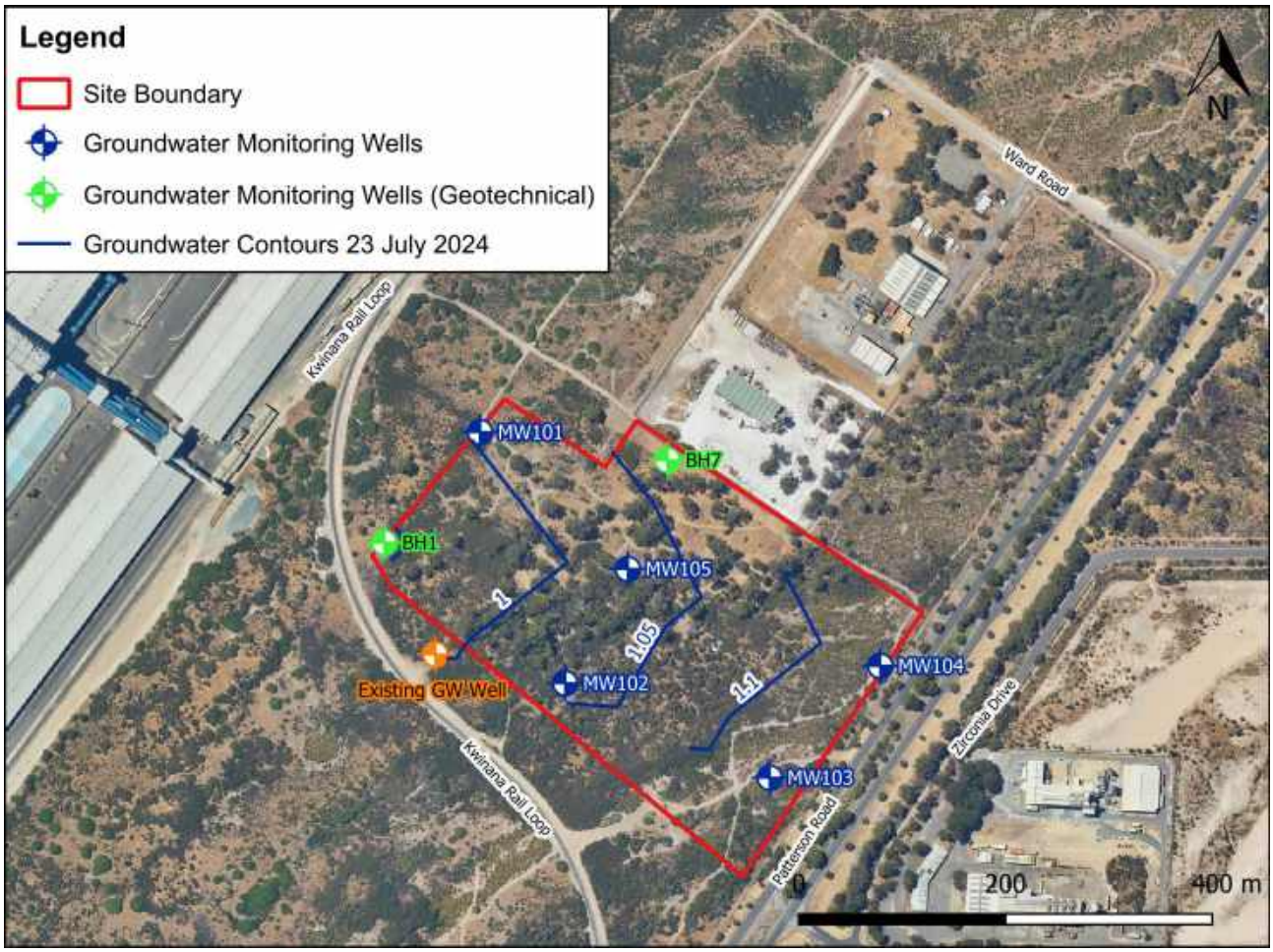


Figure 3: Groundwater Contours (23 July 2024)

12.2 Groundwater Field Parameters

Groundwater field parameters were continuously measured through a flow cell during purging prior to collection of the groundwater samples. The field results collected prior to sampling are presented in Table 7.

With reference to Table 7, the pH of the groundwater was generally neutral with the results for redox suggesting that, generally, reducing conditions are prevalent. TDS was reported between 820 mg/L and 1463 mg/L indicating that groundwater beneath the site is marginal (i.e., TDS of between 501 mg/L and 1,000 mg/L) to brackish (i.e., TDS of between 1,001 mg/L and 5,000 mg/L.

Table 7: Summary of Groundwater Field Parameters

Monitoring Well	LNAPL Thickness	pH	DO (ppm)	EC (µS/cm)	Redox Potential (mV)	Temp (°C)	TDS (mg/L)
MW101	0.0	7.5	2.2	1299	-147	20.2	931
MW102	0.0	7.5	0.5	1520	-220	18.8	1120
MW103	0.0	7.6	4.9	1265	-128	19.6	918
MW104	0.0	7.4	1.7	1903	-103	20.2	1463
MW105	0.0	7.5	0.3	1518	-195	20.4	1084
BH01	0.0	7.4	2.2	1129	-245	19.4	820
BH07	0.0	7.2	1.7	1256	-130	20.7	890

Notes: 1. DO – Dissolved Oxygen, EC – Electrical Conductivity, TDS – Total Dissolved Solids

LNAPL gauged using an oil-water interface meter provided by Environmental Test Solutions. All other parameters measured using a YSI water quality meter provided by Environmental Test Solutions.

12.3 Groundwater Analytical Results

The analytical results presented in Table H-1, Appendix H show that the CoPC were reported at concentrations below the adopted GIL's with except for the following:

- Chloride which was equal to or exceeded the adopted NPUG criterion of 250 mg/L at locations MW102, MW104 and MW105 with concentrations of 300 mg/L, 390 mg/L and 250 mg/L respectively;
- Ammonia as N which exceeded the adopted marine water criterion of 0.91 mg/L and NPUG criteria of 0.41 mg/L at location BH1 with a concentration of 1 mg/L
- NOx which exceeded the adopted marine water criterion of 0.008 mg/L at locations MW101, BH1 and BH7 with concentrations of 0.014 mg/L, 1.3 mg/L and 1.4 mg/L respectively;
- Total nitrogen which exceeded the adopted marine water criterion of 0.23 mg/L at MW101 to MW105, BH1 and BH7 with concentrations between 0.35 mg/L (MW103) and 31 mg/L (BH7);
- Phosphate as P which exceeded the adopted marine water criterion of 0.005 mg/L at locations MW102, BH1 and BH7 with concentrations of 0.0071 mg/L, 0.062 mg/L and 0.014 mg/L respectively;
- Total Phosphorus which exceeded the adopted marine water criterion of 0.02 mg/L at MW102, MW103, BH1 and BH7 with concentrations between 0.053 mg/L (MW103) and 0.11 mg/L (BH1);
- Dissolved arsenic which exceeded the adopted marine water criteria of 13 µg/L at locations MW101, MW105 and BH1 with concentrations of 43 µg/L, 22 µg/L and 16 µg/L respectively;
- Dissolved cobalt which exceeded the adopted marine water criteria of 1 µg/L at BH7 with a concentration of 8 µg/L;
- Dissolved copper which exceeded the adopted marine water criterion of 1.3 µg/L at MW103, MW104 and BH7 with concentrations of 13 µg/L, 1.9 µg/L and 1.9 µg/L respectively;
- Dissolved manganese which exceeded the adopted marine water criteria of 1,900 µg/L at BH7 with a concentration of 2,600 µg/L;

- Dissolved zinc which exceeded the adopted marine water criteria of 8 µg/L at MW012 with a concentration of 9.9 µg/L
- PFOS which exceeded the adopted marine water criterion of 0.00023 µg/L at BH07 with a concentration of 0.0021 µg/L. Concentrations of PFOS at the remaining groundwater well locations were reported below the laboratory limit of reporting (LOR) of 0.001 µg/L, which is above the adopted marine water criterion.

It is also noted that concentrations above the LOR of the following CoPC's (hydrocarbons, PFAS and radiological) were also reported, however, were below adopted GIL's, where available:

- TRH (C10-C14) of 80 µg/L and 660 µg/L at locations BH1 and BH7;
- TRH (C15-C28) of 790 µg/L at location BH7
- TRH (>C10-C16) of 120 µg/L and 1200 µg/L at locations BH1 and BH7
- TRH (>C10-C16) less N (F2) of 120 µg/L and 1200 µg/L at locations BH1 and BH7
- TRH (>C10-C34) (F3) of 180 µg/L at location BH7;
- Perfluorobutanesulfonic acid (PFBS) of 0.0035 µg/L, 0.0018 µg/L and 0.0017 µg/L at locations MW103, MW104 and BH7 respectively;
- Perfluorohexanesulfonic acid (PFHxS) of 0.0015 µg/L and 0.0024 µg/L at locations MW103 and MW104;
- Perfluorobutanoic acid (PFBA) of 0.0029 µg/L at location MW103; and
- Gross Alpha (radiological) of 0.077 Bq/L at location MW103.

12.4 **Discussion of Results (Groundwater)**

Based on the analytical results for major cations and anions and with reference to the Piper diagram presented in Figure 4, the ionic composition of the groundwater at locations MW101 to MW105 and BH01 is dominated by calcium-magnesium-chloride, whilst BH07 is dominated by calcium-bicarbonate. It is also noted that in general, the monitoring wells are generally located within the same area of the piper plot, which suggests similar ionic conditions and are not indicative of gross contamination. The slight deviation of BH07 from the other locations in the piper plot may be due to use of drilling mud during installation and presence of residual mud following development and/or temporary changes in groundwater chemistry due to breakdown of residual muds.

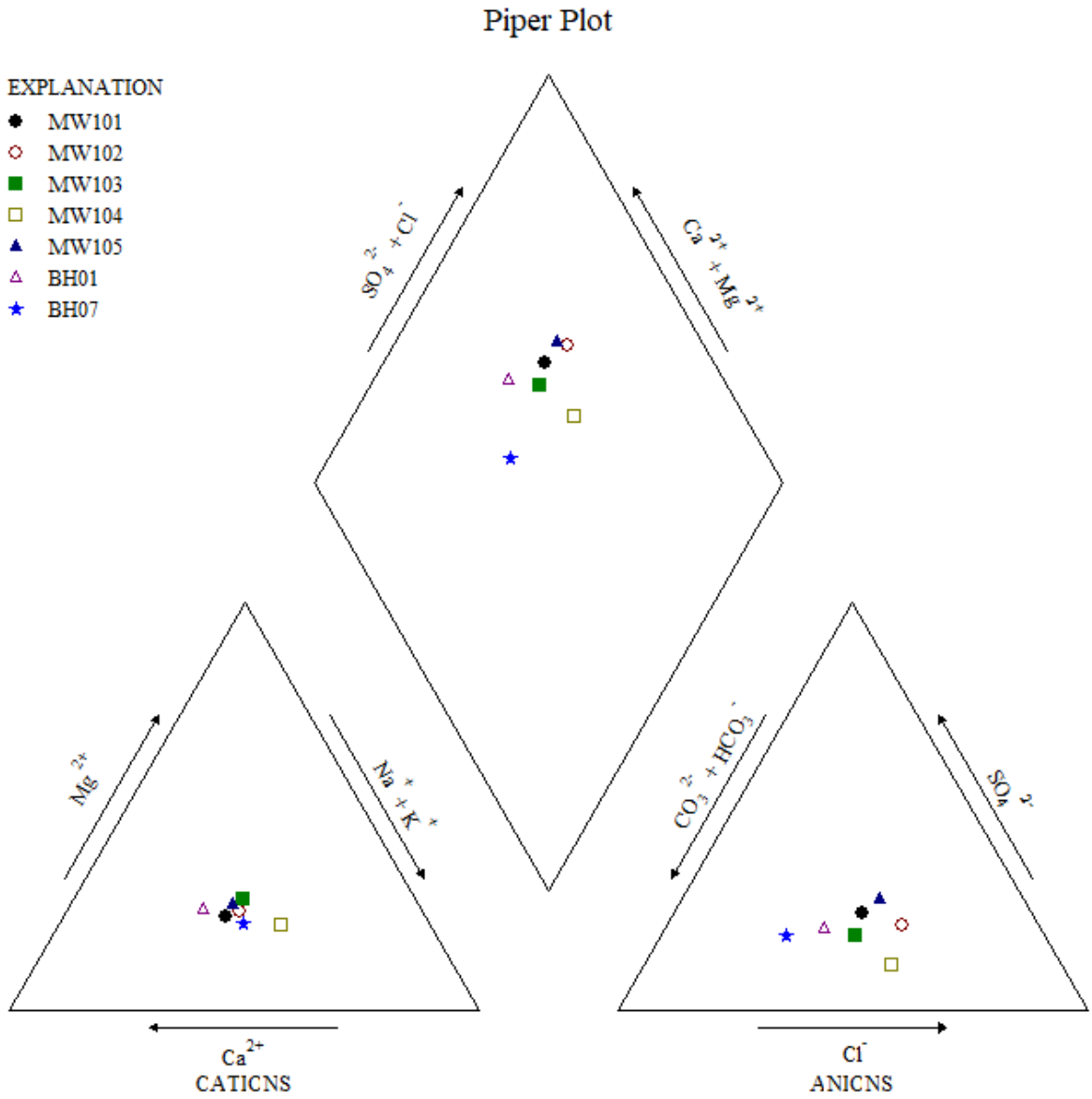


Figure 4: Piper Plot (MW101 to MW105, BH01 and BH07)

With reference to NHMRC, 2022, the adopted NPUG criterion for chloride is an aesthetic value based on a taste threshold. Furthermore, the adopted NPUG criterion for Ammonia as N been derived in respect to the protection of copper pipes and fittings and prevention of nuisance growths of microorganisms within such pipes. In this regard, the reported concentrations of chloride and Ammonia as N in excess of the adopted NPUG are not considered to present an unacceptable health risk under the future commercial-industrial development.

Detection of TRH above the laboratory LOR was reported in BH1 and BH7. Given the lack of obvious historical sources relating to petroleum hydrocarbons, the detections are possibly attributed to muds used in the drilling process during installation of BH1 and BH7. Material safety data sheets (MSDS) provided by drilling subcontractor indicate that Guar Gum, Poly Vis (oil(s), anionic polyacrylamide) and bentonite were used. Based on our experience, such products commonly report low concentrations of TRH. In order to provide a line of evidence to support that the detections are not likely to be associated with petroleum hydrocarbons, a silica gel clean-

up was conducted by the laboratory. The reported concentrations of TRH with silica gel cleanup were reported below the LOR, suggesting that the detections are likely to be a non-petroleum source (i.e drilling mud).

Elevated nutrients (total nitrogen, NOx, phosphorus and Ammonia as N) were reported in excess of adopted marine water guidelines at numerous well locations. The highest nitrogen and phosphorus results were reported in BH01 and BH07, which were the wells installed using drilling muds. It is noted that concentrations are generally comparable between the other well locations. In this regard and in the absence of obvious site sources, the elevated nitrogen and phosphorus are possibly attributed to use of muds.

Elevated concentrations of arsenic, cobalt, copper, manganese and zinc were reported in excess of the adopted marine water guidelines in several monitoring well locations. The highest arsenic concentrations (by an order of magnitude) were reported in the two down-gradient wells (BH01 and MW101) and MW105, which is located in the central part of the site. This suggests the elevated arsenic in groundwater is attributed to a point source(s) on-site, however, this is not strongly supported by the site history or the soil results, which reported reasonably low concentrations (ie < 10 mg/kg) in analysed soil samples. The highest manganese concentration (between one and two orders of magnitude) was reported at BH07 and is possibly associated with the use of drilling mud or an off-site source associated with WA Kaolin.

Low concentrations of PFAS were reported at locations MW103, MW104 and BH07, with concentrations of detectable PFOS exceeding the adopted marine water criterion at BH07. It is noted that MW103, MW104 and BH07 are located hydraulically up-gradient, suggesting the low detection of PFAS in groundwater is possibly from an up-gradient source. Ambient concentrations of PFAS in surface water and groundwater were assessed in the autumn and spring of 2019 by DWER as part of a study across the Perth Metropolitan area (DWER, 2022). With reference to DWER, 2022, median concentrations for PFOS, PFHxS and PFOA were reported as follows:

- 0.0020 µg/L (autumn) and 0.0033 µg/L (spring) – PFOS;
- 0.004 µg/L (autumn) and 0.003 µg/L (spring) – PFHxS; and
- 0.0020 µg/L (autumn) and 0.0020 µg/L (spring) – PFOA.

The reported concentrations of PFOS, PFHxS and PFOA at the monitoring well locations are equal to or less than the median ambient concentrations reported as part of DWER, 2022, suggesting the reported concentrations are likely representative of ambient/background concentrations in the Perth metropolitan area.

Notwithstanding the above, the reported concentrations of metals, nutrients and PFAS are unlikely to present a significant risk to the nearest marine water receptor given the distance to the nearest down-gradient receptor (ie 600 m) and low groundwater gradient.

13. Data Quality Control Results

Field and laboratory QC procedures formed an integral part of the BCI. The QC procedures and results are provided in Appendix I. The QC results were generally found to meet the DQIs for this project. It is therefore considered that the data is sufficiently precise and accurate and that the results can be utilised for the investigation.

14. Updated Conceptual Site Model

The preliminary CSM in Section 8 has been revised in Table 8 based on the results of the soil and groundwater sampling. It should be noted that whilst no potentially complete source-pathway-receptor linkages were identified, PAEC4 to PAEC10 under the future proposed land use have been retained in the CSM as a potential future source. The updated CSM also presumes that identified flytipped surface fragments of ACM/PACM (ie S1) will be managed as per the recommendations outlined in Section 15.

Table 8: Summary of Potentially Complete Exposure Pathways

Source and CoPC	Transport Pathway	Receptor
S3 (PAEC4 to PAEC10): Future land use.	P1: Ingestion and dermal contact P2: Inhalation of dust and/or vapours P3: Leaching of contaminants and vertical migration into groundwater P4: Lateral migration of groundwater providing base flow to water bodies P5: Contact with terrestrial ecology	R3: End users [commercial/industrial] R4: Adjacent site users [commercial/industrial]. R5: On-site local flora and fauna R6: Off-site native ecological receptors R7: Groundwater

15. Conclusions and Recommendations

Douglas has conducted a baseline contamination investigation on Part of Lot 108 Port Road in Kwinana Beach as part of pre-leasing requirements for the proposed Crux Project. The objectives of the BCI were to:

- Identify potential sources of contamination and establish associated contaminants of potential concern (CoPC) at the site;
- Identify areas of potential contamination at the site;
- Identify potential human and ecological receptors that may be impacted by the CoPC;
- Identify potentially affected media (soil, sediment, groundwater);
- Provide soil and groundwater contamination data prior to commencement of the lease;
- Provide a reference for direct comparison at the end of the lease term;
- Where contamination is found to be present, assess whether contamination poses an unacceptable ecological and/or human health risk under the proposed commercial industrial land use; and
- If required, inform the need for further investigations to address data gaps and/or the need for remediation and/or management of identified contamination.

Based on the results of the BCI, a number of PAEC's were identified and subsequently investigated via a programme of soil sampling and analysis. Following investigation and based

on the updated CSM (refer to Section 14), these PAECs are considered to pose a low risk of presenting harm to human health and environmental receptors under the proposed commercial/industrial land use subject to the recommendations outlined below.

Douglas recommends that all surface PACM/ACM observed during the site walkover should be removed from the site by a suitably qualified contractor and disposed in accordance with regulatory requirements prior to any clearing of ground disturbing activities. The completeness of the removal of known PACM/ACM should be validated by a representative from Douglas. Given that sporadic PACM/ACM has been encountered on the surface of the site and the potential for undiscovered PACM to be present, Douglas recommends that an Unexpected Finds Protocol (UFP) should be developed which outlines the management actions, reporting and safety alert processes in the situation that any unexpected finds (including asbestos) and/or contaminated soil is encountered during redevelopment works associated with the project. In the event of an unexpected find, a suitably qualified contaminated land consultant should be engaged to inspect the find and provide advice on the appropriate course of action.

The information contained in this report provides baseline soil and groundwater contamination data for the site, which is current as of July 2024. The following is recommended to be conducted over the leasing period:

- All existing groundwater monitoring wells should be protected during earthworks and construction of the proposed development to the extent practicable. Monitoring wells which are destroyed during construction should be replaced;
- Periodic groundwater monitoring should be conducted during operation of the facility to allow early detection of groundwater impacts in the vicinity of the monitoring well locations associated with future PAEC4 to PAEC10. An initial monitoring frequency of one monitoring event every two years is suggested. This monitoring frequency should be reviewed on an ongoing basis; and
- At the end of the lease period, the sampling should be repeated to assess for any changes in the contamination status at the previous sampling locations.

16. References

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National Environment Protection Council (1999 – amended 2013) National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1 - Guidelines on investigation levels for soil and groundwater.

National Environment Protection Council (1999 – amended 2013) National Environment Protection (Assessment of Site Contamination) Measure, Schedule B2 - Guideline on site characterisation.

17. **Limitations**

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at Part of Lot 108 Port Road, Kwinana Beach, WA in line with Douglas' proposal dated 18 April 2024 and acceptance received from Tuanlong Do of Cargill Australia Pty Ltd dated 23 May 2024. The work was carried out under the terms of a Services Supply Agreement. This report is provided for the exclusive use of Cargill Australia Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the environmental and groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About This Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Sampling, Testing and Excavation Methodology

About this Report

November 2023

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

continued next page

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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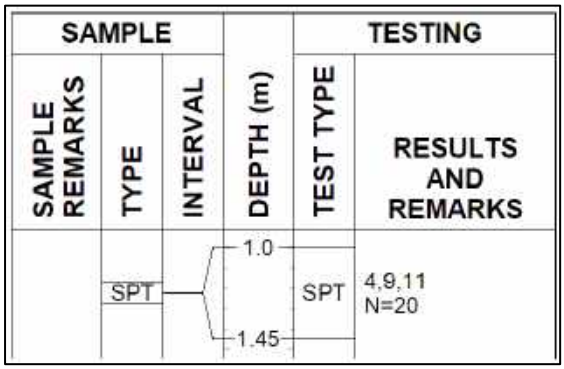
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

November 2023

Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	ES
Gas sample	G
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS
Material Sample	MT

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	R
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ3
HQ coring	HQ3
PQ coring	PQ3
Push tube	PT[1]
Rock roller	RR[1]
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HAND
Predrilled	PD
Diatube	DT[1]
Hollow flight auger	HSA[1]
Vacuum excavation	VE

[1] – numeric suffixes indicate tool diameter/width in mm

Douglas PARTNERS

Soil Descriptions

Terminology
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Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

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Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style `XW`. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	`KL`
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	`UK`
No data	Information required to allow classification of the property was not available. For example, if drilling is commenced from the base of a hole predrilled by others	`ND`
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example, providing a description of the strength of a concrete pavement	`NA`

Graphic Symbols

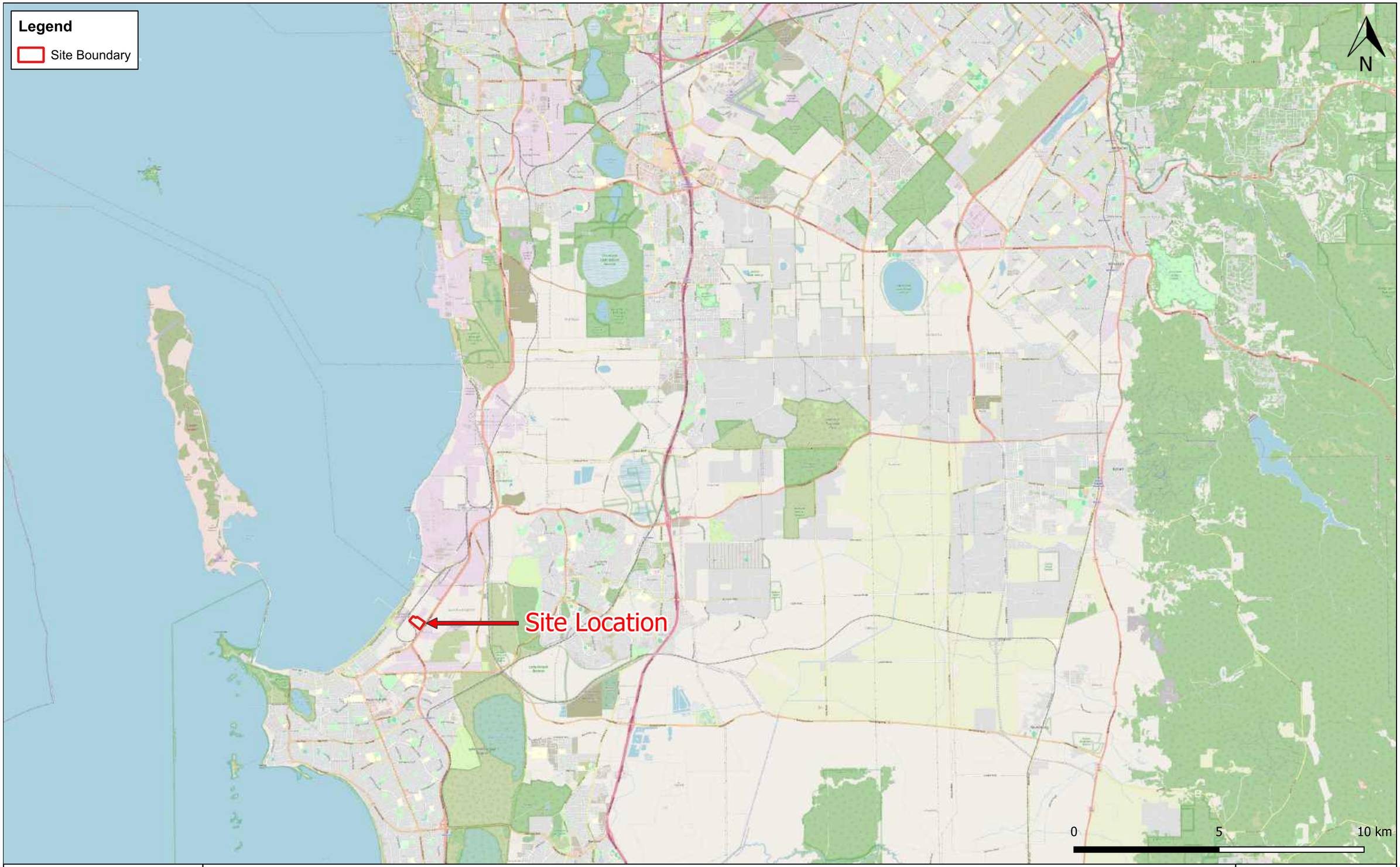
Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Appendix B

Drawings 1 to 6

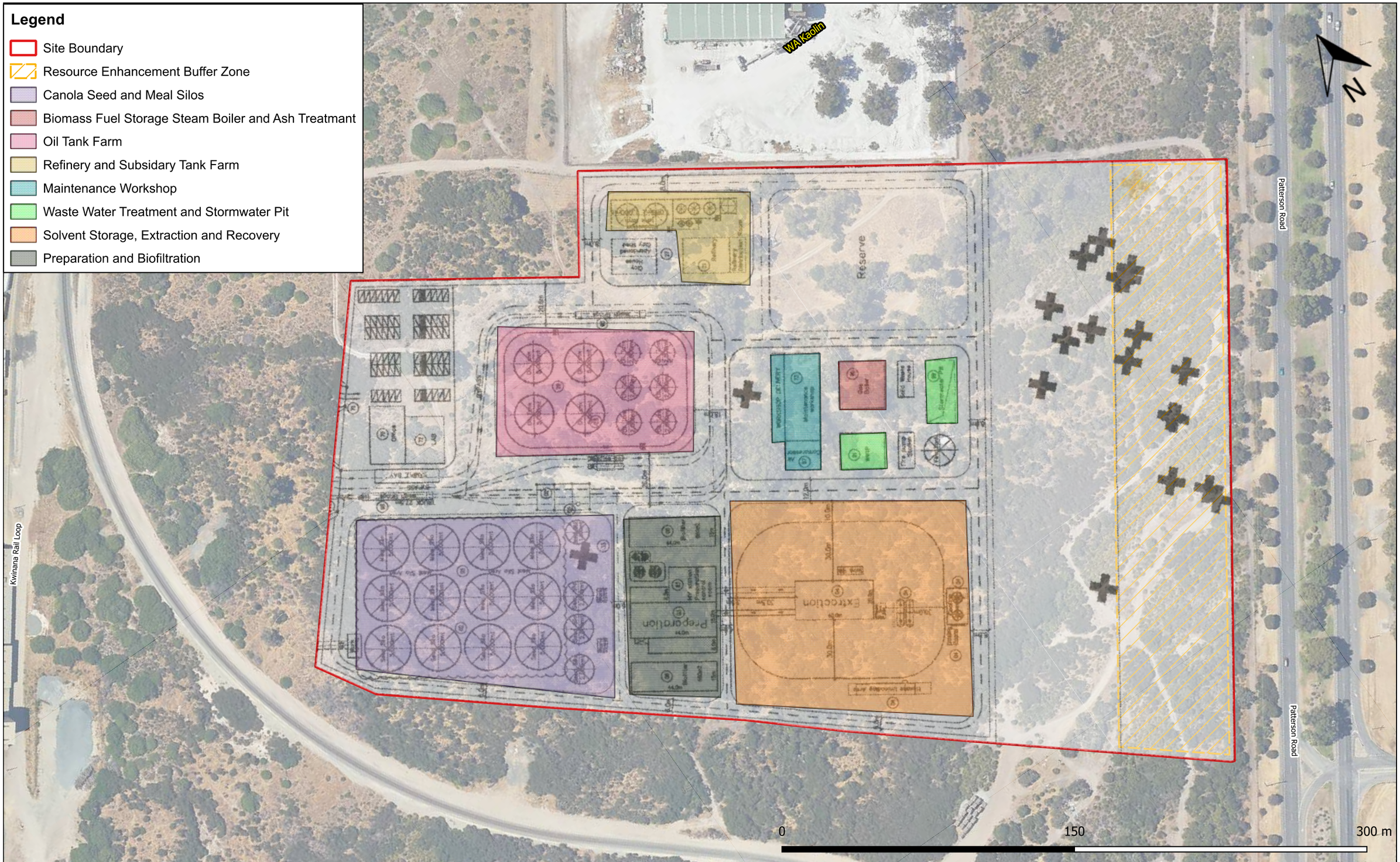
Photo Plates



Douglas PARTNERS	**Locality Plan** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 1 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 7/6/2024



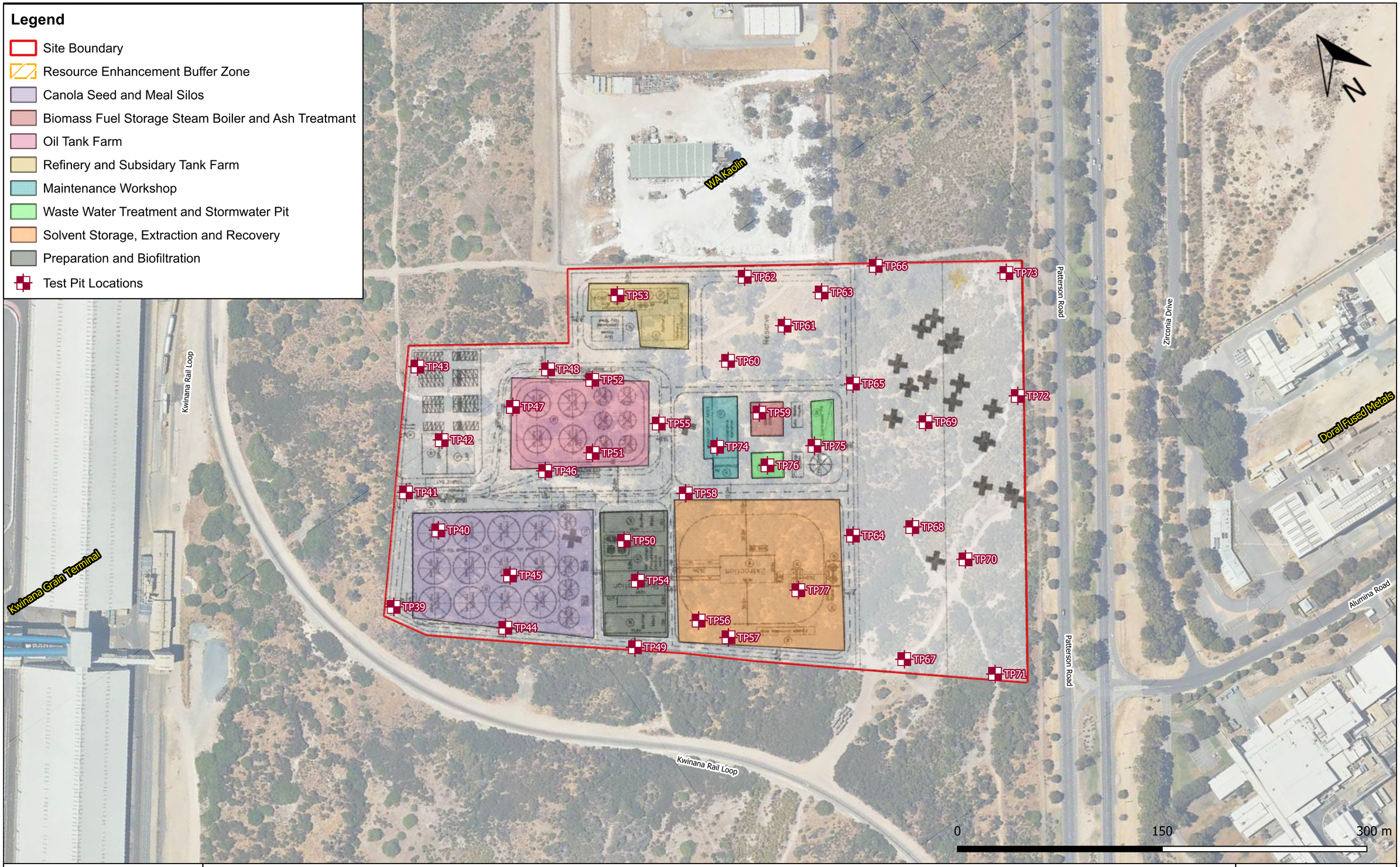
Douglas PARTNERS	**Aerial Photograph and Surrouding Land Uses** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA** CLIENT: Cargill Australia Ltd	PROJECT: 224972.01 Drawing No: 2 REV: 0 DATE: 7/6/2024



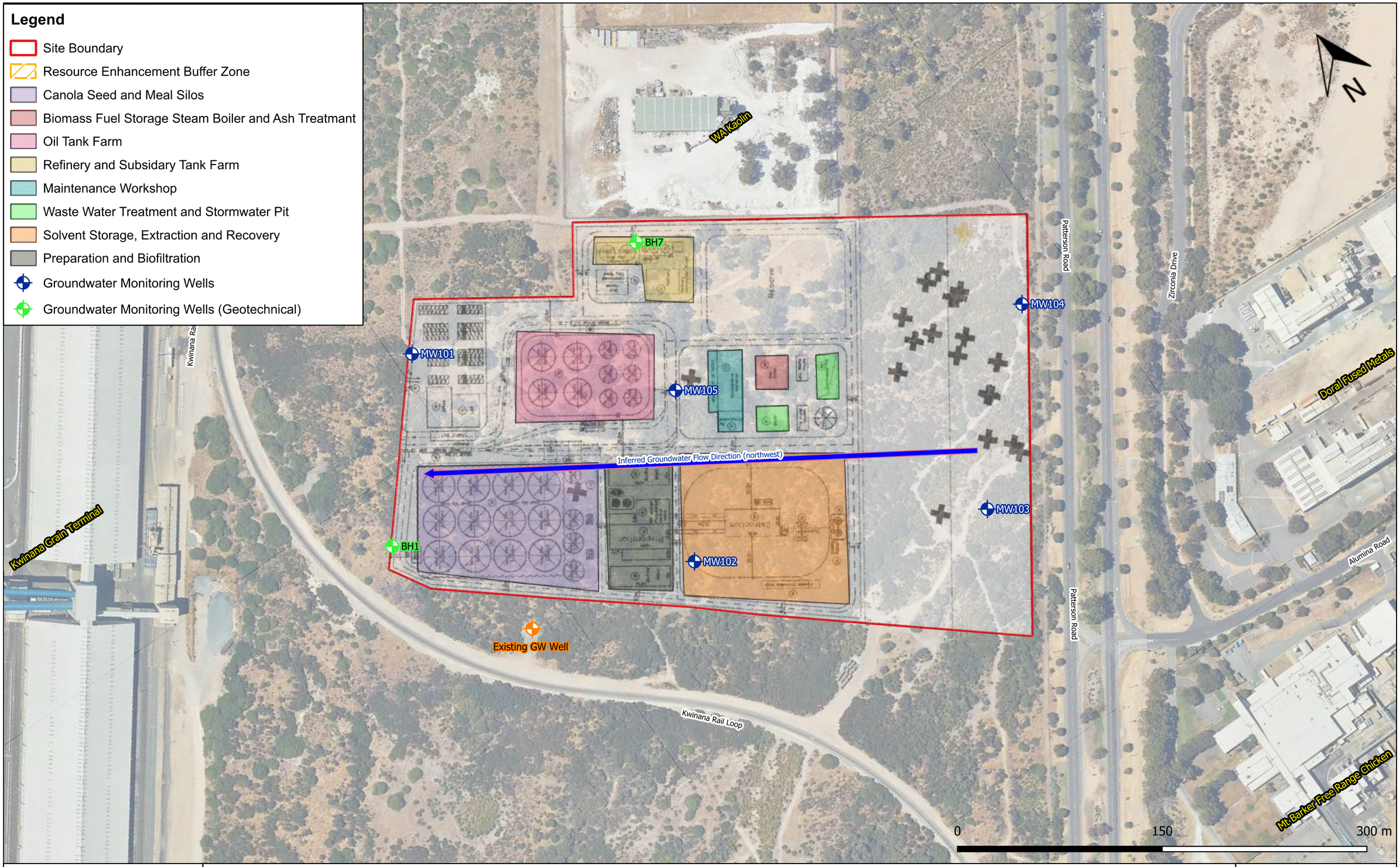
Douglas PARTNERS	**Proposed Development** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 3 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 6/9/2024



Douglas PARTNERS	**Site Walkover Features** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 4 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 6/9/2024



Douglas PARTNERS	**Test Pit Locations** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT:	224972.01
		Drawing No:	5
		REV:	0
	CLIENT: Cargill Australia Ltd	DATE:	6/9/2024



Douglas PARTNERS	**Groundwater Monitoring Well Locations** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 6 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 6/9/2024



Photo 1: Flytipped PACM at location ASB1



Photo 2:Typical Flytipping along unsealed tracks

Douglas PARTNERS	**Site Photographs**	PROJECT:	224972.01
	Baseline Contamination Investigation	PLATE No:	1
	Part of Lot 108 Port Road, Kwinana Beach, WA	REV:	0
	CLIENT	Cargill Australia Limited	



Photo 3: Northeast boundary looking towards WA Kaolin



Photo 4: Bushland in central part of the site

Douglas PARTNERS	**Site Photographs**	PROJECT:	224972.01
	Baseline Contamination Investigation	PLATE No:	2
	Part of Lot 108 Port Road, Kwinana Beach, WA	REV:	0
	CLIENT	Cargill Australia Limited	



Photo 5: Groundwater well installation at MW102



Photo 6: Bushland near western boundary

Douglas PARTNERS	**Site Photographs**	PROJECT:	224972.01
	Baseline Contamination Investigation	PLATE No:	3
	Part of Lot 108 Port Road, Kwinana Beach, WA	REV:	0
	CLIENT	Cargill Australia Limited	

Appendix C

Registered Groundwater Bore Database

Site Ref	Site Type	Site Subtype	Site Geographic Feature	Site Name	Site Short Name
61404859	Groundwater	Bore or Well	Ground	East Rockingham - Prod No1	Prod No1
61404896	Groundwater	Bore or Well	Ground	Murray River Catchment 614 - Well NoDr3B	Well NoDr3B
61404897	Groundwater	Bore or Well	Ground	Murray River Catchment 614 - Well NoDr4A	Well NoDr4A
61405458	Groundwater	Bore or Well	Ground	Murray River Catchment 614 - No25	No25
61410023	Groundwater	Bore or Well	Ground	Dewatering Rockingham - DR3B	DR3B
61410024	Groundwater	Multi-port bore	Ground	Dewatering Rockingham - DR4A	DR4A

All Site References	Zone	Easting	Northing	Longitude	Latitude	Geographic Datum	1:250,000 Map Index
20024228 [WIN_ID]; 2033-2-NW-0516 [AQWAB]; 61404859 [SITE_REF]	50	383260	6429675.5	115.760555	-32.263564	GDA2020	SH5014
20024265 [WIN_ID]; 2033-2-NW-0553 [AQWAB]; 61404896 [SITE_REF]	50	382796	6430131.5	115.755686	-32.259403	GDA2020	SH5014
20024266 [WIN_ID]; 2033-2-NW-0554 [AQWAB]; 61404897 [SITE_REF]	50	383443	6429907.5	115.762526	-32.261491	GDA2020	SH5014
20024964 [WIN_ID]; 2033-3-NE-0020 [AQWAB]; 61405458 [SITE_REF]	50	382393	6429414.5	115.751320	-32.265827	GDA2020	SH5014
2985 [WIN_ID]; 61410023 [SITE_REF]	50	382792	6430078.5	115.755637	-32.259880	GDA2020	SH5014
2986 [WIN_ID]; 61410024 [SITE_REF]	50	383304	6429885.5	115.761048	-32.261675	GDA2020	SH5014

GgStn Catchment Area(km2)	Catchment	Estuary	BOM Rainfall District	Local Govt Authority
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM
N/A	_Coastal		9 - Central Coast	CITY OF ROCKINGHAM

Locality	Department Region	Local Landmark Name	Groundwater Province	River Basin	Groundwater Area
EAST ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn
EAST ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn
EAST ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn
ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn
EAST ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn
EAST ROCKINGHAM	Kwinana-Peel		Perth	614 - Murray River	Cockburn

Surfacewater Area	Site Comment
Cockburn/Kwinana Coastal	Gravel packed from 18.2m-21.6m. Swl is an approximation. WAWA lic no. 43576.
Cockburn/Kwinana Coastal	Id no. Pee0730101b. Top of steel = 4.373m. Elevation originally recorded as: 3.889m mrl.
Cockburn/Kwinana Coastal	Id no. Pee0730102b. Flush fitting cap. Top of steel = 3.867m.
Cockburn/Kwinana Coastal	
Cockburn/Kwinana Coastal	Ahd and sle water levels converted to swl and datums adjusted - completed - 10/01/2005 - BLF
Cockburn/Kwinana Coastal	

Site Ref	Measurement Point Type	Elevation (m as per Datum Plane)	Datum	Measurement Method	Date
61410023	Top of casing	4.373	AHD	Surveyed	20/12/1983

Comments

Site Ref	From (mbGL)	To (mbGL)	Diameter (mm)	Fluid Name

Site Ref	Completed Date	Owner Name	Drill Company Name	Drill Method Name	Drill Rig Name
61404859	6/10/1993	Aust Fused Materials Pty Ltd	Baines Drilling	Rotary drill	Unknown
61404896	30/06/1983	Water Corporation	Unknown Company	Unknown	Unknown
61404897	30/06/1983	Water Corporation	Unknown Company	Unknown	Unknown
61405458	30/06/1966	Unknown Company	Niagra Drilling Company	Unknown	Unknown
61410023	20/12/1983	Department of Water	Unknown Company	Unknown	Unknown
61410024	20/12/1983	Department of Water	Unknown Company	Unknown	Unknown

Total Construction Depth (mbGL)	Depth Drilled (mbGL)
21.6	25.6
6	6
0	0
3.45	10.97
6	6
0	20

Comments
How pump tested: Pumped
Comment: Construction details obtained from gramps
Comment: Depth of bore not provided, assumed total drilled depth similar to last port. Information obtained from gramps.

Site Ref	From (mbGL)	To (mbGL)	Element	Material	Inlet Type	Inside Dia. (mm)
61404859	0	0	Unknown	Unknown	Not applicable	
61404859	18.6	21.6	Inlet (screen)	Unknown	Screen	
61404896	0	0	Unknown	Unknown	Not applicable	
61404896	4	6	Inlet (screen)	Unknown	Slotted	
61404897	0	0	Unknown	Unknown	Not applicable	
61405458	0	0	Unknown	Unknown	Not applicable	
61405458	1.52	3.45	Inlet (screen)	Unknown	Screen	
61410023	4	6	Inlet (screen)	Unknown	Unknown	
61410024	8.5	0	Inlet (screen)	Unknown	Unknown	
61410024	20	0	Inlet (screen)	Unknown	Unknown	

Outside Dia. (mm)	Aperture (mm)
	0.5

Comments
0-18.6m, 100mm dia cl p PVC. Screen: 100mm dia s/s
80mm PVC
80mm PVC. Ports: 8.5m, 20m.
25ft + 4ft waste. Screen: 5-11ft4in inc packer

Site Ref	From (mbGL)	To (mbGL)	Fill Type	Material Type	Fill Volume (m3)

Grain Size (mm)

Site Ref	Aquifer Name	Depth From/To (mbGL)

Comments

Site Ref	From (mbGL)	To (mbGL)	Interpreted By	Substance
61404859	0	1.75	Non geologist--Unknown Org Type	
61404859	1.75	7.25	Non geologist--Unknown Org Type	
61404859	7.25	7.75	Non geologist--Unknown Org Type	
61404859	7.75	12	Non geologist--Unknown Org Type	
61404859	12	20	Non geologist--Unknown Org Type	
61404859	20	21.6	Non geologist--Unknown Org Type	
61404859	21.6	25	Non geologist--Unknown Org Type	
61404859	25	25.6	Non geologist--Unknown Org Type	
61405458	0	6.1	Non geologist--Unknown Org Type	
61405458	6.1	8.53	Non geologist--Unknown Org Type	
61405458	8.53	10.97	Non geologist--Unknown Org Type	

Lithological Description
Sand and limestone - fill
Pale yellow, coarse grained, poor-moderate sorting, well rounded quartz sand, 40-50% cac03 (safety bay sand)
Yellow limestone (tamala limestone).
Well rounded quartz sand to fine gravel, 30% cac03, limestone bands
Grey, fine to coarse grained, poorly sorted, moderate-well rounded, quartz sand, 40% cac03.
Grey, fine to very coarse grained, poorly sorted, moderate-well rounded, quartz sand, 30-50% cac03.
Yellow grey, coarse to very coarse grained, poorly sorted moderate-well rounded, quartz sand-fine gravel 20% cac03.
Cavernouse limestone
Sand.
Stone liner.
Sand.

Site Ref	From (mbGL)	To (mbGL)	Interpreted By	Interpreted Date	Stratigraphy
61404859	0	7.25	Non geologist--Unknown Org Type	15/01/1997	Safety Bay Sand
61404859	7.25	25.6	Non geologist--Unknown Org Type	15/01/1997	Tamala Limest
61405458	0	10.97	Non geologist--Unknown Org Type	17/01/1997	Quaternary

Lithology1	Lithology2	Lithology3
sand	(none)	(none)
sand	limestone	(none)
sand	stones	(none)

Appendix D

Historical Aerial Photographs

Basic Summary of Records



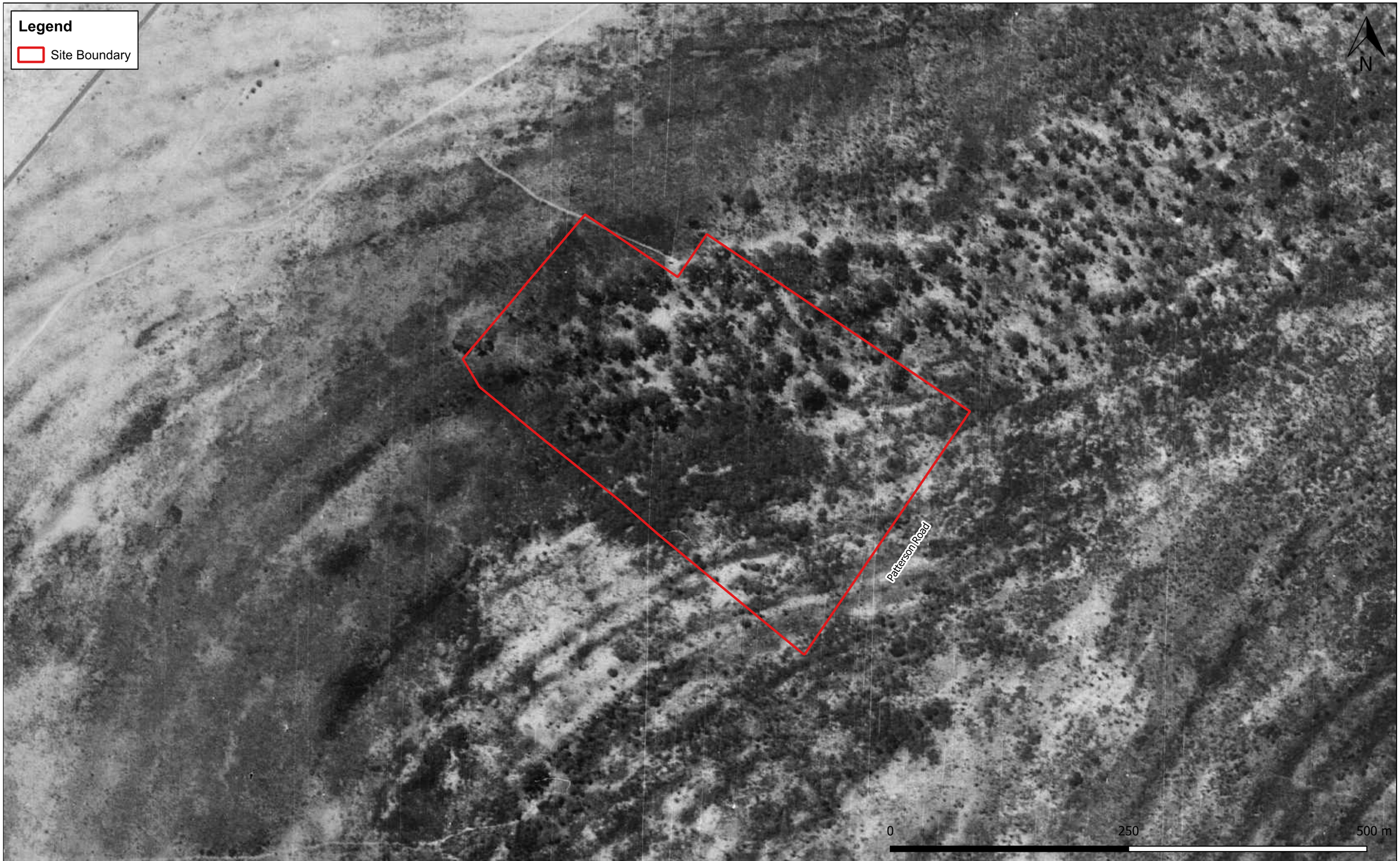
Historical Aerial Photograph - 1955

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	1
REV:	0
DATE:	5/6/2024



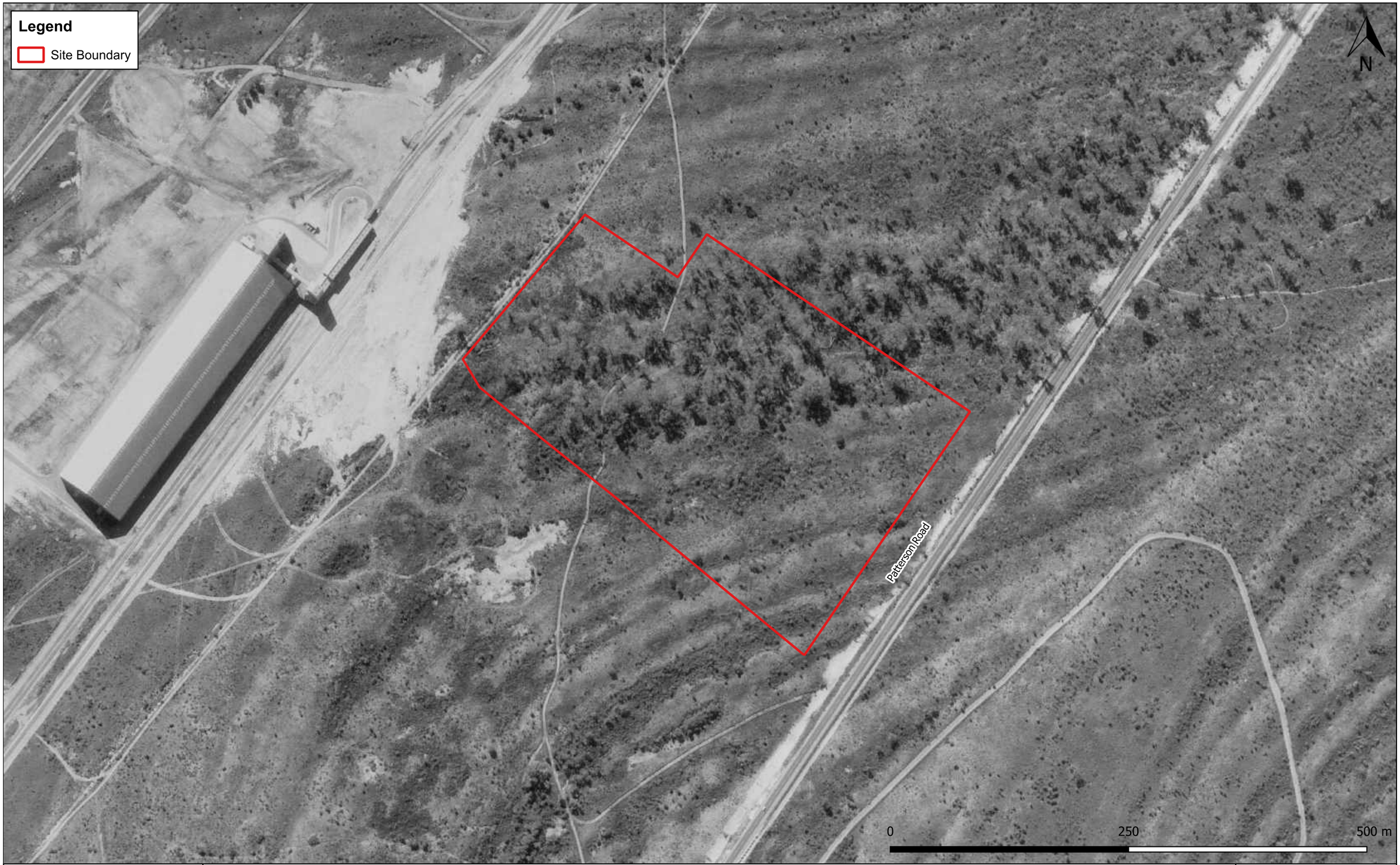
Historical Aerial Photograph - 1963

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	2
REV:	0
DATE:	5/6/2024



Historical Aerial Photograph - 1974

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	3
REV:	0
DATE:	5/6/2024



Historical Aerial Photograph - 1983

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	4
REV:	0
DATE:	5/6/2024



Historical Aerial Photograph - 1991

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	5
REV:	0
DATE:	5/6/2024



Historical Aerial Photograph - 1999

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	6
REV:	0
DATE:	5/6/2024



Historical Aerial Photograph - 2005

Baseline Contamination Investigation

Patterson Road, East Rockingham, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	7
REV:	0
DATE:	5/6/2024



Douglas PARTNERS	**Historical Aerial Photograph - 2009** **Baseline Contamination Investigation** **Patterson Road, East Rockingham, WA** CLIENT: Cargill Australia Ltd	PROJECT: 224972.01 Drawing No: 8 REV: 0 DATE: 5/6/2024



Douglas PARTNERS	**Historical Aerial Photograph - 2024** **Baseline Contamination Investigation** **Patterson Road, East Rockingham, WA**	PROJECT: 224972.01 Drawing No: 10 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 5/6/2024

Government of Western Australia
Department of Water and Environmental Regulation

Your ref: 224972.01
Our ref: DMO 3082
Enquiries: Registrar
Phone: 1300 762 982
Fax: (08) 6364 7001
Email: info@dwer.wa.gov.au

Att: Rob Shapland
Douglas Partners Pty Ltd
36 O'Malley Street
Osborne Park WA 6017

Dear Sir/Madam

BASIC SUMMARY OF RECORDS REQUEST

Thank you for your Basic Summary of Records (BSR) request for the site consisting of the following parcel(s) of land:

- LOT 108 ON DEPOSITED PLAN 400167 (PIN 12315833) as shown on certificate of title 2953/177 known as 49 Port Rd, Kwinana Beach WA 6167

which Department of Water and Environmental Regulation (the department) received on 20/05/2024

A search of the department's records of known and suspected contaminated sites was undertaken and the results of the search are attached for your information.

A guide on how to interpret the BSR response is also attached for your information.

General information on a Summary of Records and associated request forms is available from the department's website on https://www.wa.gov.au/organisation/department-of-water-and-environmental-regulation/contaminated-sites or by contacting the Contaminated Sites Information Line on 1300 762 982.

Yours sincerely

Andrew Miller, Senior Manager

CONTAMINATED SITES
Delegated Officer under section 91
of the *Contaminated Sites Act 2003*

22/05/2024

Enc. Basic Summary of Records
How to interpret information on contaminated sites
Receipt Number RR039446

CSSID = 3082

Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report generated at 11:51:40AM, 22/05/2024

Receipt No: RR039446

ID No: 77807

Search Results

This response relates to a search request received for:

49 Port Rd
Kwinana Beach, WA, 6167

This parcel belongs to a site that contains 9 parcel(s).

According to Department of Water and Environmental Regulation records, this land has been reported as a known or suspected contaminated site.

Address	49 Port Rd Kwinana Beach, WA, 6167
Lot on Plan Address	Lot 108 On Deposited Plan 400167
Parcel Status	**Classification:** 04/09/2008 - *Report not substantiated* **Nature and Extent of Contamination:** No contamination has been identified. **Restrictions on Use:** Please refer to Reasons for Classification for further information relevant to the use of the Site. **Reason for Classification:** This Site comprises the whole of Lot 1003 on Deposited Plan 47607, as well as the part of Lot 1001 on Deposited Plan 47607 EXCLUDING former Lots 14 and 15 on Plan 21876 (as described in superseded Certificates of Title Volume 2096 Folio 918 and Volume 2096 Folio 919). The Site was reported to the Department of Environment and Conservation (DEC) as per reporting obligations under section 11 of the 'Contaminated Sites Act 2003', which commenced on 1 December 2006. The Site classification is based on information submitted to DEC by May 2007. The Site was reported because a Preliminary Site Investigation undertaken in 2002 on former lots 14 and 15, as described above, found evidence of Asbestos Containing Material and Synthetic Mineral Fibres on the soil surface. The investigation however, was only conducted for former Lots 14 and 15 and do not include the remaining portion of Lot 1001 or Lot 1003. No soil or groundwater investigations have been carried out on the remainder of Lot 1001 or Lot 1003, and the quality of soil and groundwater beneath the Site are unknown. The report of a known or suspected contaminated Site, in conjunction with DEC enquiries, provides insufficient grounds to indicate that possible contamination of the Site is present from the current or historical land use. As such, the Site is classified as 'report not substantiated'. If further information regarding possible contamination of the Site is submitted to DEC, it will be

Disclaimer
This Summary of Records has been prepared by Department of Water and Environmental Regulation (DWER) as a requirement of the Contaminated Sites Act 2003. DWER makes every effort to ensure the accuracy, currency and reliability of this information at the time it was prepared, however advises that due to the ability of contamination to potentially change in nature and extent over time, circumstances may have changed since the information was originally provided. Users must exercise their own skill and care when interpreting the information contained within this Summary of Records and, where applicable, obtain independent professional advice appropriate to their circumstances. In no event will DWER, its agents or employees be held responsible for any loss or damage arising from any use of or reliance on this information. Additionally, the Summary of Records must not be reproduced or supplied to third parties except in full and unabridged form.

Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report generated at 11:51:40AM, 22/05/2024

	reviewed and the Site may be re-classified. DEC, in consultation with Department of Health, has classified this Site based on the information available to DEC at the time of classification. It is acknowledged that the contamination status of the Site may have changed since the information was collated and/or submitted to DEC, and as such, the usefulness of this information may be limited. In accordance with Department of Health advice, if groundwater is being or is proposed to be abstracted, DEC recommends that analytical testing should be carried out to determine whether the groundwater is suitable for its intended use.
Certificate of Title Memorial	Nil
Current Regulatory Notice Issued	**Type of Regulatory Notice:** *Nil* **Date Issued:** *Nil*
General	No other information relating to this parcel.

Disclaimer
This Summary of Records has been prepared by Department of Water and Environmental Regulation (DWER) as a requirement of the Contaminated Sites Act 2003. DWER makes every effort to ensure the accuracy, currency and reliability of this information at the time it was prepared, however advises that due to the ability of contamination to potentially change in nature and extent over time, circumstances may have changed since the information was originally provided. Users must exercise their own skill and care when interpreting the information contained within this Summary of Records and, where applicable, obtain independent professional advice appropriate to their circumstances. In no event will DWER, its agents or employees be held responsible for any loss or damage arising from any use of or reliance on this information. Additionally, the Summary of Records must not be reproduced or supplied to third parties except in full and unabridged form.

Appendix E

Sampling and Analysis Quality Plan

Auditor Letter Response

Rob Shapland

From: Rob Shapland
Sent: Tuesday, June 11, 2024 11:07 AM
To: AEA - Peter Alderson - Australian Environmental Auditors Pty Ltd (palderson@envaud.com.au)
Cc: Justin Williams
Subject: Part of Lot 108 Port Road, Kwinana Beach (224972.01) - SAQP [Filed 11 Jun 2024 11:07]

Categories: Filed by Mail Manager

Hi Peter,

Please find below the summary Sampling Analysis and Quality Plan (SAQP) prepared for Part of Lot 108 (No. 49) Port Road, Kwinana Beach WA (hereinafter referred to as 'the site') for your review and comment. Attachments 1 and 2 can be downloaded from the following link Part of Lot 108 Port Road, Kwinana Beach.

The SAQP sets out the proposed soil and groundwater sampling and analysis to be conducted as part of a Baseline Contamination Investigation (BCI). A locality plan and aerial photograph is presented on Drawings 1 and 2 (Attachment 1). A detailed SAQP prepared in general accordance with the NEPM, 2013 and DWER, 2021 will be provided in the Baseline Contamination Report. Notwithstanding, we have provided the following information and trust that this will be sufficient to allow for the proposed field works to commence, namely:

- A brief summary of the proposed development as understood by Douglas Partners (Douglas);
- A brief summary of the site history based on a review of historical aerial photographs, basic summary of records (BSR) and a site walkover. A copy of the historical aerial photographs and BSR are attached (Attachment 2);
- Identified potential areas of environmental concern (PAEC) and associated contaminants of potential concern (CoPC); and
- A summary of the proposed soil and groundwater sampling and analytical programme.

Douglas is also completing the geotechnical investigations over the site. As such, the proposed scope of soil and groundwater investigations has been designed to compliment the proposed scope of the geotechnical investigation, where possible.

Objectives of the Investigation

As part of the leasing arrangement for the site, Cargill are required to conduct a BCI prior to commencement of their lease. Furthermore, as a condition of the lease, the BCI must be approved/endorsed by an Auditor accredited under Section 69 of the Contaminated Sites Act 2003. As such, Cargill have engaged Mr Peter Alderson from Australian Environmental Auditors to complete the Audit components required as a condition of the leasing agreement.

In order to satisfy the requirement to conduct a BCI under the leasing agreement, the objectives of the BCI, with reference to the National Environment Protection (Assessment of Site Contamination) Measure (2013) Schedule B2 Guideline on Site
Characterisation (the 'NEPM', 2013) and the DWER (2021) Assessment and management of contaminated sites (DWER, 2021), will be to:

- Identify potential sources of contamination and establish associated contaminants of potential concern (CoPC) at the site;
- Identify areas of potential contamination at the site;

- Identify potential human and ecological receptors that may be impacted by the CoPC;
- Identify potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- Provide soil and groundwater contamination data prior to commencement of the lease;
- Provide a reference for direct comparison at the end of the lease term;
- Where contamination is found to be present, assess whether contamination poses an unacceptable ecological and/or human health risk under the proposed commercial industrial land use; and
- If required, inform the need for further investigations to address data gaps and/or the need for remediation and/or management of identified contamination.

Proposed Development

The proposed development includes the construction of a canola crushing plant with a production capacity of 2,000TPD. A proposed layout based on "CRUX-00-PP-001-VOT-discuss0516" is provided on Drawing 3 (Attachment 1). The following areas of the facility are highlighted on Drawing 3 and generally include areas which are presumed to involve storage of bulk liquids/materials and or management of wastes:

- Canola Seed and Meal Silos
- Biomass Fuel Storage, Steam Boiler and Ash Treatment
- Oil Tank Farm
- Refinery and Subsidiary Tank Farm
- Maintenance workshop
- Wastewater Treatment and Stormwater Pit
- Solvent Storage, Extraction and Recovery
- Preparation and Biofiltration

Site Setting

To gain an understanding of the existing environmental setting, a review of available published information was undertaken and is summarised below.

Site Topography	Surface level information available from LiDAR indicates that the topography across the site is relatively flat with surface levels ranging from approximately RL 3.3 m relative to the Australian Height Datum (AHD) and 4.5 m AHD.
Geology	The Rockingham 1:50 000 Environmental Geology sheet indicates that the shallow sub surface conditions beneath the site comprise Safety Bay sand, described as calcareous sand, white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin.
Acid Sulfate Soils	The published acid sulfate soil risk mapping indicates that the site is located within an area which is mapped as "no known risk of acid sulfate soils occurring within 3 m of natural soil surface".
Hydrogeology	The Perth Groundwater Atlas (2004) indicates that in May 2003 the groundwater level was approximately RL 1 m AHD, i.e. between approximately 2.3 m and 3.5 m below the existing surface level. The Atlas also indicates that the groundwater flow direction in May 2003 was in a westerly direction towards the Indian Ocean at an average gradient of approximately 1 in 3,880 m. A report on Hydrogeological and Hydrology Assessment prepared by ERM in relation to the Proposed Rockingham

	Wastewater Treatment Plant in December 2008 reported groundwater flow direction as north westerly, which is in broad agreement with the published mapping.
Hydrology	There are no surface water bodies on the site. The closest surface water body to the site is the Indian Ocean located approximately 600 m west of the site.
Wetland Mapping	The DWER geomorphic wetlands database indicates that the southern portion of the site and surrounding area to the southwest is located within a Resource Enhancement Wetland (REW) (ID 6227) described as Dampland. With reference to *Position Statement: Wetlands, Waters & Rivers Commission, 2001*, REW are wetlands which have been partially modified but still support substantial ecological attributes and functions. There are no other geomorphic wetlands within 1 km radius of the site.
Bush Forever	Bush Forever is a Western Australian Government initiative to protect regionally significant bushland on the Swan Coastal Plain of the Perth Metropolitan Region. The Department of Planning, Lands and Heritage (DPLH) Bush Forever database (2022) indicates that the site is not located within a Bush Forever protection area. The closest Bush Forever protection area is located more than 1 km from the site.
Public Drinking Water Source Areas (PDWSA)	The DWER Public Drinking Water Source Area (PDWSA) database indicates that the site is not located within a PDWSA. The nearest PDWSA is located more than 5 km northeast of the site.
Registered Bores	A search was undertaken of DWER's Water Register of bore licences (https://maps.water.wa.gov.au/#/webmap/register) and DWER's registered bore database Based on the results, the following comments can be made: • There are no licensed or registered wells within the site; • There are a number of licensed wells hydraulically up-gradient and within close proximity to the site (less than 350 m) including two wells within Patterson Road (Water Corporation), one well within Doral Fused Materials, one well within Haliburton Australia; • The nearest licensed well down-gradient of the site is located 850 m southwest of the site and is owned by City of Rockingham. • There are three registered wells (61404897, 61410024, 61404859) located up-gradient within 250 m of the site. These wells are owned by DWER, Water Corporation and Doral Fused Metals and are likely used for monitoring and/or abstraction purposes. • There are two registered wells (61404896 and 61410023) located immediately down-gradient of the site. These wells are owned by DWER and Water Corporation and are likely used for monitoring purposes.

Summary of Site History

Based on the review of historical aerial photographs dated between 1955 and present day, the following comments can be made:

- The site has remained undeveloped and comprised bushland since prior to 1955 until present day;
- Other than changes in vegetation density and the appearance of various unsealed tracks through the site, the site has generally remained unchanged since from 1955 until present day;
- Surrounding areas to the west were developed sometime prior to 1974, whilst areas to the north and east were developed sometime prior to 1991 and 1999 respectively. Areas to the south have remained undeveloped.

A basic summary of records search was submitted to the DWER on 20 May 2024. The BSR search response (DMO 3082) indicated the following:

- The site is part of a larger area (ie Lot 108) which includes nine other land parcels;
- Lot 108 was originally reported to DWER following completion of a preliminary site investigation (completed over a portion of Lot 108) which found evidence of asbestos containing material (ACM) and synthetic mineral fibres (SMF) on the soil surface; and
- DWER stated the information provided insufficient grounds to indicate that possible contamination of Lot 108 is present from the current or historical landuses. As such Lot 108 was classified "report not substantiated" on 4 September 2008.

A copy of the historical aerial photographs and BSR response is provided as Attachment 2.

A search of the DWER online Contaminated Sites Database (CSD) was conducted to assess for the presence of classified properties within a 500 m radius of the site. The CSD holds information on known contaminated sites, ie sites that have been classified by the DWER as:

- *Contaminated - remediation required (CRR);*
- *Contaminated - restricted use (CRU);* and
- *Remediated for restricted use (RRU).*

As of June 2024, there are no properties classified as CRR, CRU or RRU located within a 500 m radius of the site.

Site Walkover and Surrounding Land Uses

A site walkover conducted by a Douglas senior environmental scientist on 24 May 2024 indicated that:

- The site comprises a rectangular shaped area of approximately 12.4 ha and is surrounded by the following (refer to Drawing 2, Attachment 1):
    - West: Kwinana Rail Loop and Kwinana Grain Terminal, beyond which is the Indian Ocean;
    - South: Kwinana Rail Loop, undeveloped bushland;
    - North: WA Kaolin and Haliburton Australia; and
    - East: Patterson Road, Doral Fused Metals, Mt Barker Free Range Chicken, East Rockingham Waste Water Treatment Plant and various other commercial/industrial facilities.
- The site was free of any development or buildings and generally comprised a grassed surface with areas of thick bushland and large trees. The site is traversed with numerous sandy tracks;
- A large amount of inert fly-tipping was observed over the site, particularly in close proximity to the sandy tracks. Fly-tipping observed during the walkover mainly included discarded domestic wastes such as clothing, plastic, metal, bottles, furniture, concrete;
- Fly-tipped fragments/sheets of potential asbestos containing materials (PACM) were observed at a number of locations (refer to Drawing 4, Attachment 1). Representative samples (denoted ASB1, ASB2

and ASB3) were collected and based on visual inspection, ASB1 and ASB2 are unlikely to contain asbestos whilst ASB3 is considered likely to contain asbestos. The samples will be submitted to the laboratory to confirm the presence or absence of asbestos and the results will be provided in the pending baseline report. Given the presence of thick surface vegetation, the potential for undiscovered PACM cannot be entirely ruled out; and

- There were no obvious indications to suggest the presence of widespread fill over the site, which is generally supported by the historical aerial photograph review.

Potential Areas of Environmental Concern and Contaminants of Potential Concern

Based on the review of site history information, site walkover and the proposed future development, the following PAEC (historical, existing and future) and associated CoPC for the site are summarised in Table 1.

Table 1: Summary of Potential Areas of Environmental Concern and Contaminants of Potential Concern

Source	Potential Area of Environmental Concern	Contaminants of Potential Concern
Existing/Historical	Fly-tipping **(PAEC1:):** The site walkover identified numerous areas fly tipping which mainly included household domestic refuge, including clothes and discarded items. Surface fragments of PACM were observed at a number of locations.	Bonded asbestos
Offsite	WA Kaolin **(PAEC2):** This facility is located immediately adjacent to the northeastern boundary (ie cross-gradient of groundwater flow) and could potentially present an offsite source of soil (with respect to wind borne dust) and groundwater contamination.	Metals/metalloids (ie aluminum)
	Doral Fused Metals, East Rockingham Waste Water Treatment Plant **(PAEC3):** These two facilities are located hydraulically up-gradient and could potentially present an offsite source of groundwater contamination.	Metals/metalloids, TRH, BTEX, PAH, VOC, nutrients, PFAS
Future (under proposed development)	Oil Tank Farm **(PAEC4)**	Metals/metalloids, TRH, nutrients
	Refinery and Subsidiary Tank Farm **(PAEC5)**	Metals/metalloids, TRH, nutrients
	Maintenance Workshop **(PAEC6)**	Metals/metalloids, TRH, BTEX, PAH, VOC
	Wastewater Treatment Plan and Stormwater pit **(PAEC7)**	Metals/metalloids, TRH, nutrients
	Biomass Fuel Storage, Steam Boiler and Ash Treatment **(PAEC8)**	Metals/metalloids, TRH, PAH, nutrients
	Solvent Storage, Extraction and Recovery **(PAEC9)**	TRH, BTEX (possibly present as impurities), VOC (hexane) PFAS (potentially used in fire-

		fighting foams in case of a solvent fire)
	Preparation and Biofiltration **(PAEC10)**	Metals/metalloids, TRH, nutrients

Proposed Soil Sampling Programme and Rationale

In order to provide baseline soil contamination data, soil sampling will be conducted from 37 test pit locations (refer to Drawing 5, Attachment 1). The proposed test pit locations have been selected with due consideration of the following:

- Collection of baseline data from judgemental and targeted locations from PAEC4 to PAEC10 together with general site coverage;
- Support the apparent absence of widespread fill over site; and
- To achieve the objectives of the geotechnical investigation.

Test pits will be excavated using a 5-tonne excavator to a target depth of 3.0 m (for geotechnical purposes). Samples will be collected at broadly regular intervals based on observed changes in strata and upon obvious signs of potential contamination such as odours or staining. The minimum number of samples collected from each location was:

- One surface sample ie 0.0 m to 0.1 m depth;
- 0.5 m and 1.0 m (where no fill is encountered); and
- One sample of natural material immediately below any encountered fill (where encountered).

A sub-sample will be collected and screened for the presence of volatile organic compounds (VOC) using a pre-calibrated photo-ionisation detector (PID).

Soil sampling for the assessment of bonded ACM will be conducted with due consideration of Section 5.7.1 of the DoH (2021) guidelines and include:

- Collection of one bulk (~10 L) at 0 – 0.2 m. Where fill profiles are encountered, at least one soil samples per metre depth of potentially impacted strata (ie uncontrolled filling material) will be collected per test pit location;
- Screening of each bulk sample through a ≤7 mm aperture sieve;
- Weighing of all retrieved PACM fragments; and
- Calculation of the asbestos % weight for weight (w/w) in soil, as per DoH (2021) guidelines.

A total of 37 primary soil samples will be submitted to a NATA accredited laboratory, within the recommended holding times for respective analytes, for analysis of the following:

- Metals/metalloids including aluminium, arsenic, boron, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, mercury, nickel, lead, selenium, vanadium and zinc;
- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethyl-benzene, xylene (BTEX);
- Polycyclic aromatic hydrocarbons (PAH); and
- Per-and polyfluoroalkyl substances (PFAS).

In addition, two background soil samples will also be analysed for % iron, cation exchange capacity (CEC), pH and total organic carbon (TOC) to establish site-specific ecological investigation levels (EILs).

The following field quality control (QC) samples will be collected during soil sampling:

- One intra-laboratory replicate sample per 20 primary samples for analysis of the above (except PFAS);
- One inter-laboratory replicate sample per 20 primary samples for analysis of the above (except PFAS);
- One intra-laboratory replicate sample per 10 primary samples for analysis of except PFAS;
- One inter-laboratory replicate sample per 10 primary samples for analysis of PFAS;
- One trip blank per sampling day; and
- One trip spike per sampling day.

Proposed Groundwater Sampling Programme and Rationale

In order to provide baseline groundwater contamination data and allow assessment of groundwater flow direction, the following is proposed (refer to Drawing 6, Attachment 1):

- Installation and sampling of two groundwater monitoring wells (MW103 and MW104)) positioned hydraulically up-gradient of the proposed development. The results will be used to inform groundwater quality entering the site and to assess potential contamination migrating over the site boundary from potential offsite sources (associated with PAEC3);
- Installation and sampling of one groundwater monitoring well (MW101) positioned down-gradient of the proposed development to assess groundwater quality exiting the site;
- Sampling of the existing groundwater monitoring well (BH1) positioned down-gradient of the proposed development to assess groundwater quality exiting the site;
- Sampling of the existing groundwater monitoring well (BH7) positioned adjacent to the northeast boundary to assess groundwater quality down-gradient of the WA Kaolin facility (associated with PAEC2);
- Installation and sampling of two groundwater monitoring wells (MW102 and MW105) which are positioned down-gradient of the solvent storage, extraction and recovery area (associated with PAEC9) and workshop/waste water treatment plant and stormwater drain associated PAEC6 and PAEC7) respectively;
- The existing monitoring well (located off-site between the site and Kwinana Rail Loop) together with BH1, BH7 and BH8 and proposed monitoring wells MW101 to MW105 will be surveyed and gauged in order to assess groundwater flow direction.

All groundwater monitoring wells will be initially surveyed by Douglas using a differential GPS with a reported accuracy of 0.01 m. However, given the anticipated very low groundwater gradient, a more accurate survey by an accredited surveyor capable of an accuracy of 0.001 m may be required.

Groundwater wells will be sampled using low flow (peristaltic) methods including bore dedicated tubing. Prior to purging, groundwater levels and the presence of any light non-aqueous phase liquid (LNAPL) will be gauged at each monitoring well using an oil/water interface probe. Groundwater geochemical parameters: pH, electrical conductivity (EC), salinity and dissolved oxygen (DO) will be measured throughout purging using a pre-calibrated water quality meter and flow through cell.

Primary groundwater samples will be submitted to a NATA accredited laboratory, within the recommended holding times for respective analytes, for analysis of the following CoPCs:

- Metals/metalloids including aluminium, arsenic, boron, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, mercury, nickel, lead, selenium, vanadium and zinc;
- TRH (TRH would be used to assess presence of hexane);

- BTEXN;
- PAH;
- Volatile Organic Compounds (VOC);
- Nutrients including total nitrogen, nitrite as N (NO2), nitrate as N (NO3), Ammonia as N, Total Kjeldahl Nitrogen (TKN), total phosphorus;
- PFAS;
- Hardness; and
- Major cations and anions.

The following field QC samples will be collected during groundwater sampling:

- One intra-laboratory replicate sample for the above analysis;
- One inter-laboratory replicate sample for above analysis;
- One trip blank per sampling day for analysis of v-TRH and BTEX; and
- One trip spike per sampling day v-TRH and BTEX.

Equipment rinsates are not proposed to be collected and analysed given that bore dedicated tubing will be used for each groundwater water monitoring wells.

Likely Future Management of Surface PACM

All surface PACM observed during the site walkover should be removed from site and disposed in accordance with regulatory requirements prior to any clearing or ground disturbing activity. The completeness of the removal of known PACM should be validated by a representative from Douglas. In addition, Douglas recommends that an Unexpected Finds Protocol (UFP) is developed which outlines the management actions, reporting and safety alert processes in the situation that any unexpected finds (including asbestos) and/or contaminated soil is encountered during redevelopment works associated with the project. In the event of an unexpected find, Douglas should be engaged to inspect the find and provide advice on the appropriate course of action.

Please do not hesitate to contact us if you have any queries or require any further information.

Kind regards,

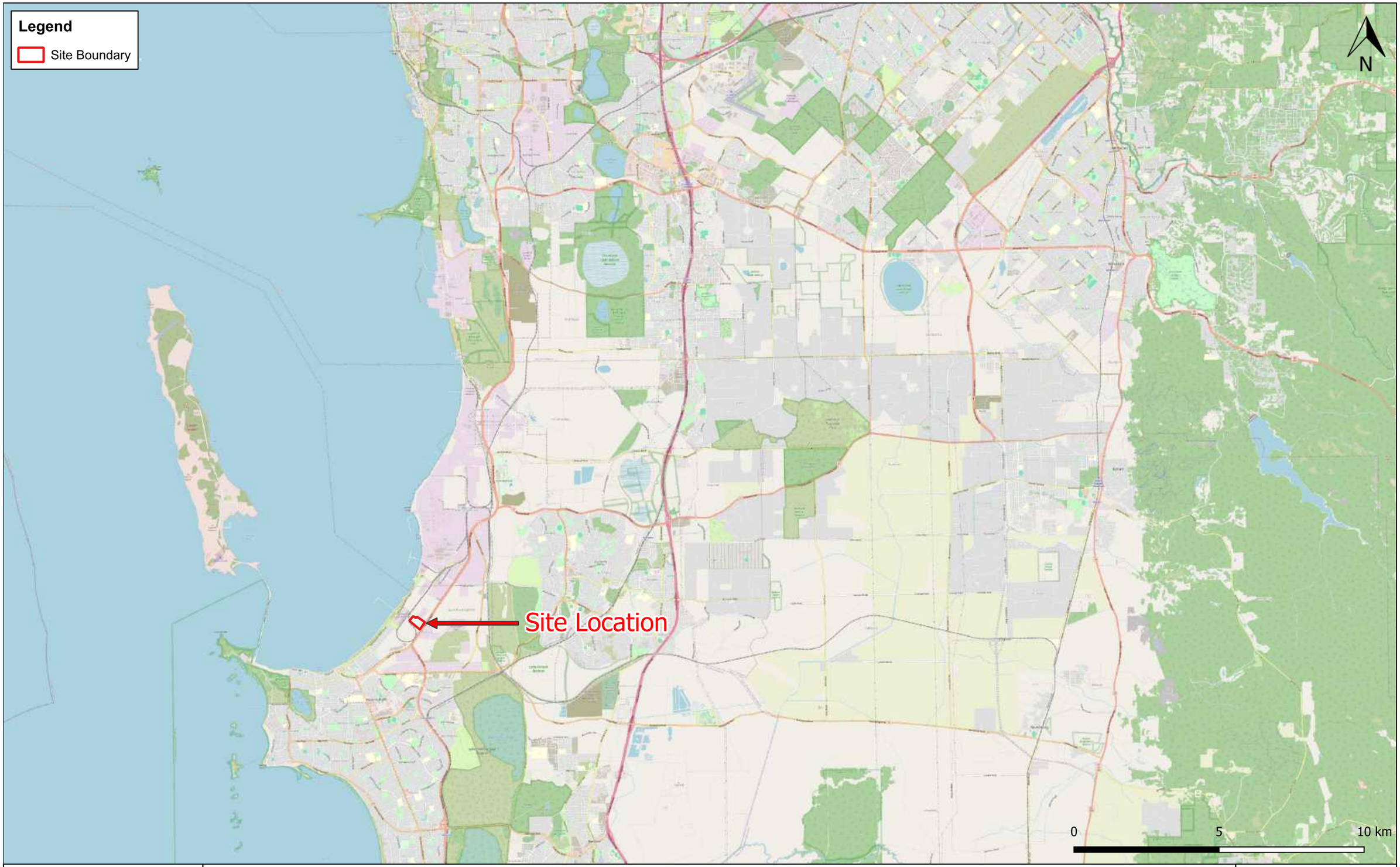
Rob Shapland | Environmental Chemist / Senior Associate

08 9204 3511 +61 412 448 485 Rob.Shapland@douglaspartners.com.au

www.douglaspartners.com.au 36 O'Malley Street, Osborne Park, WA 6017 | Whadjuk Country

Douglas PARTNERS | GROUNDED EXPERTISE

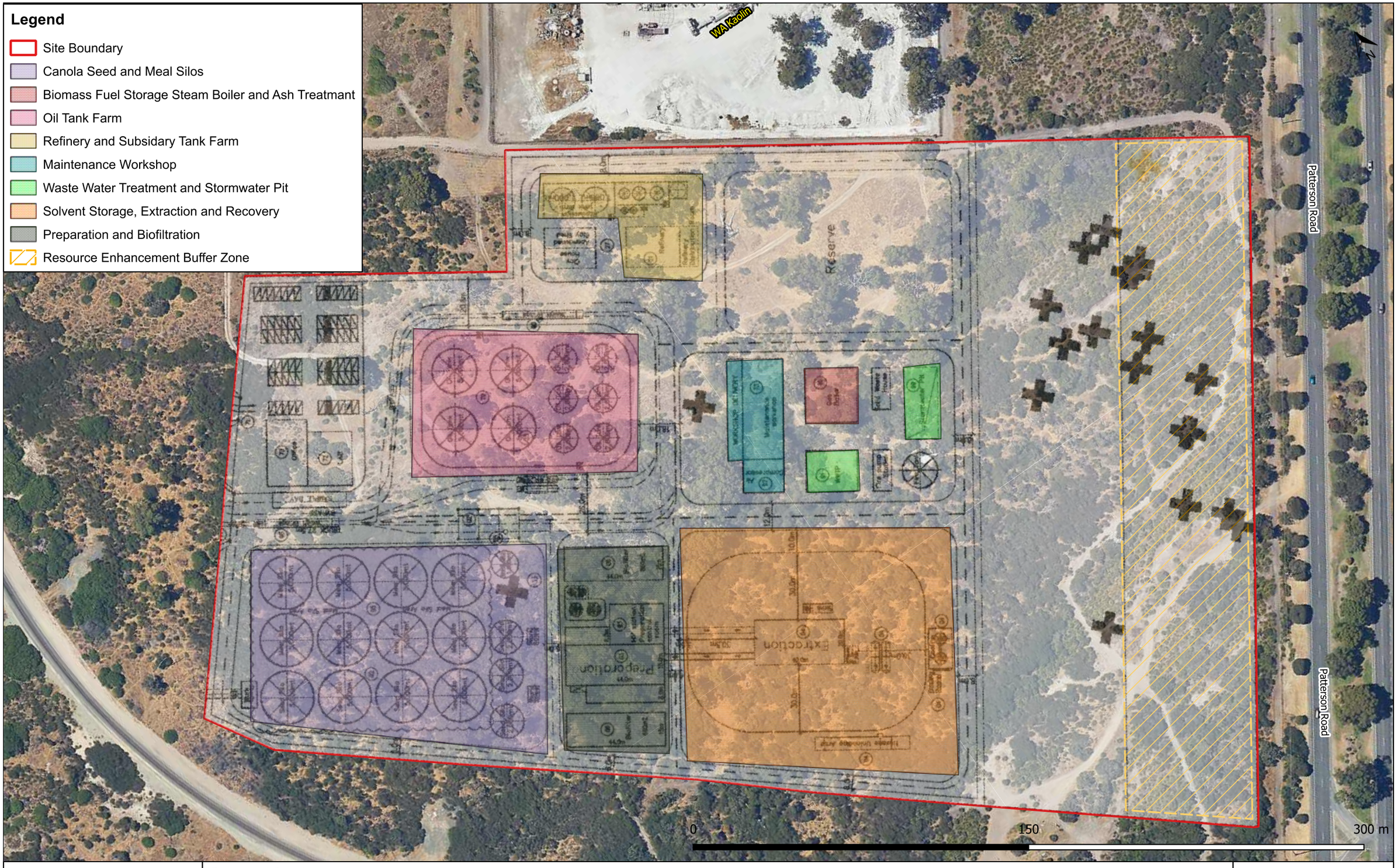
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Douglas PARTNERS	**Locality Plan** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 1 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 7/6/2024



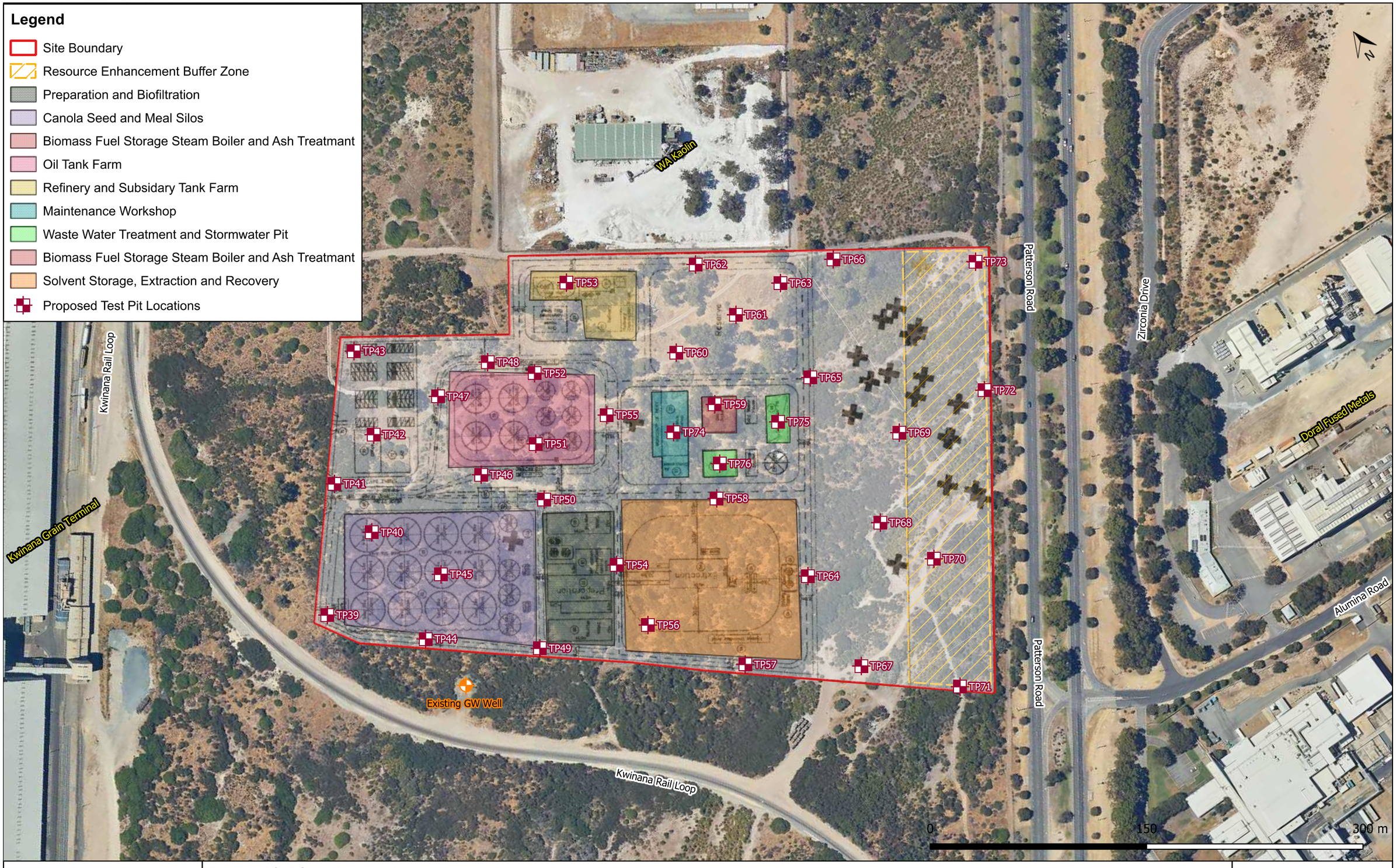
Douglas PARTNERS	**Aerial Photograph and Surrouding Land Uses** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA** CLIENT: Cargill Australia Ltd	PROJECT: 224972.01 Drawing No: 2 REV: 0 DATE: 7/6/2024



Douglas PARTNERS	**Proposed Development** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 3 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 7/6/2024



Douglas PARTNERS	**Site Walkover Features** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 4 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 7/6/2024



Douglas PARTNERS	**Proposed Soil Sampling Locations** **Baseline Contamination Investigation** **Part of Lot 108 Port Road, Kwinana Beach, WA**	PROJECT: 224972.01 Drawing No: 5 REV: 0
	CLIENT: Cargill Australia Ltd	DATE: 7/6/2024



Proposed Groundwater Sampling Locations

Baseline Contamination Investigation

Part of Lot 108 Port Road, Kwinana Beach, WA

CLIENT: Cargill Australia Ltd

PROJECT:	224972.01
Drawing No:	6
REV:	0
DATE:	7/6/2024

AUSTRALIAN
ENVIRONMENTAL AUDITORS

AEA Ref: EA1119-C1 17 June 2024

Cargill Australia
c/- Jeff Barham
Ramboll Perth
Level 7, 41 St Georges Terrace
Perth, WA 6000

Email : jbarham@ramboll.com;
Rob.Shapland@douglaspartners.com.au

Auditor Comments –SAQP
Baseline Contamination Investigation
Part Lot 108, East Rockingham, WA

Dear Mr Barham,

I have been commissioned to complete a Contaminated Site Audit, (the Audit) in relation to the property identified as Part Lot 108, East Rockingham, Western Australia (the Site).

I have been provided with the following document for review:

- Douglas Partners Email (11 June 2024) Part of Lot 108 Port Road, Kwinana Beach (224972.01) - SAQP.

Overall, the document is of good quality and generally compliant with DWER guidance's. The Auditor provides the following comments re data gaps for the project:

Test Pit Locations

It is understood that the proposed infrastructure plans are yet to be finalised, hence test pit locations are in effect provisional and may not actually provide exact baseline data for the final infrastructure. However, assuming the plans are reasonably predictive:

1. Please relocate (or provide an additional) test pit to the vicinity of the proposed hexane underground hexane storage tanks; and
2. Please relocate (or provide an additional) test pit to the centre of the preparation building (03 on the project plot plan).

Registered Wells 61404896 and 61410023

The desk top search suggests that there may be two existing monitoring wells to the north west of the Site (61404896 and 61410023). These may be well be mislocated or destroyed, however:

3. Please complete a walkover of the area between Site and the rail line to the north west of the Site; and
4. If the wells are located and accessible, please gauge and sample for the analytes proposed for other wells.

Groundwater Flow Direction / Revision of SAQP If Required

Groundwater flow in the Rockingham area can vary from mapping. To ensure that the location and analysis suite to delineate off and onsite sources is fit for purpose:

5. Please complete and provide static water levels (SWLs as AHD) and groundwater contouring at the earliest opportunity after wells have been surveyed and stable SWLs recorded.
6. If the groundwater flow direction is not that predicted (north west to west north west), please call to discuss repercussions to the SAQP at your earliest convenience.

Iwatani Plant - NORM Risk

The Iwatani (formerly Doral) plant at 1 Zirconia Drive handles mineral sands, which are considered to be Naturally-Occurring Radioactive Materials (NORM), due to the presence of thorium and uranium in mineral grains. While a low risk, the plant has operated for over 20 years and hence possible NORM impacts have (or will) migrate onto the Site, hence baseline groundwater sampling should include radioactivity.

7. Water samples from proposed MW103 and MW104 should be analysed by a suitable laboratory to first determine the gross alpha and beta concentration and if the relevant reference level is exceeded, to determine each radionuclide present and its activity concentration.

Auditor Site Visit

An Auditor site visit has been recommended to ensure areas of concern can be 'ground truthed' and so that sampling methodologies can be observed.

8. Please notify the Auditor of the date of soil bore installation and sampling.

Any questions, please contact me on 0437 707 585 or palderson@envaud.com.au.

Yours sincerely



Peter Alderson
WA DWER Accredited Contaminated Sites Auditor-FT0073
Australian Environmental Auditors Pty

Appendix F

Test Pit Logs (TP39 to TP77)

Groundwater Monitoring Well Construction Logs (MW101 to MW105, BH1 and BH7)

Calibration Certificates

Groundwater Monitoring Well Survey (BCE)

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:382752.1, N:6429969.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP39
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4	0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05		
			SAND (SP-SM), with silt: dark grey; fine to medium; Safety Bay Sand.		AEO					ES		0.15 0.20		
		0.40	SAND (SP), trace silt: pale grey; fine to medium; Safety Bay Sand.							ES		0.40		
			From 0.60m: - pale brown									0.50		
			From 0.90m: - lithified							B			PSP/150	5 10 15
	3	1				MD	M					1		
	2				AEO									
		2										2		
	1	3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:382810.4, N:6429996.3
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP40
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP			Asbestos Sieving Dup 1-1 and Dup 1-2	ES ES		0.05 0.15 0.20	PSP/150	5 10 15 Refusal 30
		SAND (SP), trace silt: grey-brown; fine to medium; Safety Bay Sand.			MD			B		0.50		
		From 0.40m: - pale brown										
	1	From 1.30m: - pale grey-brown, lithified		AEO	D to VD	M				1		
	2									2		
	3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:382806.1, N:6430032.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP41
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4 / 0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05		
		SAND (SP-SM), with silt: dark grey; fine to medium; Safety Bay Sand.		AEO					ES		0.15 0.20		
	0.40	SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.							ES		0.40		
		From 0.80m: - pale grey, lithified, trace limestone particles		AEO	MD		M				0.50	PSP/150	5 10 15
	1 / 3								D		1.00		
	1.80 / 2	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR							2		
	3 / 1	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:382850.6, N:6430049.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP42
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP	L to MD	M	Asbestos Sieving	ES		0.05	PSP/150	
		SAND (SP-SM), with silt: grey; fine to medium; Safety Bay Sand.		AEO				ES		0.15 / 0.20		
	0.40	SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.						ES		0.50 / 0.60		
	3 1	From 0.90m: - lithified								1		
				AEO	MD							
	2 2	From 2.00m: - pale grey-brown, fine to coarse grained								2		
	1 3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:382868.9, N:6430102.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP43
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[†] / DENSITY.[†]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4	0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP			Asbestos Sieving	D	0.05	0.05		
			SAND (SP-SM), with silt: dark grey-brown and grey-brown; fine to medium; Safety Bay Sand.		AEO				ES	0.10	0.10		
		0.40	SAND (SP), trace silt: grey-brown; fine to medium; Safety Bay Sand.			L to MD			ES	0.15	0.15		
	3		From 0.70m: - pale grey, lithified							0.20	0.20		
		1							ES	0.50	0.50		
										0.60	0.60		
									D	1.00	1.00		
					AEO		M					PSP/150	5 10 15
	2	2	From 1.90m: - fine to coarse grained, pale pink-brown			MD					2		
	1	3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.5 AHD
COORDINATE: E:382809.4, N:6429910.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP44
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[†]	DENSITY.[†]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving Dup 4-1 and Dup 4 -2	ES		0.05 0.15 0.20	PSP/150	5 10 15
	0.40	SAND (SP-SM), with silt: dark grey-brown; fine to medium; Safety Bay Sand.		AEO					ES				
	1	SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand. From 0.55m: - pale grey		AEO	MD		M		ES		0.40 0.50 1		
	2	Test Pit discontinued at 2.00m depth. (Collapsing conditions).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:382835.4, N:6429939.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP45
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[†]	DENSITY.[†]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with roots and rootlets, with silt: grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.							ES		0.15 0.20		
		From 0.40m: - pale brown							ES		0.40 0.50		
	1	From 1.20m: - pale grey, weakly lithified		AEO		MD	M		D		1.00	PSP/150	5 10 15
	2										2		
		Test Pit discontinued at 2.50m depth. (Collapsing conditions).											
	3												





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382899.5, N:6429986.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP46
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with rootlets and silt: dark grey-brown and grey; fine to medium; trace roots.		TOP	MD		Asbestos Sieving Dup 201 and Dup 2 -2	ES		0.05 0.15 0.20	PSP/150	5 10 15 Refusal 30
	0.50	SAND (SP-SM), with silt: dark grey and grey; fine to medium; Safety Bay Sand.		AEO				ES				
		SAND (SP), trace silt: pale grey; fine to medium; Safety Bay Sand.						ES		0.50 0.60	PSP/150	5 10 15 Refusal 30
	1	From 1.00m: - lithified			D to VD	M				1		
		1.30m: - trace limestone particles between 1.3 m and 1.6 m depth		AEO								
	2									2		
	3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:382907.1, N:6430040.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP47
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP	MD	M	Asbestos Sieving	ES		0.10 0.15 0.20	PSP/150	5 10 15 Refusal 30
	0.40	SAND (SP-SM), with silt: grey; fine to medium; Safety Bay Sand.		AEO				ES				
		SAND (SP), trace silt: pink-brown; fine to medium; weakly lithified, Safety Bay Sand.						B ES		0.50 0.60		
	1									1		
		From 2.20m: - trace pockets of SAND SP-SM		AEO	(D) to (VD)			D		2.00		
18/06/24	2.50	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR		W						
	3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:382942.9, N:6430046.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP48
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: grey-brown; fine to medium.		TOP			Asbestos Sieving	ES		0.05		
			SAND (SP), trace silt: grey-brown; fine to medium; Safety Bay Sand.			MD			ES		0.15 0.20	PSP/150	5 10 15 Refusal 30
			From 0.35m: - pale brown										
		1	From 1.00m: - lithified						ES		0.50 0.60		
	2				AEO		M				1		
	1					(D) to (VD)							
		2	From 2.60m: - with bands of fine to coarse grained shelly sand								2		
		2.70	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR		W						
		3	Test Pit discontinued at 3.00m depth. (Target depth).						D		3.00		





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.5 AHD
COORDINATE: E:382877.5, N:6429839.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP49
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP			Asbestos Sieving	ES	0.05–0.10	0.05 0.10		
		SAND (SP), trace silt: pale brown; fine to medium; weakly lithified, Safety Bay Sand.		AEO	MD	M		ES ES B	0.10–0.20 0.20–0.40 0.40–0.50	0.20 0.40 0.50	PSP/150	5 10 15
▼ 19/06/24	2.70	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR		W						
		Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.1 AHD
COORDINATE: E:382917.6, N:6429911.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP50
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	TOPSOIL / SAND (SP-SM), with roots and rootlets, with silt: dark grey-brown; fine to medium.	TS	TOP	MD	M	Asbestos Sieving	ES		0.05		
	0.20	LIMESTONE: pale grey, fine to medium grained, dry; Safety Bay Sand; low to medium strength.			VD	D		ES		0.15		
		Test Pit discontinued at 0.50m depth. (Hard digging, refusal on limestone).					Rock Sample	D		0.20 / 0.50	PLT	PSP/150: 5, 10, 15; Refusal 30 PL(I)=0.11MPa
	2 1											
	1 2											
	0 3											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:382936.5, N:6429977.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP51
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	D		0.05		
			SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.							ES		0.15		
										ES		0.20	PSP/150	5 10 15 Refusal 30
	3		From 0.60m: - lithified									0.40		
										ES		0.50		
	1	1												
								M		D		1.00		
	2		From 1.90m: - weakly lithified		AEO		D							
		2										2		
▼ 18/06/24	1													
		2.90	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR			D						
		3	Test Pit discontinued at 3.00m depth.											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.9 AHD
COORDINATE: E:382964.6, N:6430021.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP52
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.			MD				ES		0.15 0.20	PSP/150	5 10 15 Refusal 30
		From 0.80m: - pale grey, lithified							ES		0.40		
		From 1.50m: - weakly lithified		AEO	D to VD	M			B		0.50		
	2.70	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:383017.3, N:6430061.8
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP53
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*)	DENSITY.(*) MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.00	FILL / SAND (SP-SM), with silt: grey-brown; fine to medium; Safety Bay Sand.		FILL			Asbestos Sieving	ES		0.10		
											0.20		
									ES				
		0.40	TOPSOIL / SAND (SP-SM), with silt, trace rootlets and organics: dark grey-brown; fine to medium.		TOP				ES		0.40		
		0.50	SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.								0.50		
			From 0.80m: - pale grey, lithified, trace limestone particles						B				
		1	From 1.10m: - pale grey			MD	M		ES		0.80		
					AEO						0.90		
			From 1.80m: - pale grey-brown, fine to coarse grained								1		
		2									2		
		3	Test Pit discontinued at 3.00m depth. (Target depth).										

PSP/150: 5, 10, 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:382910.8, N:6429883.3
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP54
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[†]	DENSITY.[†]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	TOPSOIL / SAND (SP-SM), with roots and rootlets, with silt: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.20	PSP/150	5 10 15
	0.80	SAND (SP-SM), with silt: dark grey-brown; fine to medium; Safety Bay Sand. From 0.30m: - grey, lithified		AEO					D ES		0.40 0.50		
	2.40	SAND (SP), trace silt: grey; fine to medium; cemented, Safety Bay Sand.		AEO	MD		M				1 2		
	3	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:382989.1, N:6429966.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP55
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[†]	DENSITY.[†]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05 0.10		
	0.30	SAND (SP-SM), with silt: grey-brown; fine to medium; Safety Bay Sand.		AEO					ES		0.20		
		SAND (SP), trace silt: pale brown; fine to medium; Safety Bay Sand.							ES		0.40 0.50	PSP/150	5 10 15
		From 1.50m: - lithified		AEO	MD		M		D		1.00		
	2.70	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:382929.9, N:6429832.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP56
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†)	DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving Dup 5-1 and Dup 5 -2	ES		0.05	PSP/150	5 10 15
	0.30	SAND (SP-SM), with silt: dark grey; fine to medium; Safety Bay Sand.		AEO					ES		0.15 0.20		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.											
		From 0.55m: - pale grey, lithified									0.40		
									ES		0.50		
	1				MD		M						
				AEO									
		From 1.70m: - weakly lithified											
	2								D		1.00		
											2		
	3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:382940.4, N:6429810.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP57
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with roots and rootlets, with silt: dark grey-brown; fine to medium.		TOP			Asbestos Sieving	ES		0.05	PSP/150	5 10 15 Refusal 30
	0.30	SAND (SP-SM), with silt: dark grey; fine to medium; Safety Bay Sand.		AEO				ES		0.15 / 0.20		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.										
		From 0.60m: - pale brown, lithified			D to VD	M		B		0.50		
	1			AEO				ES		0.60		
	2	From 2.20m: - weakly lithified								1		
	3									2		
		Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.3 AHD
COORDINATE: E:382972.9, N:6429914.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP58
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.20	TOPSOIL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP	MD		M	Asbestos Sieving	D/ES		0.05		
												0.15		
			LIMESTONE: pale grey, fine to medium grained, dry; Safety Bay Sand; very low to low strength.			VD		D		ES		0.20	PLT	PSP/150 5 10 15 PL(I)=0.08MPa Refusal 30
									Rock Sample	D		0.40		
			Test Pit discontinued at 0.40m depth. (Hard digging, refusal on limestone).											





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:383053.1, N:6429931.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP59
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	0.20	TOPSOIL / organic SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05		
												0.15		
			SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.			MD				ES		0.20	PSP/150	5 10 15 Refusal 30
			From 0.60m: - pale grey, lithified							ES		0.50		
	1											0.60		
	2				AEO	VD		M				1		
		2	2.00m: - weakly lithified											
			2.20m: - trace bands of fine to coarse grained, shelly sand									2		
	1					(MD) - (D)				D		2.50		
		2.90	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		3	Test Pit discontinued at 3.00m depth.											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:383055.9, N:6429975.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP60
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†)	DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.00	FILL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium; clear of rubbish.		FILL	MD			Asbestos Sieving	D ES ES	0.05 0.10 0.15 0.20		PSP/150	5 10 15 Refusal 30
			From 0.30m: - pale grey and grey-brown											
	3	0.50	SAND (SP-SM), with roots and rootlets, with silt: dark grey-brown; fine to medium; Safety Bay Sand.		AEO					ES	0.50 0.60			
		0.65	SAND (SP), trace silt: pale grey; fine to medium; lithified, Safety Bay Sand.											
		1								ES	0.90 1.00			
	2				AEO	MD to D		M				2		
		2												
	1	2.70	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No soil odour noted.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.1 AHD
COORDINATE: E:383103.4, N:6429972.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP61
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 2

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†)	DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4		FILL / SAND (SP-SM), with silt, trace rootlets: grey-brown; fine to medium; clear of rubbish.		FILL				Asbestos Sieving	ES		0.10		
										B		0.20		
		0.50										0.50		
		0.60	TOPSOIL / SAND (SP-SM), with silt, trace rootlets and organics: dark grey-brown; fine to medium; Safety Bay Sand.		TOP					ES		0.60		
			SAND (SP), trace silt: grey and pale grey; fine to medium; Safety Bay Sand. From 0.90m: - lithified							ES		0.90		
	3	1										1.00		
			1.40m: - trace of very low to low strength limestone between 1.4 m and 1.8 m depth		AEO		MD	M						
	2	2										2		
		2.90	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
	1	3	Test Pit discontinued at 3.00m depth.											

PSP/150: 5, 10, 15; Refusal





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.1 AHD
COORDINATE: E:383099.6, N:6430018.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP62
PROJECT No: 224972.00
DATE: 18/06/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4	0.20	FILL / SAND (SP-SM), with silt, trace roots and rootlets: dark grey-brown and grey-brown; fine to medium; clear of rubbish.		FILL				Asbestos Sieving	ES		0.10	PSP/150	5 10 15
			TOPSOIL / SAND (SP-SM), with silt, trace rootlets and organics: dark grey-brown; fine to medium; Safety Bay Sand.		TOP					ES		0.20		
		0.45	SAND (SP), trace silt: grey-brown; fine to medium. Safety Bay Sand.		AEO		MD			ES		0.40		
		0.70	SAND (SP), trace silt: pale grey; fine to medium; lithified, Safety Bay Sand.		AEO		D to VD	M		ES		0.50		
	3	1										0.70		Refusal 30
			Test Pit discontinued at 1.70m depth. (Hard digging, refusal on limestone/lithified sand).									0.80		
	2	2										1		
	1	3												





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.0 AHD
COORDINATE: E:383141.0, N:6429978.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP63
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†)	DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4		FILL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown and dark grey; fine to medium; clear of rubbish.		FILL	MD			Asbestos Sieving	ES		0.05		
												0.15		
										ES		0.20		
		0.50	SAND (SP-SM), with silt: dark grey-brown; fine to medium; Safety Bay Sand.		AEO					ES		0.50	PSP/150	5 10 15
		0.60	SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.									0.60		
	3	1	From 0.90m: - pale grey, lithfied							ES		0.80		
												0.90		Refusal 30
								M				1		
					AEO	D to VD								
	2	2	From 2.00m: - grey-brown, weakly lithified									2		
										D		2.50		
	1	3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [†] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:383056.5, N:6429817.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP64
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.20	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES	0.05–0.15	0.05		
			SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.							ES	0.15–0.20	0.15		
			From 0.40m: - pale brown, lithified							ES	0.20–0.40	0.20		
		1										0.40		
					AEO	MD		M		B	0.40–0.50	0.50		
			From 1.70m: - weakly lithified									1		
		2	From 1.90m: - trace bands of fine to coarse grained shelly sand									2		
		2.80	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		3	Test Pit discontinued at 3.00m depth. (Target depth).											

PSP/150: 5, 10, 15





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:383110.1, N:6429919.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP65
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	0.80	FILL / SAND (SP-SM), with silt, trace rootlets: bands of dark grey-brown, grey and brown; fine to medium; clear of rubbish.		FILL	MD		M	Asbestos Sieving	ES		0.05	PLT	PL(I)=0.09MPa
										ES		0.15		
												0.20		
										ES		0.40		
												0.50		
										B				
		1.00	SAND (SP-SM), with roots of diameter of 10 mm, with silt: grey; fine to medium; Safety Bay Sand.		AEO					ES		0.90		
			LIMESTONE: pale grey, fine to medium grained, dry; Safety Bay Sand; very low to low strength.			VD		D				1.00		
	2	2	Test Pit discontinued at 1.20m depth. (Hard digging, refusal on limestone).						Rock Sample	D		1.20		
	1	3												

PSP/150: 5, 10, 15; Refusal 30





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.2 AHD
COORDINATE: E:383182.8, N:6429970.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP66
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	0.20	TOPSOIL / SAND (SP-SM), with roots and rootlets, with silt: dark grey-brown; fine to medium.		TOP	MD		M	Asbestos Sieving	ES		0.05 0.10		
			LIMESTONE: pale grey, fine to medium grained, dry; Safety Bay Sand; medium to high strength.			VD		D	Rock Sample	ES		0.20	PLT	PL(I)=1.1MPa Refusal 30
			Test Pit discontinued at 0.30m depth. (Hard digging, refusal on limestone).							D		0.30		





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No soil odour noted.

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.9 AHD
COORDINATE: E:383036.5, N:6429721.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP67
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving and Jar Sample	ES		0.20	PSP/150	5 10 15
			SAND (SP), trace silt: brown; fine to medium; Safety Bay Sand.							ES		0.40		
			From 0.70m: - pale brown									0.50		
	3	1										1		
			From 1.20m: - lithified		AEO	MD		M		D		1.50		
	2	2										2		
		2.80	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
	1	3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:383097.1, N:6429798.8
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP68
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES	0.05–0.10	0.05	PSP/150	5 10 15
			SAND (SP), trace silt: brown; fine to medium; trace rootlets to 0.7 m depth, Safety Bay Sand.							ES	0.10–0.20	0.10		
	3											0.20		
		1	From 1.00m: - pale grey, lithified							ES	0.40–0.50	0.40		
					AEO	MD		M		B		0.50		
	2		From 1.70m: - weakly lithified											
		2								D	1.00	1.00		
												2		
	1	2.80	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR									
		3	Test Pit discontinued at 3.00m depth. (Target depth).											





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Test pit beside sand track, some household rubbish observed at

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.9 AHD
COORDINATE: E:383148.0, N:6429856.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP69
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.20	TOPSOIL / organic SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium; organic odour encountered.		TOP				Asbestos Sieving	ES		0.05		
			SAND (SP), trace silt: grey and pale grey; fine to medium. Safety Bay Sand.			L to MD		M		ES		0.15 0.20	PSP/150	5 10 15
	4				AEO							0.40		
		1.00	LIMESTONE: pale grey, fine to medium grained; strongly lithified. Safety Bay Sand			MD				ES		0.50		
	3		Test Pit discontinued at 1.10m depth. (Hard digging, refusal on strongly lithified sand).									1		
	2	2												
		3												





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.9 AHD
COORDINATE: E:383116.2, N:6429756.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP70
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP			Asbestos Sieving Dup 3-1 and Dup 3 -2	ES		0.05 0.10 0.15 0.20	PSP/150	5 10 15 Refusal 30
		SAND (SP), trace silt: grey-brown; fine to medium; Safety Bay Sand.			MD			ES D				
		From 0.50m: - grey						ES		0.40 0.50		
	1	From 0.90m: - pale grey, lithified		AEO		M				1		
	2	From 2.00m: - weakly lithified			D to VD					2		
	3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:383082.8, N:6429671.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP71
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.10	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: brown; fine to medium.		TOP			Asbestos Sieving	ES	0.05–0.10	0.05 0.10	PSP/150	5 10 15 Refusal 30
			SAND (SP), trace silt: grey and brown; fine to medium; Safety Bay Sand.						ES	0.10–0.20	0.20		
	3		From 0.60m: - lithified										
		1							ES	0.40–0.50	0.40 0.50		
					AEO	D to VD	M				1		
	2		From 1.60m: - weakly lithified										
		2									2		
▼ 19/06/24	1												
		2.80	SAND (SP), trace silt: grey-brown; fine to medium; trace fragments of shell. Becher Sand.		MAR								
		3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.35 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.5 AHD
COORDINATE: E:383213.2, N:6429834.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP72
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	0.10	SAND (SP-SM), with silt, trace rootlets: grey-brown; fine to medium; clear of rubbish. Disturbed Soil - 4WD Track.		TOP	MD		Asbestos Sieving	ES		0.10	PSP/150	5 10 15
		0.20	TOPSOIL / SAND (SP-SM), with organics, with silt: dark grey; fine to medium; Safety Bay Sand.						D/ES		0.20		
			SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand. From 0.50m: - pale brown						ES		0.40		
											0.50		
	1	1	From 1.00m: - pale grey, lithified		AEO	D	M				1		
	2	2	From 2.50m: - trace pockets of fine to coarse grained shelly sand								2		
	1	2.80	SAND (SP), trace silt: grey-brown; fine to coarse; trace fragments of shell. Becher Sand.		MAR								
		3	Test Pit discontinued at 3.00m depth. (Target depth).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.1 AHD
COORDINATE: E:383259.4, N:6429911.8
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP73
PROJECT No: 224972.00
DATE: 19/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	4 / 0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP	MD	M		Asbestos Sieving	ES		0.05	PSP/150	5 10 15 Refusal 30
		SAND (SP), trace silt: grey; fine to medium; with rootlets to 0.7 m depth, Safety Bay Sand.									0.15		
									ES		0.20		
		From 0.75m: - pale grey, lithified		AEO	VD						0.40		
	1								ES		0.50		
	3										1		
	1.80 / 2	SAND (SP-SM), with silt: pale grey; fine to medium; weakly lithified, Safety Bay Sand.		AEO	MD - D						2		
	2												
	3	Test Pit discontinued at 3.00m depth. (Target depth).											
	1												





NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.2 AHD
COORDINATE: E:383014.4, N:6429927.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP74
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3 / 0.15	TOPSOIL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP	MD		Asbestos Sieving	ES		0.05	PSP/150	5 10 15 Refusal 30
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.						ES		0.15 0.20		
		From 0.25m: - pale grey, lithified		AEO	VD	M		ES		0.50 0.60		
	1	Test Pit discontinued at 1.00m depth. (Target depth).										
	2											
	1											
	0											
	3											





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:383072.8, N:6429888.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP75
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP	MD	M	Asbestos Sieving	ES		0.05	DCP9/150	5 10 15 Refusal 30
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.		AEO				ES		0.15 / 0.20		
		From 0.40m: - pale brown, lithified			VD			ES		0.40 / 0.50		
	1	Test Pit discontinued at 1.00m depth. (Target depth).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.7 AHD
COORDINATE: E:383036.2, N:6429895.3
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP76
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	TOPSOIL / SAND (SP-SM), with rootlets, with silt: dark grey-brown; fine to medium.		TOP				Asbestos Sieving	ES		0.05 0.10		
	0.30	SAND (SP-SM), with silt: dark grey; fine to medium; Safety Bay Sand.		AEO	MD				ES		0.20		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.				M			ES		0.40 0.50	PSP/150	5 10 15 Refusal 30
		From 0.60m: - lithified		AEO	VD								
	1	Test Pit discontinued at 1.00m depth. (Target depth).							D		1.00		





NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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TEST PIT LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:383002.3, N:6429808.8
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP77
PROJECT No: 224972.00
DATE: 20/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.20	TOPSOIL / SAND (SP-SM), with silt, trace rootlets: dark grey-brown; fine to medium.		TOP			Asbestos Sieving	ES		0.05		
		SAND (SP), trace silt: grey; fine to medium; Safety Bay Sand.		AEO	MD	M		ES		0.15 0.20		
		From 0.60m: - pale grey, lithified						ES		0.40 0.50	PSP/150	5 10 15 Refusal 30
	0.80	LIMESTONE: pale grey, fine to medium grained, dry; Safety Bay Sand; medium strength.			VD	D						
		Test Pit discontinued at 1.00m depth. (Target depth / refusal on limestone).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 8 tonne backhoe
OPERATOR: ANH Contracting
LOGGED: GG

METHOD: 450 mm toothed bucket

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:382846.7, N:6430087.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW101
PROJECT No: 224972.01
DATE: 28/06/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3	0.20	TOPSOIL / SAND (SP-SM), with silt: brown; fine to medium.	TS	TOP										Sand	
	1		SAND (SP), trace silt: light grey; fine to medium.					M				1			Bentonite	50mm Class 18
04/07/24		2			RS							2				
	0	3	3.00m: becoming grey, trace silt, wet					M				3			Gravel	50mm Class 18
	-1	4										4				
		5	Borehole discontinued at 5.00m depth. Targeted Depth Reached.													



NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Push Tube
OPERATOR: Direct Push Probing
LOGGED: RS
CASING: Uncased

REMARKS: Surface levels surveyed using a different GPS with a reported accuracy +/-0.1m
Free ground water observed at 2.7m

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382929.0, N:6429844.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW102
PROJECT No: 224972.01
DATE: 28/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	0.10	TOPSOIL / SAND (SP-SM), with silt: grey-brown; fine to medium.	TS	TOP		M								
		SAND (SP-SM), with silt: grey-brown; fine to medium.												
		0.60m: light grey, trace silt, moist		RS		M								
▼ 04/07/24		3.00m: grey with silt, wet												
	5	Borehole discontinued at 5.00m depth. Targeted Depth Reached.												

BACKFILL: Sand; Bentonite; Gravel
WELL PIPE: 50mm Class 18; 50mm Class 18



NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Push Tube
REMARKS: Surface levels surveyed using a different GPS with a reported accuracy +/-0.1m
Free ground water observed at 2.8m

OPERATOR: Direct Push Probing

LOGGED: RS
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:383126.9, N:6429752.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW103
PROJECT No: 224972.01
DATE: 28/06/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3.8	0.10	TOPSOIL / SAND (SP-SM), with silt: grey-brown; fine to medium.	TS	TOP			M				0			Sand	
			SAND (SP-SM), with silt: grey-brown; fine to medium.													
			0.30m: becoming light grey, trace silt									1			Bentonite	50mm Class 18
▼ 04/07/24					RS			M				2				
			2.70m: grey with silt, wet									3			Gravel	50mm Class 18
												4				
		5	Borehole discontinued at 5.00m depth. Targeted Depth Reached.													



NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Push Tube
OPERATOR: Direct Push Probing
LOGGED: RS
CASING: Uncased

REMARKS: Surface levels surveyed using a different GPS with a reported accuracy +/-0.1m
Free ground water observed at 2.7m

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log with Photo

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:383233.9, N:6429860.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW104
PROJECT No: 224972.01
DATE: 28/06/24
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3.6	0.10	TOPSOIL / SAND (SP-SM), with silt: grey-brown; fine to medium.	TS	TOP			M							Sand	
			SAND (SP-SM), with silt: grey-brown; fine to medium.													
			0.60m: becoming light grey, trace silt												Bentonite	50mm Class 18
▼ 04/07/24					RS			M								
			2.80m: becoming grey, trace silt												Gravel	50mm Class 18
		5.00	Borehole discontinued at 5.00m depth. Targeted Depth Reached.													



NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Push Tube
REMARKS: Surface levels surveyed using a different GPS with a reported accuracy +/-0.1m
Free ground water observed at 2.5m

OPERATOR: Direct Push Probing

LOGGED: RS
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:382989.6, N:6429954.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW105
PROJECT No: 224972.01
DATE: 28/06/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3.5	0.10	TOPSOIL / SAND (SP-SM), with silt: grey-brown; fine to medium.	TS	TOP		M				1			Sand	
			SAND (SP-SM), with silt: grey-brown; fine to medium. 0.40m: becoming light grey, trace silt											Bentonite	50mm Class 18
▼ 04/07/24	1	2	2.50m: becoming grey, trace silt		RS		M				2			Gravel	
	0	3									3				50mm Class 18
	-1	4									4				
		5	Borehole discontinued at 5.00m depth. Targeted Depth Reached.												



NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Push Tube
REMARKS: Surface levels surveyed using a different GPS with a reported accuracy +/-0.1m
Free ground water observed at 2.7m

OPERATOR: Direct Push Probing

LOGGED: RS
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Soil Log with Photo

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 1 of 7

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
		0.30	TOPSOIL / SAND (SP-SM), with organics, with silt: brown; fine to coarse; with roots up to 50 mm diameter.	TS	TOP	(L) - (MD)	D - M							Gravel - Gravel Backfill from 0.5 m to 0.2 m depth Concrete - Concrete to 0.2 m depth	50mm Plain PVC to 2.0 m depth
	3	1.00	SAND (SP), trace silt: brown to pale-brown; fine to coarse. Safety Bay Sand.		AEO	L - MD	D - M				1				
	2	2	SAND (SP), with silt: yellow-brown to off-white; fine to coarse. Safety Bay Sand.		AEO	MD	D - M				2	SPT	4,5,11 N=16		
03/07/24	1	3	From 3.00m: sand fine to medium grained with bands of fine to coarse grained sand and shells.				W				3	SPT	5,7,7 N=14		
	0	4.00	SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.		MAR	MD	W				4	SPT	7,10,9 N=19		50mm Slotted PVC from 2.0 m depth to 8.0 m depth
	-1	5									5				
	-2														

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 2 of 7

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-3	7	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.								7	SPT	5,8,10 N=18		
	-4	8				MD					8	SPT	4,7,8 N=15		
	-5	9			MAR		W				9	SPT	7,11,12 N=23		
	-6	10				L - MD					10	SPT	3,4,4 N=8		
	-7	11									11				
	-8													Sand - Sand Fall-in	

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 3 of 7

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-9	13	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.			L - MD					13	SPT	2,5,5 N=10		
	-10	14									14				
	-11	15	15.00m: zone of very loose sand, containing fibres and organics.		MAR		W				15	SPT	2,1,3 N=4		
	-12	16				VL					16				
	-13	17									17				
	-14														

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 4 of 7

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-15	19	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.		MAR	MD	W				19	SPT	8,12,16 N=28		
	-16	20									20				
	-17	21									21	SPT	8,10,10 N=20		
	-18	22.00	CLAY (CL-CI), with shells and shell fragments, with sand: grey-brown; low to medium plasticity; fine to medium sand. Bridport Calcilutite.		MAR	VS	w=PL				22				
	-19	23									23				
	-20														

NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 5 of 7

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	24.00	[CONT] CLAY (CL-CI), with shells and shell fragments, with sand: grey-brown; low to medium plasticity; fine to medium sand. Bridport Calcilutite.										SPT	0,0,0 N=0		
	-21 / 25	Sandy CLAY (CL-CI), with shells and shell fragments: grey-brown; low to medium plasticity; fine to medium sand. Bridport Calcilutite.		MAR	VS	w=PL					25				
	25.30	Silty SAND (SM), with shells: pale grey-brown; fine to coarse. Bridport Calcilutite.		MAR	(D) - (VD)	D - M									
	-22 / 26										26			Backfill - Fall-in	
	26.43	Continued as rock													
	-23 / 27										27				
	-24 / 28										28				
	-25 / 29										29				
	-26														

NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 6 of 7

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-21 / 25													25				
	-22 / 26													26				
		Continued from soil			26.43	L - M												
	-23 / 27	LIMESTONE: off-white to yellow-brown, fine to medium sand and silt sized grains, with bands of fine to coarse grained sand and fine quartz gravels; highly fractured to fragmented and recovered as silty sandy gravel in sections. Tamala Limestone.		SOIL	26.79	SOIL	100	51	SOIL	26.72m: FC, 10°, I R, RF, stained				27				
	27.45	CORE LOSS													SPT	3,0,0 N=0		
	-24 / 28.00	LIMESTONE: " "; band of dark-brown Silty SAND SM, 30 mm thick, at 28.25m depth.		SOIL	28.00	SOIL	47	0	SOIL					28				
	28.25	Sandy CLAY (CI), with gravel: yellow-brown banded grey-brown; medium plasticity; fine to coarse, quartz sand; fine to medium, sub-angular gravel.		SOIL	28.25	SOIL			SOIL									
	28.50 / -25 / 29	CORE LOSS					20	0						29				
	29.70 / -26	LIMESTONE: off-white to yellow-brown, fine to medium grained, sand			29.70	VL - L				29.70-29.95m: FG, IR, 20-40mm								

Backfill - Fall-in

NOTES [1] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 7 of 7

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.2, 0.6, 2.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
			and silt sized grains; recovered as Silty Sandy GRAVEL GM with fragmented sections. Tamala Limestone.																
			Borehole discontinued at 30.00m depth. (Target depth).																

Generated with CORE-GS by Geroc - Split Soil-Rock Log

NOTES [#] Soil origin is "probable" unless otherwise stated.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH

METHOD: Rotary mud washbore from surface to 24.0 m, then HQ coring to end of hole
CASING: Uncased

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Douglas PARTNERS

CORE PHOTO LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 3.8 AHD
COORDINATE: E:382754.1, N:6429980.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 224972.00
DATE: 07/06/24
SHEET: 1 of 1



BH01 Box 1 of 2: 25.00-29.00 m depth



BH01 - Box 2 of 2: 29.00-30.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 1 of 8

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	4	0.10	TOPSOIL / SAND (SP-SM), with rootlets, with silt: pale brown; fine to medium.		TOP											
			SAND (SP), trace tree root of diameter of 100 mm at 0.3 m depth, trace silt: brown to dark brown; fine to coarse; Safety Bay Sand.		AEO	(L) - (MD)		D - M								
		0.80	Gravelly SAND (SP), trace silt: off-white to yellow-brown; fine to coarse; medium to coarse, limestone gravel. Safety Bay Sand.													
	3	1										1				
			1.40m-1.70m: moderately cemented		AEO	(MD)		D - M								
	2	2										2				
		2.70	Shelly SAND (SP), trace silt: off-white; medium to coarse; 5-10mm diameter shell fragments.		LIT	MD		M								
▼ 03/07/24	1	3										3	SPT	5,6,7 N=13		
		3.20	SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.													
	0	4										4				
					MAR	L		W					SPT	1,3,8 N=11		
	-1	5	5.50m-5.90m: with shell fragments.									5				

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

BACKFILL: Bentonite - Bentonite plug from 1.0 to 1.2m depth; Gravel; Concrete - Concrete to 0.25m depth
WELL PIPE: 50mm Solid PVC pipe to 2.0 m depth; 50mm Slotted PVC pipe from 2.0 m depth to 8.0 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 2 of 8

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-2	7	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.									7	SPT	2,3,1 N=4		
	-3															
	-4	8										8	SPT	3,2,2 N=4		
	-5	9			MAR		L	W				9	SPT	1,2,6 N=8		
	-6	10										10	SPT	5,4,3 N=7		
	-7	11										11				

NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01 **OPERATOR:** Precision Drilling Australia **LOGGED:** VH
METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring **CASING:** Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE:GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 3 of 8

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-8	13	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.									13	SPT	1,1,1 N=2		
	-9															
	-10	14										14	SPT	2,2,2 N=4		
	-11	15			MAR		L	W				15	SPT	2,2,2 N=4		
	-12	16	From 16.00m: bands of organic fibres									16	SPT	3,1,3 N=4		
	-13	17										17				

NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01 **OPERATOR:** Precision Drilling Australia **LOGGED:** VH

METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring **CASING:** Uncased

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE:GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 4 of 8

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL / WELL PIPE
	-14	19	[CONT] SAND (SP-SM), with silt: grey-brown; fine to medium; with dark mineral grains and fine shell fragments present in sections. Becher Sand.		MAR	L - MD		W				19	SPT	9,10,10 N=20	Gravel - Gravel backfill from base of hole to 12m depth from surface.
	-15														
	-16	20										20			
	-17	21										21	SPT	3,4,4 N=8	
	-18	22										22			
	-19	23.00	Sandy CLAY (CI-CH), with shells and shell fragments: grey-brown; medium to high plasticity; fine to medium sand. Bridport Calcilutite.		MAR	F		w=PL				23			

NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

Generated with CORE:GS by Geroc - Split Soil-Rock Log

PLANT: PDR01 **OPERATOR:** Precision Drilling Australia **LOGGED:** VH
METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring **CASING:** Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 5 of 8

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*]	DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-20	25	[CONT] Sandy CLAY (CI-CH), with shells and shell fragments: grey-brown; medium to high plasticity; fine to medium sand. Bridport Calcilutite.		MAR	F		w=PL				25	SPT	2,3,4 N=7		
	-21															
	-22	26										26				
		27.00	Continued as rock									27				
	-23															
	-24	28										28				
	-25	29										29				

NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PDR01 **OPERATOR:** Precision Drilling Australia **LOGGED:** VH
METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring **CASING:** Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE:GS by Geroc - Split Soil-Rock Log

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 6 of 8

CONDITIONS ENCOUNTERED														SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, HW, DW, MW, SW, FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-20	25													25				
	-21																		
	-22	26													26				
		27	Continued from soil												27				
	-23	27.45	LIMESTONE: off-white to yellow-brown, fine to medium grained, sand and silt sized grains; fragmented and weathered to residual soil in sections. Band of fine gravels from 27.95 to 28.05m. Tamala Limestone.			27.72	M to H	76	0		27.81m: FC, 30°, UN, weathered					SPT	9,16,16 N=32		
		27.70	CORE LOSS		SOIL	27.86	SOIL			SOIL						PLT	PL(D)=2.6MPa		
	-24	28	LIMESTONE: " "		SOIL	28.05	L to M			SOIL					28				
		28.50	CORE LOSS			28.21	SOIL												
		29				28.41	M to L	100	0						29				
	-25	29.40	LIMESTEONE: " "		SOIL	29.40	SOIL			SOIL	29.40-29.50m: FG, 10-20 mm								
		29.50	CORE LOSS																
		29.70	LIMESTONE: off-white to yellow-brown, fine to coarse grained, sand sized			29.70					29.70-29.75m: FG, IR, 10-20mm					PLT	PL(D)=2.2MPa		
						29.75	M to H	75	42										
						29.92					29.92-29.97m: FG, IR, 10-					PLT	PL(A)=2MPa		

NOTES [a] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH

METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring
CASING: Uncased

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 7 of 8

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-26	30.12	grains, with shells and fine gravels; fractured to fragmented with sections of residual soil. Tamala Limestone				VL	12	0		20mm								
			CORE LOSS																
		30.93				30.93	VL												
		31.00	LIMESTONE: " "												31				
	-27		CORE LOSS																
		32													32				
	-28	32.17	CLAY (CI-CH), trace sand, trace gravel: dark brown-black;medium to high plasticity; fine to medium sand; sub-rounded gravel.		SOIL	32.17	SOIL	55	0	SOIL						PP	>600kPa		
		33													33				
	-29															SPT	12,21,25 N=46		
		33.77	SANDSTONE: yellow-brown banded grey-brown, fine to coarse grained, very low strength; medium to coarse grained sand and fine sub-rounded gravel. Rockingham Sand			33.77	(L)	100	0		33.9m: FC, 20°, UN, RF, weathered 34.11m: FC, 10°, UN, RF, weathered								
		34				33.92	(VL)								34				
	-30	34.50	CORE LOSS								34.50m DB								
		35						30	0						35				
	-31	35.55	SAND (SP), with gravel, trace silt: yellow-brown; medium to coarse; medium to coarse		SOIL	35.55	SOIL			SOIL									

NOTES [#] Soil origin is "probable" unless otherwise stated.

Generated with CORE-GS by Geroc - Split Soil-Rock Log

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH

METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring
CASING: Uncased

REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 8 of 8

CONDITIONS ENCOUNTERED													SAMPLE				TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (PS, XW, DW [HW, MW, SW], FR)	DEPTH (m)	STRENGTH (VL, L, M, H, VH, EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.03, 0.06, 0.20, 0.60, 2.00, 5.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	-32	36.45	sandstone gravel. Rockingham Sand.		SOIL		SOIL			SOIL						SPT	12,32/150 N=50 Refusal* *Apparent overfilled SPT of fall-in sand		
			CORE LOSS					29	0										
	-33	37													37				
		37.30	SAND (SP): yellow-brown to brown; fine to coarse quartz sand. Rockingham Sand.		SOIL	37.30	SOIL			SOIL						SPT	2,2,2 N=4 possible SPT on fall-in material		
	-34	38						100	0						38				
		39													39	SPT	6,17,32 N=49 Refusal		
	-35		Borehole discontinued at 39.45m depth. (Target depth).																
	-36	40																	
	-37	41																	

NOTES [1] Soil origin is "probable" unless otherwise stated.

PLANT: PDR01
OPERATOR: Precision Drilling Australia
LOGGED: VH
METHOD: HQ coring from surface to 16.5m, then rotary mud washbore to 27.0 m, then back to HQ coring
CASING: Uncased
REMARKS: Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

Refer to explanatory notes for symbol and abbreviation definitions

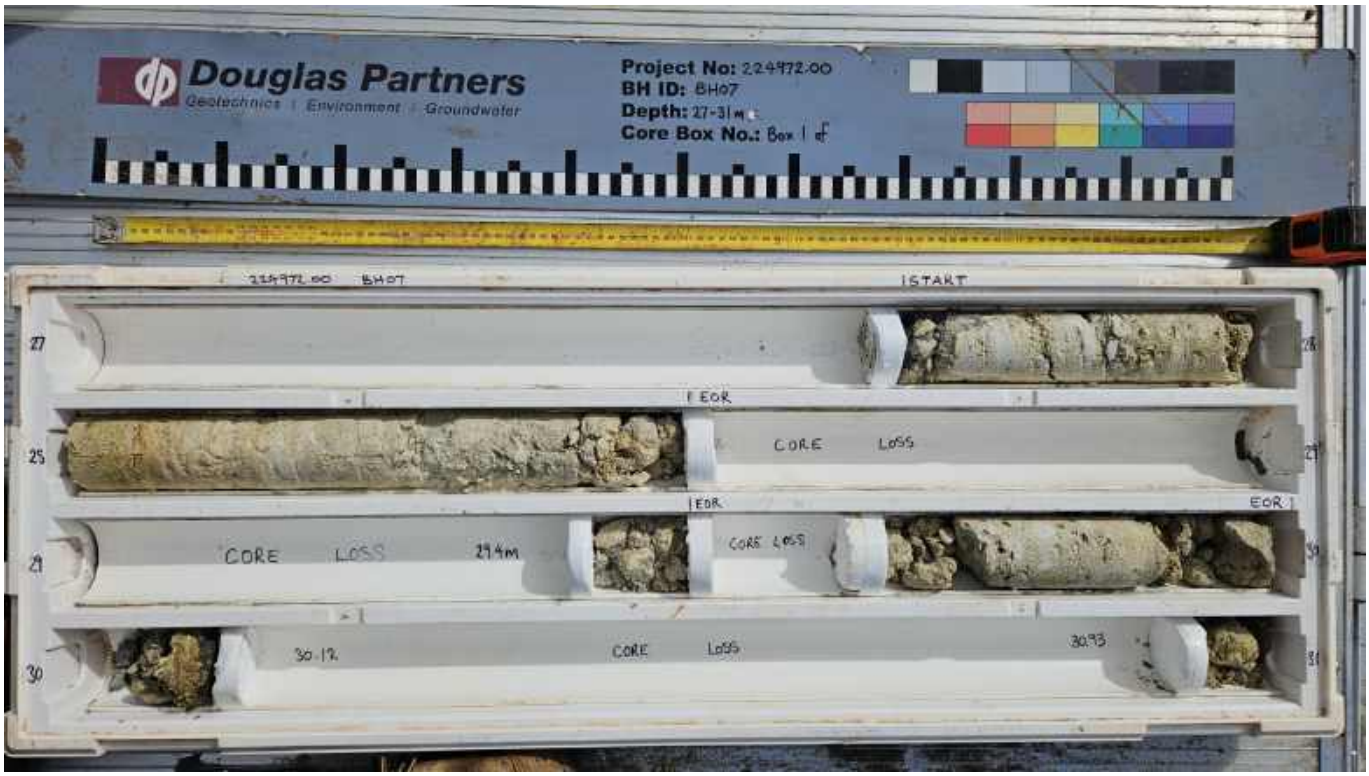
Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
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LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 1 of 2



BH07 - Box 1 of 3: 27.00-31.00 m depth



BH07 - Box 2 of 3: 31.00-35.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

CORE PHOTO LOG

CLIENT: Cargill Australia Ltd (NCL)
PROJECT: Proposed Industrial Development
LOCATION: Patterson Road, Rockingham, WA

SURFACE LEVEL: 4.2 AHD
COORDINATE: E:383028.2, N:6430060.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH07
PROJECT No: 224972.00
DATE: 27/05/24 - 31/05/24
SHEET: 2 of 2



BH07 - Box 3 of 3: 35.00-39.00 m depth

Generated with CORE-GS by Geroc - Split Soil-Rock Log

environmental test solutions

DELIVERY DOCKET

Rental Number : H20240601682

Invoice Number :

Docket Date : 12/06/2024

Reference Number: PE251546

Delivery Date 12/06/2024 12:00 AM

Sales Person : Williams Clive

Environmental Test Solutions Pty Ltd
Unit 3/30 Paramount Drive
Wangara
Perth
WA 6065
Australia
Phone No. 08 9344 7831
ABN : 90 614 506 286

Bill To
Douglas Partners
36 O'Malley Street
Osborne Park
WA 6017
accounts.payable.invoices@douglaspartners.com.au
9204 3011

Ship To
Rob
36 O'Malley Street
Osborne Park
WA 6017
accounts.payable.invoices@douglaspartners.com.au
9204 3011

Item Code	Item Name	Serial Number	Bin Location	Qty	Check	Comments
PID Minirae Lite	Minirae Lite Photolonisation detector	595-000866	Reception	1.00	☑	
SHIPPING	Shipping			1.00	☑	

Comments :

All rented equipment is the responsibility of the client whilst in their possession.
If rentals are held longer than the end date, charges will continue to be applied as stated here.
BANK ACCOUNT DETAILS FOR PAYMENTS
Bank: Commonwealth BSB: 062-692 Account No: 78915928
All payments due 30 days after invoice date unless otherwise agreed upon.

Received By : Chris Lachy

Received Date : 12/06/24

Signature :

Rob Shapland

From: John Hammon <john.hammon@bcesurveying.com.au>
Sent: Tuesday, July 9, 2024 10:37 AM
To: Rob Shapland
Cc: BCE Admin; Damian Morris; Chris Mcintosh
Subject: P2010: Survey and Leveling of Nine Groundwater Monitoring Wells - Patterson Road - Rockingham deliverables

Morning Rob,

Here are the updated levels for the requested wells.

MGA94 Coordinates			
Point ID	Easting	Northing	Elevation
MW101	382846.742	6430087.403	4.320
MW102	382929.044	6429844.040	4.472
MW103	383126.900	6429752.403	4.353
MW104	383233.853	6429860.869	4.195
MW105	382989.640	6429954.744	4.149
BH1	382754.010	6429980.235	4.372
BH7	383028.174	6430060.170	4.674
GMWELL	382803.676	6429871.942	4.931

If you have any further questions, feel free to get in touch.

Thanks

Please confirm you have received the attached files via return email.

Best regards

John Hammon
WA State Manager

BCE Surveying Pty Ltd
M 0457 741 120
P 08 9791 7411
E John.Hammon@bcesurveying.com.au

Appendix G

Summary of Soil Analytical Results

EIL Calculation Sheets

95% UCL Calculation Sheet (Nickel)

Laboratory Reports and Chain of Custody Forms

Table G-1: Summary of Soil Analytical Results (Locations TP39 to TP54)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP39	TP40	TP41	TP42	TP43	TP44	TP45	TP46	TP47	TP48
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.15	0.05-0.15	0.05-0.15	0.1-0.2	0.1-0.2	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
													19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
General Physical Parameters																						
pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cation Exchange Capacity	meq/100	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	%	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals / metalloids																						
Aluminium	mg/kg	10	-	-	-	-	-	-	-	-	-	-	**1100**	**1100**	**1000**	**1100**	**1200**	**910**	**1300**	**1100**	**1200**	**1200**
Arsenic	mg/kg	4	3000	-	-	-	-	160	-	-	-	-	**5.9**	**6.9**	**6.6**	**7**	**5.7**	**6.3**	**6.8**	**5.3**	<4.0	<4.0
Boron	mg/kg	10	300,000	-	-	-	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Barium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**7.1**	**6.6**	**7.3**	**6.5**	**8.8**	**6.4**	**8**	**8**	**6.3**	**11**
Beryllium	mg/kg	1	500	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.4	900	-	-	-	-	-	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1	4000	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**1.4**
Chromium	mg/kg	1	3600	-	-	-	-	460	-	-	-	-	**10**	**11**	**10**	**11**	**11**	**11**	**13**	**11**	**10**	**10**
Copper	mg/kg	1	240000	-	-	-	-	160	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**5**
Iron	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/kg	0.1	730	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	mg/kg	1	60000	-	-	-	-	-	-	-	-	-	**41**	**26**	**41**	**26**	**51**	**46**	**49**	**28**	**18**	**33**
Nickel	mg/kg	1	6000	-	-	-	-	70	-	-	-	-	**9.4**	**3.3**	**8.4**	**2.3**	**12**	**8.4**	**9.7**	**6**	**4.1**	**72**
Lead	mg/kg	1	1500	-	-	-	-	1800	-	-	-	-	**3.4**	**2.9**	**2.9**	**2.7**	**3.7**	**3.1**	**3.7**	**3**	**3**	**6.9**
Selenium	mg/kg	2	10000	-	-	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**5.1**	**5.2**	**5**	**5**	**4.9**	**5.3**	**6.1**	**4.7**	**2.6**	**3.6**
Zinc	mg/kg	1	400000	-	-	-	-	440	-	-	-	-	**1.3**	**1.3**	**1.4**	**1.1**	**1.5**	**1.3**	**1.5**	**1.3**	<1.0	**7**
Total Recoverable Hydrocarbons																						
TRH C6 - C9	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6 - C10	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	-	260	370	NL	NL	-	215	700	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C10 - C14	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH C15 - C28	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C10 - C16	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C10-C16 less N (F2)	mg/kg	50	-	NL	NL	NL	NL	-	170	1,000	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C16 - C34	mg/kg	100	-	-	-	-	-	-	1700	2,500	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40	mg/kg	100	-	-	-	-	-	-	3300	10,000	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Monocyclic Aromatic Hydrocarbons																						
MTBE	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzene	mg/kg	0.2	-	3	3	77	160	-	75	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	-	NL	NL	NL	NL	-	135	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	1	-	NL	NL	NL	NL	-	165	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	2	-	230	NL	NL	NL	-	180	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-xylene	mg/kg	1	-			NL	NL	-		-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	mg/kg	1	-	NL	NL	NL	NL	370	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons																						
Naphthalene	mg/kg	0.1	-	NL	NL	NL	NL	370	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.05	-	-	-	-	-	-	0.7	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.5	40	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	0.05	4000	-	-	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Per- and Poly-fluoronated Alkyl Substances																						
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	1,000 [10]	**0.35**	**0.16**	**0.2**	<0.1	**0.18**	**0.18**	**0.17**	<0.1	**0.16**	**0.34**
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid (PFBA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	**0.2**	**0.25**	<0.2	<0.2	**0.22**	<0.2	<0.2	<0.2
Perfluoropentanoic acid (PFPeA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	-	-	-	-	-	-	-	-	50,000	10,000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid (PFNA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Table G-1: Summary of Soil Analytical Results (Locations TP39 to TP54)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP39	TP40	TP41	TP42	TP43	TP44	TP45	TP46	TP47	TP48
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.15	0.05-0.15	0.05-0.15	0.1-0.2	0.1-0.2	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
													19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Total +ve PFHxS+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	20,000	-	**0.35**	**0.16**	**0.2**	<0.1	**0.18**	**0.18**	**0.17**	<0.1	**0.16**	**0.34**
Total +ve PFOA+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	**0.35**	**0.16**	**0.2**	<0.1	**0.18**	**0.18**	**0.17**	<0.1	**0.16**	**0.34**
Total +ve PFAS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	**0.35**	**0.16**	**0.2**	**0.25**	**0.18**	**0.18**	**0.17**	<0.1	**0.16**	**0.34**

Notes:

1- Health Investigtion Levels (NEPM - Schedule B1, 2013) - HIL D: Commercial/Industrial
2- Health Screening Levels (NEPM - Schedule B1, 2013) - HSL D: Commercial/Industrial: Sand
3- Ecological Investigation Levels (NEPM - Schedule B1, 2013) - EIL D: Commercial/Industrial
4- Ecological Screening Levels (NEPM - Schedule B1, 2013) - ESL D: Commercial/Industrial
5- Management Limits (NEPM - Schedule B1, 2013) - Coarse.
6- HEPA, PFAS NEMP - Soil criteria for investigation – human health based guidance values (HIL D)
7- HEPA, PFAS NEMP - Soil criteria for investigation – ecological based guidance values for direct exposure and [indirect exposure]

150	Bold cells indicate result greater than Laboraotry Limit of Reporintg (LOR) but below SAC
170	Bold + yellow highlighted cells indicate exceedance of adopted ecological assessment criteria.
170	Bold + red highlighted cells indicate exceedance of adopted human health assessment criteria.

Table G-1: Summary of Soil Analytical Results (Locations TP55 to TP68)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP55	TP56	TP57	TP58	TP59	TP60	TP61	TP62	TP63	TP63
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.1-0.2	0.1-0.2	0.05-0.15	0.5-0.6
													20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024
General Physical Parameters																						
pH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cation Exchange Capacity	meq/100	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	%	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals / metalloids																						
Aluminium	mg/kg	10	-	-	-	-	-	-	-	-	-	-	**1100**	**930**	**910**	**2100**	**1300**	**1300**	**1200**	**1200**	**1100**	**1100**
Arsenic	mg/kg	4	3000	-	-	-	-	160	-	-	-	-	**6.8**	**5.6**	**5**	<4.0	5.2	7.4	7.1	6.4	6.3	<4.0
Boron	mg/kg	10	300,000	-	-	-	-	-	-	-	-	-	<10	<10	**14**	**11**	<10	<10	<10	<10	10	<10
Barium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**7.8**	**8.2**	**12**	**31**	**10**	**9.6**	**8.6**	**9.3**	**8.9**	**10**
Beryllium	mg/kg	1	500	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.4	900	-	-	-	-	-	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1	4000	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	**1.3**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1	3600	-	-	-	-	460	-	-	-	-	**12**	**9.8**	**7.2**	**10**	**11**	**12**	**11**	**11**	**10**	**9**
Copper	mg/kg	1	240000	-	-	-	-	160	-	-	-	-	<1.0	<1.0	**2.1**	**12**	**2.7**	**1.3**	**1.1**	**2.2**	**1**	<1.0
Iron	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/kg	0.1	730	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	mg/kg	1	60000	-	-	-	-	-	-	-	-	-	**35**	**29**	**52**	**150**	**29**	**43**	**36**	**44**	**35**	**45**
Nickel	mg/kg	1	6000	-	-	-	-	70	-	-	-	-	**3.8**	**6.8**	**38**	**50**	**37**	**20**	**12**	**31**	**17**	**13**
Lead	mg/kg	1	1500	-	-	-	-	1800	-	-	-	-	**3.7**	**3.3**	**5.7**	**15**	**4.7**	**4.1**	**3.4**	**4.4**	**3.7**	**3.4**
Selenium	mg/kg	2	10000	-	-	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**5.4**	**4.7**	**3.3**	**3.3**	**4.8**	**5.7**	**5.3**	**5.3**	**4.6**	**3.9**
Zinc	mg/kg	1	400000	-	-	-	-	440	-	-	-	-	**1.7**	**1.4**	**2.1**	**7.7**	**4.8**	**1.9**	**2.1**	**2.1**	**2.3**	**1.1**
Total Recoverable Hydrocarbons																						
TRH C6 - C9	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6 - C10	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	-	260	370	NL	NL	-	215	700	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C10 - C14	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH C15 - C28	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C10 - C16	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C10-C16 less N (F2)	mg/kg	50	-	NL	NL	NL	NL	-	170	1,000	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C16 - C34	mg/kg	100	-	-	-	-	-	-	1700	2,500	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40	mg/kg	100	-	-	-	-	-	-	3300	10,000	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Monocyclic Aromatic Hydrocarbons																						
MTBE	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzene	mg/kg	0.2	-	3	3	77	160	-	75	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	-	NL	NL	NL	NL	-	135	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	1	-	NL	NL	NL	NL	-	165	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	2	-	230	NL	NL	NL	-	180	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-xylene	mg/kg	1	-			NL	NL	-		-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	mg/kg	1	-	NL	NL	NL	NL	370	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons																						
Naphthalene	mg/kg	0.1	-	NL	NL	NL	NL	370	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.05	-	-	-	-	-	-	0.7	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.5	40	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	0.05	4000	-	-	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Per- and Poly-fluoronated Alkyl Substances																						
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	**0.18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	**0.31**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	1,000 [10]	**0.17**	**0.22**	**0.31**	**16** NEMP, ECO	**0.65**	**0.21**	**0.23**	**0.22**	<0.1	<0.1
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid (PFBA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	**0.32**	**0.29**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.22**	<0.2
Perfluoropentanoic acid (PFPeA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	**0.21**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	-	-	-	-	-	-	-	-	50,000	10,000	<0.1	<0.1	<0.1	**4.3**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorononanoic acid (PFNA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	**0.11**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Table G-1: Summary of Soil Analytical Results (Locations TP55 to TP68)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP55	TP56	TP57	TP58	TP59	TP60	TP61	TP62	TP63	TP63
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.1-0.2	0.1-0.2	0.05-0.15	0.5-0.6
													20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024
Total +ve PFHxS+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	20,000	-	**0.17**	**0.22**	**0.31**	**16**	**0.65**	**0.21**	**0.23**	**0.22**	**0.22**	<0.1
Total +ve PFOA+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	**0.17**	**0.22**	**0.31**	**20**	**0.65**	**0.21**	**0.23**	**0.22**	**0.22**	<0.1
Total +ve PFAS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	**0.17**	**0.54**	**0.6**	**21**	**0.65**	**0.21**	**0.23**	**0.22**	**0.22**	<0.1

Notes:

1- Health Investigtion Levels (NEPM - Schedule B1, 2013) - HIL D: Commercial/Industrial
2- Health Screening Levels (NEPM - Schedule B1, 2013) - HSL D: Commercial/Industrial: Sand
3- Ecological Investigation Levels (NEPM - Schedule B1, 2013) - EIL D: Commercial/Industrial
4- Ecological Screening Levels (NEPM - Schedule B1, 2013) - ESL D: Commercial/Industrial
5- Management Limits (NEPM - Schedule B1, 2013) - Coarse.
6- HEPA, PFAS NEMP - Soil criteria for investigation – human health based guidance values (HIL D)
7- HEPA, PFAS NEMP - Soil criteria for investigation – ecological based guidance values for direct exposure and [indirect exposure]

150	Bold cells indicate result greater than Laboraotry Limit of Reporintg (LOR) but below SAC
170	Bold + yellow highlighted cells indicate exceedance of adopted ecological assessment criteria.
170	Bold + red highlighted cells indicate exceedance of adopted human health assessment criteria.

Table G-1: Summary of Soil Analytical Results (Locations TP69 to TP77)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP69	TP70	TP71	TP72	TP73	TP74	TP75	TP76	TP77	Rep1-1
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.10	0.05-0.15	0.05-0.15	0.1-0.2	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	
													19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024	18/06/2024
General Physical Parameters																						
pH	-	-	-	-	-	-	-	-	-	-	-	-	9	8.9	-	-	-	-	-	-	-	-
Cation Exchange Capacity	meq/100	0.1	-	-	-	-	-	-	-	-	-	-	5.6	5	-	-	-	-	-	-	-	-
Total Organic Carbon	%	0.01	-	-	-	-	-	-	-	-	-	-	1	1.1	-	-	-	-	-	-	-	-
Metals / metalloids																						
Aluminium	mg/kg	10	-	-	-	-	-	-	-	-	-	-	**1500**	**1100**	**100**	**1700**	**1300**	**1900**	**1400**	**1000**	**980**	**1200**
Arsenic	mg/kg	4	3000	-	-	-	-	160	-	-	-	-	<4.0	**7.5**	**7.4**	**6.1**	**7.9**	**6.4**	**7.2**	**5.4**	**6.4**	**7.6**
Boron	mg/kg	10	300,000	-	-	-	-	-	-	-	-	-	<10	<10	**12**	**14**	<10	<10	**12**	**12**	<10	<10
Barium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**11**	**9**	**9.6**	**17**	**9.3**	**16**	**10**	**12**	**14**	**7.4**
Beryllium	mg/kg	1	500	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.4	900	-	-	-	-	-	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1	4000	-	-	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	**1.2**	<1.0	**2.3**	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1	3600	-	-	-	-	460	-	-	-	-	**12**	**13**	**11**	**13**	**13**	**16**	**15**	**11**	**9.4**	**13**
Copper	mg/kg	1	240000	-	-	-	-	160	-	-	-	-	<1.0	**1.3**	<1.0	**4.8**	**2.4**	**7.1**	<1.0	<1.0	<1.0	<1.0
Iron	mg/kg	10	-	-	-	-	-	-	-	-	-	-	**2700**	**2500**	-	-	-	-	-	-	-	-
Mercury	mg/kg	0.1	730	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	mg/kg	1	60000	-	-	-	-	-	-	-	-	-	**50**	**46**	**22**	**71**	**49**	**46**	**47**	**30**	**67**	**30**
Nickel	mg/kg	1	6000	-	-	-	-	70	-	-	-	-	**3.5**	**16**	**14**	**70** [EIL]	**29**	**74** [EIL]	**8.7**	**11**	**6.1**	**7.8**
Lead	mg/kg	1	1500	-	-	-	-	1800	-	-	-	-	**3.3**	**5.2**	**5.4**	**14**	**7.4**	**15**	**4.3**	**4.1**	**3.7**	**3.5**
Selenium	mg/kg	2	10000	-	-	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1	-	-	-	-	-	-	-	-	-	-	**3.1**	**6.7**	**6.2**	**5.5**	**7.2**	**6.3**	**6.1**	**5.3**	**3.5**	**6**
Zinc	mg/kg	1	400000	-	-	-	-	440	-	-	-	-	1.2	2.2	2.4	4.5	3.3	3.9	2.2	29	1.7	1.8
Total Recoverable Hydrocarbons																						
TRH C6 - C9	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6 - C10	mg/kg	25	-	-	-	-	-	-	-	-	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	-	260	370	NL	NL	-	215	700	-	-	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C10 - C14	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH C15 - C28	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C29 - C36	mg/kg	100	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C10 - C16	mg/kg	50	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C10-C16 less N (F2)	mg/kg	50	-	NL	NL	NL	NL	-	170	1,000	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C16 - C34	mg/kg	100	-	-	-	-	-	-	1700	2,500	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH >C34 - C40	mg/kg	100	-	-	-	-	-	-	3300	10,000	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Monocyclic Aromatic Hydrocarbons																						
MTBE	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzene	mg/kg	0.2	-	3	3	77	160	-	75	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	-	NL	NL	NL	NL	-	135	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	1	-	NL	NL	NL	NL	-	165	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	2	-	230	NL	NL	NL	-	180	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-xylene	mg/kg	1	-			NL	NL	-		-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	mg/kg	1	-	NL	NL	NL	NL	370	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons																						
Naphthalene	mg/kg	0.1	-	NL	NL	NL	NL	370	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.05	-	-	-	-	-	-	0.7	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.5	40	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	0.05	4000	-	-	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Per- and Poly-fluoronated Alkyl Substances																						
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	1,000 [10]	<0.1	**0.2**	<0.1	**0.12**	**0.25**	**0.59**	**0.46**	**7.7**	**0.14**	**0.13**
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorobutanoic acid (PFBA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	**0.31**	<0.2	<0.2	<0.2	**0.33**	**0.24**	<0.2
Perfluoropentanoic acid (PFPeA)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.16**	<0.1	<0.1	<0.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.17**	<0.1	<0.1	<0.1
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	-	-	-	-	-	-	-	-	50,000	10,000	<0.1	<0.1	<0.1	**0.11**	<0.1	**0.18**	**0.23**	**1.9**	<0.1	<0.1
Perfluorononanoic acid (PFNA)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.5	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Table G-1: Summary of Soil Analytical Results (Locations TP69 to TP77)

Analyte Group / Analyte	Unit	LOR	HIL-D[1]	HSL-D[2]		Intrusive Maintenance Worker		EIL[3]	ESL[4]	ML-D [5]	PFAS NEMP [6]	PFAS NEMP [7]	TP69	TP70	TP71	TP72	TP73	TP74	TP75	TP76	TP77	Rep1-1
				0 to <1 m	1 to <2 m	2 - <4m	>4m						0.05-0.10	0.05-0.15	0.05-0.15	0.1-0.2	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15	
													19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024	18/06/2024
Total +ve PFHxS+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	20,000	-	<0.1	**0.2**	<0.1	**0.12**	**0.25**	**0.59**	**0.46**	**7.7**	**0.14**	**0.13**
Total +ve PFOA+PFOS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	**0.2**	<0.1	**0.23**	**0.25**	**0.77**	**0.69**	**9.6**	**0.14**	**0.13**
Total +ve PFAS	µg/kg	0.1	-	-	-	-	-	-	-	-	-	-	<0.1	**0.2**	<0.1	**0.54**	**0.25**	**0.77**	**1**	**10**	**0.38**	**0.13**

Notes:

1- Health Investigtion Levels (NEPM - Schedule B1, 2013) - HIL D: Commercial/Industrial
2- Health Screening Levels (NEPM - Schedule B1, 2013) - HSL D: Commercial/Industrial: Sand
3- Ecological Investigation Levels (NEPM - Schedule B1, 2013) - EIL D: Commercial/Industrial
4- Ecological Screening Levels (NEPM - Schedule B1, 2013) - ESL D: Commercial/Industrial
5- Management Limits (NEPM - Schedule B1, 2013) - Coarse.
6- HEPA, PFAS NEMP - Soil criteria for investigation – human health based guidance values (HIL D)
7- HEPA, PFAS NEMP - Soil criteria for investigation – ecological based guidance values for direct exposure and [indirect exposure]

150	Bold cells indicate result greater than Laboraotry Limit of Reporintg (LOR) but below SAC
170	Bold + yellow highlighted cells indicate exceedance of adopted ecological assessment criteria.
170	Bold + red highlighted cells indicate exceedance of adopted human health assessment criteria.

Inputs
Select contaminant from list below
As
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	Arsenic generic EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	20	40
Urban residential and open public spaces	50	100
Commercial and industrial	80	160

Inputs
Select contaminant from list below
Pb
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	Lead generic EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	110	470
Urban residential and open public spaces	270	1100
Commercial and industrial	440	1800

Inputs
Select contaminant from list below
Cu
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.3
Enter soil pH (calcium chloride method) (values from 1 to 14)
8.9
Enter organic carbon content (%OC) (values from 0 to 50%)
0.1
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
0.25
or for aged ABCs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	25	50
Urban residential and open public spaces	55	120
Commercial and industrial	80	160

Inputs
Select contaminant from list below
Ni
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.3
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
0.25
or for aged ABCs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Ni soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	4	10
Urban residential and open public spaces	15	45
Commercial and industrial	25	70

Inputs
Select contaminant from list below
Cr_III
Below needed to calculate fresh and aged ACLs
Enter % clay (values from 0 to 100%)
3
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
0.25
or for aged ABCs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Cr III soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	40	100
Urban residential and open public spaces	110	280
Commercial and industrial	180	460

Inputs
Select contaminant from list below
Zn
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
5.3
Enter soil pH (calcium chloride method) (values from 1 to 14)
8.9
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
0.25
or for aged ABCs only
Enter State (or closest State)
SA
Enter traffic volume (high or low)
low

Outputs		
Land use	Zn soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	30	110
Urban residential and open public spaces	100	300
Commercial and industrial	150	440

General UCL Statistics for Full Data Sets

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Number of Valid Observations	39	Number of Distinct Observations	33

Raw Statistics

Minimum	2.3
Maximum	78
Mean	21.29
Geometric Mean	12.7
Median	11
SD	22.64
Std. Error of Mean	3.625
Coefficient of Variation	1.063
Skewness	1.433

Log-transformed Statistics

Minimum of Log Data	0.833
Maximum of Log Data	4.357
Mean of log Data	2.542
SD of log Data	1.031

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.757
Shapiro Wilk Critical Value	0.939

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	27.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	28.14
95% Modified-t UCL (Johnson-1978)	27.54

Gamma Distribution Test

k star (bias corrected)	1.037
Theta Star	20.53
MLE of Mean	21.29
MLE of Standard Deviation	20.9
nu star	80.9
Approximate Chi Square Value (.05)	61.17
Adjusted Level of Significance	0.0437
Adjusted Chi Square Value	60.5
Anderson-Darling Test Statistic	1.352
Anderson-Darling 5% Critical Value	0.776
Kolmogorov-Smirnov Test Statistic	0.176
Kolmogorov-Smirnov 5% Critical Value	0.145

Data not Gamma Distributed at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.939

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	32.47
95% Chebyshev (MVUE) UCL	39.03
97.5% Chebyshev (MVUE) UCL	46.75
99% Chebyshev (MVUE) UCL	61.93

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	27.25
95% Jackknife UCL	27.4
95% Standard Bootstrap UCL	27.15
95% Bootstrap-t UCL	28.47
95% Hall's Bootstrap UCL	27.81
95% Percentile Bootstrap UCL	27.38
95% BCA Bootstrap UCL	27.96
95% Chebyshev(Mean, Sd) UCL	37.09
97.5% Chebyshev(Mean, Sd) UCL	43.93

Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	57.36
95% Approximate Gamma UCL (Use when n >= 40)	28.15		
95% Adjusted Gamma UCL (Use when n < 40)	28.47		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	37.09

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Sample Receipt Advice PFF0839

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	224972.01 - Crux Rockingham
Envirolab Reference	PFF0839
Date Sample Received	14/06/2024
Date Instructions Received	14/06/2024
Date Final Results Expected	18/06/2024

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	3 Material
Turnaround Time	2 Days
Temperatures / Cooling Methods	20.0°C No Cooling

Additional Info

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

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

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

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

Please direct any queries to:

Heram Halim

Phone	08 9317 2505
Email	hhalim@mpl.com.au

Meredith Conroy

Phone	08 9317 2505
Email	mconroy@mpl.com.au

Analysis underway, details on the following page

Sample Receipt Advice PFF0839

Analysis Grid

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

	Asbestos-Bulk Materials
PFF0839-01 Material | 14/06/2024 ASB1	•
PFF0839-02 Material | 14/06/2024 ASB2	•
PFF0839-03 Material | 14/06/2024 ASB3	•

Suite Details

Suite Name	Suite Analyses
Asbestos-Bulk Materials|Material	Description, Dimension, Material, Trace

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16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PFF0839

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	224972.01 - Crux Rockingham
Number of Samples	3 Material
Date Samples Received	14/06/2024
Date Instructions Received	14/06/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	18/06/2024
Date of Issue	18/06/2024

NATA Accreditation Number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Asbestos Approved By	Analysed by Asbestos Approved Analyst: Lalanee Rupasinghe Authorised by Asbestos Approved Signatory: Thomas Edwards
Results Approved By	Thomas Edwards, OHL Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PFF0839

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PFF0839-01	ASB1	Material	14/06/2024	14/06/2024
PFF0839-02	ASB2	Material	14/06/2024	14/06/2024
PFF0839-03	ASB3	Material	14/06/2024	14/06/2024

Certificate of Analysis PFF0839

Asbestos ID in Material

Client ID	Envirolab ID	Description	Result
ASB1	PFF0839-01	120x60x5mm Fibre Cement	**No Asbestos Detected** **No trace fibres detected** Organic fibres detected
ASB2	PFF0839-02	90x60x5mm Fibre Cement	**No Asbestos Detected** **No trace fibres detected** Organic fibres detected
ASB3	PFF0839-03	50x60x5mm Fibre Cement	**Asbestos Detected** **Trace Analysis Not Applicable** Chrysotile asbestos detected

Method Summary

Method ID	Methodology Summary
ASB-001_AS4964	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004. When mineral fibres of unknown type are detected by polarized light microscopy including dispersion staining, the fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required. Visible asbestos is defined as asbestos detected below the reporting limit of 0.1g/kg as per AS4964-2004

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

Miscellaneous Information

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

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

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFF0839

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	224972.01 - Crux Rockingham
Date Issued	18/06/2024

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFF0839

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Asbestos-Bulk Materials | Material	1-3	14/06/2024	18/06/2024	18/06/2024	Yes

Douglas Partners Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Cryx Nodanshan
Project No: 72419772-01 ..... 16 – 18 Hayden Court
DP Contact Person: Rob Shapland
Prior Storage: esky / fridge / shelved

To: MPL Envirolab
Myaree
Ph: 9317 2505

Sample ID	Sampling Time / Date	Sample Type S-soil W-water	Preservation	Lab ID	Asbestos												NOTES
AS1	1	Eag	Sbf		✓												
AS2	2	"	"		✓												
AS3	3	"	"		✓												
LOR (S)																	
LOR (W)																	

mpl Laboratories ENVIROLAB
Job No: PFC0839
Date Rec - 14 JUN 2024
Time Rec - 0930
Rec By - QO
TAT Req - SAME 1 / 2 / 3 STD
Temp - cool / ambient
Cooling - Ice / Ice pack / None
Security Seal - Yes / No

LOR = Limit of Reporting, *As per Laboratory Method Detection Limit

Sampled By: [signature] Relinquished By: [signature] Sign: [signature] Date/Time: 14/6/24
Received By: Mailed Relinquished By: _____ Sign: QO Date/Time: 14 JUN 2024

** IMPORTANT: PLEASE SIGN AND DATE TO ACKNOWLEDGE RECIEPT OF SAMPLES AND RETURN BY EMAIL**

Send Results to:
Douglas Partners Pty Ltd
36 O'Malley Street
OSBORNE PARK 6017
Ph: (08) 9204 3511
Fax: (08) 9204 3522
Accounts: perth@douglaspartners.com.au

Douglas PARTNERS | GROUNDED EXPERTISE

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

PURCHASE ORDER

Date	14-Jun-24
PO No.	PE251549

Vendor/ Subcontractor:
MPL
Contact Name: Kiara

Deliver To:
Douglas Partners Pty Ltd
Requisitioner: RS

This order covers the supply of goods, materials or services shown here, subject to the terms and conditions of the purchase order.

PO number or **Project number** and **Requisitioner** should always be quoted in your invoice.

To ensure prompt payment, please attach this PO to your invoice and **email** it directly to **apinvoices@douglaspartners.com.au** in PDF format.

Item	Description	Quantity	Unit Price	Total	Project No. & G/L Code
	As per COC				512
					224972.01

Comments or Special Instructions

SUBTOTAL	
GST/TAX	
SHIPPING/ OTHER	
TOTAL	

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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lab@mpl.com.au
www.mpl.com.au

Sample Receipt Advice PFF1497

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	224972.01 - Rockingham
Envirolab Reference	PFF1497
Date Sample Received	25/06/2024
Date Instructions Received	25/06/2024
Date Interim Results Expected	02/07/2024
Date Final Results Expected	04/07/2024

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	49 Soil
Turnaround Time	7 Days
Temperatures / Cooling Methods	-1.0°C On Ice

Additional Info

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

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

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

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

Please direct any queries to:

Heram Halim

Phone	08 9317 2505
Email	hhalim@mpl.com.au

Meredith Conroy

Phone	08 9317 2505
Email	mconroy@mpl.com.au

Analysis underway, details on the following page

Sample Receipt Advice PFF1497

Analysis Grid

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

	TRH & BTEXN NEPM w/ MTBE	CEC	PFAS-Extended	BTEX TS	PAH	Metals	Metals-Hg	TOC by Combustion	pH	Moisture	1:5 Soil:Water Extraction
PFF1497-01 Soil | 19/06/2024 39 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-02 Soil | 18/06/2024 40 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-03 Soil | 18/06/2024 41 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-04 Soil | 18/06/2024 42 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-05 Soil | 18/06/2024 43 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-06 Soil | 19/06/2024 44 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-07 Soil | 19/06/2024 45 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-08 Soil | 18/06/2024 46 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-09 Soil | 18/06/2024 47 | 0.1m-0.15m	•		•		•	•	•			•	
PFF1497-10 Soil | 18/06/2024 48 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-11 Soil | 19/06/2024 49 | 0.05m-0.1m	•		•		•	•	•			•	
PFF1497-12 Soil | 20/06/2024 50 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-13 Soil | 18/06/2024 51 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-14 Soil | 18/06/2024 52 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-15 Soil | 18/06/2024 53 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-16 Soil | 20/06/2024 54 | 0.05m-0.15m	•		•		•	•	•			•	

Sample Receipt Advice PFF1497

Analysis Grid *(Cont.)*

	TRH & BTEXN NEPM w/ MTBE	CEC	PFAS-Extended	BTEX TS	PAH	Metals	Metals-Hg	TOC by Combustion	pH	Moisture	1:5 Soil:Water Extraction
PFF1497-17 Soil | 20/06/2024 55 | 0.05m-0.1m	•		•		•	•	•			•	
PFF1497-18 Soil | 20/06/2024 56 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-19 Soil | 20/06/2024 57 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-20 Soil | 20/06/2024 58 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-21 Soil | 20/06/2024 59 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-22 Soil | 18/06/2024 60 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-23 Soil | 18/06/2024 61 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-24 Soil | 18/06/2024 62 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-25 Soil | 19/06/2024 63 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-26 Soil | 19/06/2024 63 | 0.5m-0.6m	•		•		•	•	•			•	
PFF1497-27 Soil | 20/06/2024 64 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-28 Soil | 20/06/2024 65 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-29 Soil | 20/06/2024 65 | 0.9m-1m	•		•		•	•	•			•	
PFF1497-30 Soil | 19/06/2024 66 | 0.05m-0.1m	•		•		•	•	•			•	
PFF1497-31 Soil | 19/06/2024 67 | 0.05m-0.1m	•		•		•	•	•			•	
PFF1497-32 Soil | 19/06/2024 68 | 0.05m-0.1m	•		•		•	•	•			•	

Sample Receipt Advice PFF1497

Analysis Grid *(Cont.)*

	TRH & BTEXN NEPM w/ MTBE	CEC	PFAS-Extended	BTEX TS	PAH	Metals	Metals-Hg	TOC by Combustion	pH	Moisture	1:5 Soil:Water Extraction
PFF1497-33 Soil | 19/06/2024 69 | 0.05m-0.15m	•	•	•		•	•	•	•	•	•	•
PFF1497-34 Soil | 19/06/2024 70 | 0.05m-0.15m	•	•	•		•	•	•	•	•	•	•
PFF1497-35 Soil | 19/06/2024 71 | 0.05m-0.1m	•		•		•	•	•			•	
PFF1497-36 Soil | 19/06/2024 72 | 0.1m-0.2m	•		•		•	•	•			•	
PFF1497-37 Soil | 19/06/2024 73 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-38 Soil | 20/06/2024 74 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-39 Soil | 20/06/2024 75 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-40 Soil | 20/06/2024 76 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-41 Soil | 20/06/2024 77 | 0.05m-0.15m	•		•		•	•	•			•	
PFF1497-42 Soil | 18/06/2024 Rep 1-1	•		•		•	•	•			•	
PFF1497-43 Soil | 18/06/2024 Rep 2-1			•							•	
PFF1497-44 Soil | 19/06/2024 Rep 3-1	•		•		•	•	•			•	
PFF1497-45 Soil | 19/06/2024 Rep 4-1			•							•	
PFF1497-46 Soil | 20/06/2024 Rep 5-1	•		•		•	•	•			•	
PFF1497-47 Soil | 18/06/2024 Trip Spike				•							
PFF1497-48 Soil | 19/06/2024 Trip Spike				•							

Sample Receipt Advice PFF1497

Analysis Grid *(Cont.)*

	TRH & BTEXN NEPM w/ MTBE	CEC	PFAS-Extended	BTEX TS	PAH	Metals	Metals-Hg	TOC by Combustion	pH	Moisture	1:5 Soil:Water Extraction
PFF1497-49 Soil | 20/06/2024 Trip Spike				•							

Suite Details

Suite Name	Suite Analyses
TRH & BTEXN NEPM w/ MTBE|Soil	vTRH&MBTEXN, sTRH
CEC|Soil	CEC, Exchangeable Cations
PFAS-Extended|Soil	PFAS EXT-ISTD, PFAS-Extended

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Certificate of Analysis PFF1497

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	224972.01 - Rockingham
Number of Samples	49 Soil
Date Samples Received	25/06/2024
Date Instructions Received	25/06/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	04/07/2024
Date of Issue	04/07/2024

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Authorisation Details

Results Approved By	Ben Carpenter, Metals Technician Heram Halim, Operations Manager Sean McAlary, Chemist Stacey Hawkins, ASS/AMD Supervisor Travis Carey, Organics Supervisor Varsha Ho Wing, Inorganics and Metals Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PFF1497

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PFF1497-01	39	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-02	40	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-03	41	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-04	42	0.10-0.20	Soil	18/06/2024	25/06/2024
PFF1497-05	43	0.10-0.20	Soil	18/06/2024	25/06/2024
PFF1497-06	44	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-07	45	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-08	46	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-09	47	0.10-0.15	Soil	18/06/2024	25/06/2024
PFF1497-10	48	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-11	49	0.05-0.10	Soil	19/06/2024	25/06/2024
PFF1497-12	50	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-13	51	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-14	52	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-15	53	0.10-0.20	Soil	18/06/2024	25/06/2024
PFF1497-16	54	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-17	55	0.05-0.10	Soil	20/06/2024	25/06/2024
PFF1497-18	56	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-19	57	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-20	58	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-21	59	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-22	60	0.05-0.15	Soil	18/06/2024	25/06/2024
PFF1497-23	61	0.10-0.20	Soil	18/06/2024	25/06/2024
PFF1497-24	62	0.10-0.20	Soil	18/06/2024	25/06/2024
PFF1497-25	63	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-26	63	0.50-0.60	Soil	19/06/2024	25/06/2024
PFF1497-27	64	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-28	65	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-29	65	0.90-1.00	Soil	20/06/2024	25/06/2024
PFF1497-30	66	0.05-0.10	Soil	19/06/2024	25/06/2024
PFF1497-31	67	0.05-0.10	Soil	19/06/2024	25/06/2024
PFF1497-32	68	0.05-0.10	Soil	19/06/2024	25/06/2024
PFF1497-33	69	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-34	70	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-35	71	0.05-0.10	Soil	19/06/2024	25/06/2024

Certificate of Analysis PFF1497

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PFF1497-36	72	0.10-0.20	Soil	19/06/2024	25/06/2024
PFF1497-37	73	0.05-0.15	Soil	19/06/2024	25/06/2024
PFF1497-38	74	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-39	75	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-40	76	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-41	77	0.05-0.15	Soil	20/06/2024	25/06/2024
PFF1497-42	Rep 1-1		Soil	18/06/2024	25/06/2024
PFF1497-43	Rep 2-1		Soil	18/06/2024	25/06/2024
PFF1497-44	Rep 3-1		Soil	19/06/2024	25/06/2024
PFF1497-45	Rep 4-1		Soil	19/06/2024	25/06/2024
PFF1497-46	Rep 5-1		Soil	20/06/2024	25/06/2024
PFF1497-47	Trip Spike		Soil	18/06/2024	25/06/2024
PFF1497-48	Trip Spike		Soil	19/06/2024	25/06/2024
PFF1497-49	Trip Spike		Soil	20/06/2024	25/06/2024

Volatile TRH and BTEX (Soil)

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*106*	*97.8*	*92.2*	*103*	*114*

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*90.2*	*113*	*104*	*110*	*109*

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*101*	*102*	*97.4*	*105*	*106*

Volatile TRH and BTEX (Soil)

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*94.8*	*106*	*110*	*98.5*	*101*

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*105*	*107*	*95.4*	*96.5*	*108*

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*96.1*	*99.9*	*96.8*	*100*	*89.2*

Volatile TRH and BTEX (Soil)

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*102*	*91.7*	*74.5*	*99.0*	*104*

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
TRH C6-C9	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*101*	*114*	*98.4*	*81.4*	*99.0*

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-44	PFF1497-46
Your Reference			77	Rep 1-1	Rep 3-1	Rep 5-1
Date Sampled			20/06/2024	18/06/2024	19/06/2024	20/06/2024
Depth			0.05-0.15			
TRH C6-C9	mg/kg	25	<25	<25	<25	<25
TRH C6-C10	mg/kg	25	<25	<25	<25	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	<25	<25
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
Benzene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20
Toluene	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	mg/kg	3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
Surrogate aaa-Trifluorotoluene	%		*96.5*	*92.9*	*67.6*	*98.4*

BTEX Trip Spike (Soil)

Envirolab ID	Units	PQL	PFF1497-47	PFF1497-48	PFF1497-49
Your Reference			Trip Spike	Trip Spike	Trip Spike
Date Sampled			18/06/2024	19/06/2024	20/06/2024
Benzene	%		83.0	86.0	81.0
Toluene	%		90.0	90.0	88.0
Ethylbenzene	%		93.0	93.0	91.0
meta+para Xylene	%		93.0	92.0	90.0
ortho-Xylene	%		94.0	93.0	91.0
Surrogate aaa-Trifluorotoluene	%		*99.2*	*102*	*104*

Semi-volatile TRH (Soil)

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*101*	*101*	*102*	*101*	*102*

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*101*	*101*	*103*	*102*	*100*

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*102*	*102*	*102*	*102*	*103*

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50

Semi-volatile TRH (Soil)

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*102*	*103*	*102*	*103*	*104*

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*102*	*102*	*100*	*99.5*	*101*

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	840
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	190
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	1000
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	160
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	160
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	870
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	150
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	1200
Surrogate o-Terphenyl	%		*100*	*100*	*101*	*99.8*	*105*

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100

Semi-volatile TRH (Soil)

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*99.8*	*99.1*	*99.8*	*99.2*	*100*

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
TRH C10-C14	mg/kg	50	<50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*99.5*	*98.3*	*99.6*	*99.3*	*100*

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-44	PFF1497-46
Your Reference			77	Rep 1-1	Rep 3-1	Rep 5-1
Date Sampled			20/06/2024	18/06/2024	19/06/2024	20/06/2024
Depth			0.05-0.15			
TRH C10-C14	mg/kg	50	<50	<50	<50	<50
TRH C15-C28	mg/kg	100	<100	<100	<100	<100
TRH C29-C36	mg/kg	100	<100	<100	<100	<100
Total +ve TRH C10-C36	mg/kg	50	<50	<50	<50	<50
TRH >C10-C16	mg/kg	50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	mg/kg	50	<50	<50	<50	<50
TRH >C16-C34 (F3)	mg/kg	100	<100	<100	<100	<100
TRH >C34-C40 (F4)	mg/kg	100	<100	<100	<100	<100
Total +ve TRH >C10-C40	mg/kg	50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*99.2*	*99.9*	*99.8*	*98.5*

Polycyclic Aromatic Hydrocarbons (Soil)

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*84.3*	*82.8*	*82.4*	*80.9*	*84.8*

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*85.3*	*85.1*	*98.5*	*93.3*	*99.7*

Polycyclic Aromatic Hydrocarbons (Soil)

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*100*	*96.5*	*96.3*	*97.9*	*101*

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*104*	*102*	*97.5*	*99.2*	*96.7*

Polycyclic Aromatic Hydrocarbons (Soil)

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*104*	*94.8*	*105*	*97.6*	*101*

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*94.6*	*95.0*	*117*	*106*	*109*

Polycyclic Aromatic Hydrocarbons (Soil)

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*119*	*104*	*107*	*107*	*100*

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*106*	*104*	*101*	*101*	*103*

Polycyclic Aromatic Hydrocarbons (Soil)

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-44	PFF1497-46
Your Reference			77	Rep 1-1	Rep 3-1	Rep 5-1
Date Sampled			20/06/2024	18/06/2024	19/06/2024	20/06/2024
Depth			0.05-0.15			
Naphthalene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	mg/kg	0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene TEQ calc zero	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc Half	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
Benzo(a)pyrene TEQ calc PQL	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*101*	*104*	*113*	*114*

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
Aluminium	mg/kg	10	1100	1100	1000	1100	1200
Arsenic	mg/kg	4.0	5.9	6.9	6.6	7.0	5.7
Boron	mg/kg	10	<10	<10	<10	<10	<10
Barium	mg/kg	1.0	7.1	6.6	7.3	6.5	8.8
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1.0	10	11	10	11	11
Copper	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	41	26	41	26	51
Nickel	mg/kg	1.0	9.4	3.3	8.4	2.3	12
Lead	mg/kg	1.0	3.4	2.9	2.9	2.7	3.7
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	5.1	5.2	5.0	5.0	4.9
Zinc	mg/kg	1.0	1.3	1.3	1.4	1.1	1.5

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
Aluminium	mg/kg	10	910	1300	1100	1200	1200
Arsenic	mg/kg	4.0	6.3	6.8	5.3	<4.0	<4.0
Boron	mg/kg	10	<10	<10	<10	<10	<10
Barium	mg/kg	1.0	6.4	8.0	8.0	6.3	11
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	1.4
Chromium	mg/kg	1.0	11	13	11	10	10
Copper	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	5.0
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	46	49	28	18	33
Nickel	mg/kg	1.0	8.4	9.7	6.0	4.1	72
Lead	mg/kg	1.0	3.1	3.7	3.0	3.0	6.9
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	5.3	6.1	4.7	2.6	3.6
Zinc	mg/kg	1.0	1.3	1.5	1.3	<1.0	7.0

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Aluminium	mg/kg	10	1200	840	1200	1200	1200
Arsenic	mg/kg	4.0	7.2	<4.0	<4.0	5.7	6.9
Boron	mg/kg	10	<10	<10	<10	<10	<10

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Barium	mg/kg	1.0	44	14	9.6	9.0	11
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1.0	11	5.0	12	11	11
Copper	mg/kg	1.0	1.6	<1.0	<1.0	<1.0	3.5
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	28	56	20	33	47
Nickel	mg/kg	1.0	12	6.7	3.7	4.3	34
Lead	mg/kg	1.0	21	2.8	2.9	3.6	5.2
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	5.6	1.4	3.2	5.1	5.3
Zinc	mg/kg	1.0	7.1	1.4	1.2	1.7	16

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
Aluminium	mg/kg	10	1300	1100	930	910	2100
Arsenic	mg/kg	4.0	<4.0	6.8	5.6	5.0	<4.0
Boron	mg/kg	10	12	<10	<10	14	11
Barium	mg/kg	1.0	19	7.8	8.2	12	31
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	1.3
Chromium	mg/kg	1.0	9.0	12	9.8	7.2	10
Copper	mg/kg	1.0	9.8	<1.0	<1.0	2.1	12
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	47	35	29	52	150
Nickel	mg/kg	1.0	7.7	3.8	6.8	38	50
Lead	mg/kg	1.0	5.3	3.7	3.3	5.7	15
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	3.5	5.4	4.7	3.3	3.3
Zinc	mg/kg	1.0	16	1.7	1.4	2.1	7.7

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Aluminium	mg/kg	10	1300	1300	1200	1200	1100
Arsenic	mg/kg	4.0	5.2	7.4	7.1	6.4	6.3
Boron	mg/kg	10	<10	<10	<10	<10	10
Barium	mg/kg	1.0	10	9.6	8.6	9.3	8.9
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1.0	11	12	11	11	10
Copper	mg/kg	1.0	2.7	1.3	1.1	2.2	1.0
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	29	43	36	44	35
Nickel	mg/kg	1.0	37	20	12	31	17
Lead	mg/kg	1.0	4.7	4.1	3.4	4.4	3.7
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	4.8	5.7	5.3	5.3	4.6
Zinc	mg/kg	1.0	4.8	1.9	2.1	2.1	2.3

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
Aluminium	mg/kg	10	1100	1300	1300	1400	1700
Arsenic	mg/kg	4.0	<4.0	6.0	7.0	7.9	4.6
Boron	mg/kg	10	<10	<10	17	10	10
Barium	mg/kg	1.0	10	9.9	12	11	20
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	1.1	<1.0	1.5
Chromium	mg/kg	1.0	9.0	12	12	14	11
Copper	mg/kg	1.0	<1.0	1.8	4.9	<1.0	5.6
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	0.10	<0.10	<0.10
Manganese	mg/kg	1.0	45	47	38	61	100
Nickel	mg/kg	1.0	13	31	62	4.0	78
Lead	mg/kg	1.0	3.4	6.2	6.4	3.8	8.0
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	3.9	5.9	5.9	6.6	3.8
Zinc	mg/kg	1.0	1.1	2.0	7.3	1.5	12

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
Aluminium	mg/kg	10	1100	1100	1500	1100	1000
Arsenic	mg/kg	4.0	9.0	6.9	<4.0	7.5	7.4
Boron	mg/kg	10	10	<10	<10	<10	12
Barium	mg/kg	1.0	7.7	8.3	11	9.0	9.6
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1.0	14	12	12	13	11
Copper	mg/kg	1.0	<1.0	<1.0	<1.0	1.3	<1.0

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
Iron	mg/kg	10	[NA]	[NA]	2700	2500	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	27	28	50	46	22
Nickel	mg/kg	1.0	3.7	3.7	3.5	16	14
Lead	mg/kg	1.0	3.7	3.6	3.3	5.2	5.4
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	6.9	5.5	3.1	6.7	6.2
Zinc	mg/kg	1.0	1.7	1.5	1.2	2.2	2.4

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Aluminium	mg/kg	10	1700	1300	1900	1400	1000
Arsenic	mg/kg	4.0	6.1	7.9	6.4	7.2	5.4
Boron	mg/kg	10	14	<10	<10	12	12
Barium	mg/kg	1.0	17	9.3	16	10	12
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	1.2	<1.0	2.3	<1.0	<1.0
Chromium	mg/kg	1.0	13	13	16	15	11
Copper	mg/kg	1.0	4.8	2.4	7.1	<1.0	<1.0
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	71	49	46	47	30
Nickel	mg/kg	1.0	70	29	74	8.7	11
Lead	mg/kg	1.0	14	7.4	15	4.3	4.1
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	5.5	7.2	6.3	6.1	5.3
Zinc	mg/kg	1.0	4.5	3.3	3.9	2.2	29

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-44	PFF1497-46
Your Reference			77	Rep 1-1	Rep 3-1	Rep 5-1
Date Sampled			20/06/2024	18/06/2024	19/06/2024	20/06/2024
Depth			0.05-0.15			
Aluminium	mg/kg	10	980	1200	1100	980
Arsenic	mg/kg	4.0	6.4	7.6	7.6	5.6
Boron	mg/kg	10	<10	<10	<10	<10
Barium	mg/kg	1.0	14	7.4	8.5	8.2
Beryllium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40	<0.40
Cobalt	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
Chromium	mg/kg	1.0	9.4	13	13	11
Copper	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0
Iron	mg/kg	10	[NA]	[NA]	[NA]	[NA]
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Manganese	mg/kg	1.0	67	30	45	31

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-44	PFF1497-46
Your Reference			77	Rep 1-1	Rep 3-1	Rep 5-1
Date Sampled			20/06/2024	18/06/2024	19/06/2024	20/06/2024
Depth			0.05-0.15			
Nickel	mg/kg	1.0	6.1	7.8	5.8	7.8
Lead	mg/kg	1.0	3.7	3.5	4.0	3.6
Selenium	mg/kg	2.0	<2.0	<2.0	<2.0	<2.0
Vanadium	mg/kg	1.0	3.5	6.0	6.7	5.1
Zinc	mg/kg	1.0	1.7	1.8	1.8	2.0

Exchangeable Cations (Soil)

Envirolab ID	Units	PQL	PFF1497-33	PFF1497-34
Your Reference			69	70
Date Sampled			19/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15
Calcium	meq/100g	0.10	5.4	4.7
Potassium	meq/100g	0.10	<0.10	<0.10
Magnesium	meq/100g	0.10	0.15	0.28
Sodium	meq/100g	0.10	<0.10	<0.10
Cation Exchange Capacity (CEC)	meq/100g	0.10	5.6	5.0

Inorganics - Carbon, Nitrogen and Sulfur Species (Soil)

Envirolab ID	Units	PQL	PFF1497-33	PFF1497-34
Your Reference			69	70
Date Sampled			19/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15
Total Organic Carbon	%	0.010	1.0	1.1

Inorganics - General Physical Parameters (Soil)

Envirolab ID	Units	PQL	PFF1497-33	PFF1497-34
Your Reference			69	70
Date Sampled			19/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15
pH	pH units		9.0	8.9

Inorganics - Moisture (Soil)

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
Moisture	%	0.10	11	9.5	11	10	12

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
Moisture	%	0.10	8.5	10	11	7.0	9.4

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Moisture	%	0.10	13	25	12	15	15

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
Moisture	%	0.10	25	8.7	11	17	23

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Moisture	%	0.10	12	15	13	14	13

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
Moisture	%	0.10	10	13	13	11	25

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
Moisture	%	0.10	12	12	26	11	11

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Moisture	%	0.10	17	14	16	16	15

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-43	PFF1497-44	PFF1497-45
Your Reference			77	Rep 1-1	Rep 2-1	Rep 3-1	Rep 4-1
Date Sampled			20/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.15				
Moisture	%	0.10	15	9.5	9.9	12	9.8

Inorganics - Moisture (Soil)

Envirolab ID	Units	PQL	PFF1497-46
Your Reference			Rep 5-1
Date Sampled			20/06/2024
Moisture	%	0.10	11

PFAS Extended List (Soil) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.35	0.16	0.20	<0.10	0.18
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	0.20	0.25	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*103*	*101*	*98.9*	*105*	*97.8*
Surrogate 13C2 PFOA	%		*102*	*95.4*	*98.9*	*99.3*	*100*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.35	0.16	0.20	<0.10	0.18
Total +ve PFOA+PFOS	µg/kg	0.10	0.35	0.16	0.20	<0.10	0.18
Total +ve PFAS	µg/kg	0.10	0.35	0.16	0.40	0.25	0.18
Extraction Internal Standard 13C3 PFBS	%		*93.1*	*68.6*	*90.4*	*91.6*	*87.9*
Extraction Internal Standard 18O2 PFHxS	%		*89.3*	*64.7*	*85.8*	*89.2*	*85.8*
Extraction Internal Standard 13C4 PFOS	%		*93.0*	*65.2*	*88.0*	*86.0*	*90.3*
Extraction Internal Standard 13C4 PFBA	%		*97.6*	*70.3*	*94.6*	*95.2*	*93.6*
Extraction Internal Standard 13C3 PFPeA	%		*101*	*76.2*	*97.1*	*98.6*	*97.3*
Extraction Internal Standard 13C2 PFHxA	%		*99.2*	*69.8*	*91.0*	*90.0*	*92.4*
Extraction Internal Standard 13C4 PFHpA	%		*97.0*	*71.1*	*94.8*	*92.5*	*93.0*
Extraction Internal Standard 13C4 PFOA	%		*99.5*	*73.8*	*96.4*	*96.4*	*95.7*
Extraction Internal Standard 13C5 PFNA	%		*102*	*79.3*	*98.0*	*102*	*100*

PFAS Extended List (Soil) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFF1497-01	PFF1497-02	PFF1497-03	PFF1497-04	PFF1497-05
Your Reference			39	40	41	42	43
Date Sampled			19/06/2024	18/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20
Extraction Internal Standard 13C2 PFDA	%		*96.6*	*75.6*	*97.1*	*94.5*	*98.0*
Extraction Internal Standard 13C2 PFUnDA	%		*105*	*76.4*	*106*	*110*	*108*
Extraction Internal Standard 13C2 PFDoDA	%		*99.4*	*70.5*	*95.1*	*96.3*	*102*
Extraction Internal Standard 13C2 PFTeDA	%		*117*	*82.1*	*106*	*109*	*108*
Extraction Internal Standard 13C2 4:2FTS	%		*91.5*	*70.8*	*94.7*	*97.4*	*95.6*
Extraction Internal Standard 13C2 6:2FTS	%		*89.4*	*73.2*	*95.5*	*85.1*	*97.5*
Extraction Internal Standard 13C2 8:2FTS	%		*103*	*72.2*	*83.5*	*91.5*	*105*
Extraction Internal Standard 13C8 FOSA	%		*98.4*	*71.0*	*93.5*	*96.6*	*93.7*
Extraction Internal Standard d3 N MeFOSA	%		*93.0*	*64.3*	*88.9*	*89.8*	*86.8*
Extraction Internal Standard d5 N EtFOSA	%		*86.6*	*61.3*	*83.6*	*86.7*	*84.0*
Extraction Internal Standard d7 N MeFOSE	%		*98.0*	*65.7*	*93.4*	*97.3*	*87.2*
Extraction Internal Standard d9 N EtFOSE	%		*87.3*	*64.7*	*83.9*	*94.9*	*85.3*
Extraction Internal Standard d3 N MeFOSAA	%		*95.6*	*70.5*	*91.0*	*92.2*	*96.5*
Extraction Internal Standard d5 N EtFOSAA	%		*99.2*	*74.5*	*95.3*	*92.3*	*105*

Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.18	0.17	<0.10	0.16	0.34
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	0.22	<0.20	<0.20	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Envirolab ID	Units	PQL	PFF1497-06	PFF1497-07	PFF1497-08	PFF1497-09	PFF1497-10
Your Reference			44	45	46	47	48
Date Sampled			19/06/2024	19/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.15	0.05-0.15
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*103*	*106*	*104*	*102*	*104*
Surrogate 13C2 PFOA	%		*101*	*104*	*102*	*99.0*	*103*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.18	0.17	<0.10	0.16	0.34
Total +ve PFOA+PFOS	µg/kg	0.10	0.18	0.17	<0.10	0.16	0.34
Total +ve PFAS	µg/kg	0.10	0.18	0.39	<0.10	0.16	0.34
Extraction Internal Standard 13C3 PFBS	%		*90.9*	*91.7*	*85.9*	*90.1*	*88.9*
Extraction Internal Standard 18O2 PFHxS	%		*84.9*	*88.7*	*85.6*	*86.3*	*80.5*
Extraction Internal Standard 13C4 PFOS	%		*89.5*	*83.8*	*83.9*	*80.2*	*72.2*
Extraction Internal Standard 13C4 PFBA	%		*94.0*	*91.8*	*87.9*	*89.0*	*85.5*
Extraction Internal Standard 13C3 PFPeA	%		*98.0*	*99.5*	*90.4*	*92.1*	*86.0*
Extraction Internal Standard 13C2 PFHxA	%		*90.3*	*91.6*	*83.4*	*83.4*	*74.1*
Extraction Internal Standard 13C4 PFHpA	%		*94.6*	*95.1*	*89.0*	*86.8*	*88.6*
Extraction Internal Standard 13C4 PFOA	%		*103*	*95.5*	*85.1*	*89.4*	*82.9*
Extraction Internal Standard 13C5 PFNA	%		*102*	*105*	*88.3*	*86.6*	*76.9*
Extraction Internal Standard 13C2 PFDA	%		*105*	*94.6*	*77.1*	*75.4*	*64.5*
Extraction Internal Standard 13C2 PFUnDA	%		*117*	*94.9*	*93.3*	*86.4*	*63.4*
Extraction Internal Standard 13C2 PFDoDA	%		*97.6*	*85.6*	*77.6*	*78.4*	*57.2*
Extraction Internal Standard 13C2 PFTeDA	%		*116*	*98.7*	*83.6*	*81.0*	*56.6*
Extraction Internal Standard 13C2 4:2FTS	%		*95.7*	*101*	*76.1*	*78.6*	*84.5*
Extraction Internal Standard 13C2 6:2FTS	%		*96.0*	*96.1*	*69.0*	*72.1*	*74.9*
Extraction Internal Standard 13C2 8:2FTS	%		*101*	*91.1*	*68.8*	*68.1*	*67.7*
Extraction Internal Standard 13C8 FOSA	%		*93.2*	*94.2*	*92.3*	*89.3*	*70.9*
Extraction Internal Standard d3 N MeFOSA	%		*85.4*	*86.9*	*87.6*	*85.5*	*64.4*
Extraction Internal Standard d5 N EtFOSA	%		*81.9*	*86.3*	*85.9*	*81.2*	*69.0*
Extraction Internal Standard d7 N MeFOSE	%		*87.9*	*93.1*	*85.1*	*86.4*	*70.0*
Extraction Internal Standard d9 N EtFOSE	%		*90.6*	*90.0*	*93.6*	*89.6*	*73.2*
Extraction Internal Standard d3 N MeFOSAA	%		*97.4*	*89.3*	*79.8*	*72.4*	*62.3*
Extraction Internal Standard d5 N EtFOSAA	%		*113*	*94.6*	*79.9*	*84.0*	*70.6*

Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	0.12	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	0.12	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.16	2.3	0.25	0.25	0.30
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	0.26	<0.20	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20

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Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	0.11	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	0.17	0.26	<0.10	<0.10	0.32
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*110*	*104*	*108*	*111*	*110*
Surrogate 13C2 PFOA	%		*99.9*	*97.1*	*97.0*	*95.3*	*96.3*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.16	2.4	0.25	0.25	0.30
Total +ve PFOA+PFOS	µg/kg	0.10	0.33	2.6	0.25	0.25	0.62
Total +ve PFAS	µg/kg	0.10	0.33	2.9	0.51	0.25	0.62
Extraction Internal Standard 13C3 PFBS	%		*85.2*	*82.7*	*86.9*	*85.0*	*86.9*
Extraction Internal Standard 18O2 PFHxS	%		*78.8*	*68.3*	*72.1*	*65.8*	*72.8*
Extraction Internal Standard 13C4 PFOS	%		*69.5*	*51.1*	*69.5*	*55.6*	*65.1*
Extraction Internal Standard 13C4 PFBA	%		*83.3*	*78.2*	*82.3*	*80.3*	*78.7*
Extraction Internal Standard 13C3 PFPeA	%		*84.9*	*83.4*	*87.8*	*93.3*	*85.3*
Extraction Internal Standard 13C2 PFHxA	%		*78.0*	*72.8*	*81.2*	*93.8*	*78.0*
Extraction Internal Standard 13C4 PFHpA	%		*84.8*	*83.2*	*88.4*	*80.9*	*88.0*
Extraction Internal Standard 13C4 PFOA	%		*79.4*	*71.0*	*80.8*	*61.5*	*78.9*
Extraction Internal Standard 13C5 PFNA	%		*83.3*	*40.2 [4]*	*82.4*	*68.8*	*64.6*
Extraction Internal Standard 13C2 PFDA	%		*69.2*	*38.6 [4]*	*63.8*	*61.2*	*60.5*
Extraction Internal Standard 13C2 PFUnDA	%		*80.9*	*28.2 [4]*	*68.0*	*38.6 [4]*	*50.9*
Extraction Internal Standard 13C2 PFDoDA	%		*69.3*	*21.3 [4]*	*62.7*	*63.8*	*36.8 [4]*
Extraction Internal Standard 13C2 PFTeDA	%		*77.4*	*26.2 [4]*	*69.9*	*63.4*	*53.8*
Extraction Internal Standard 13C2 4:2FTS	%		*75.5*	*81.8*	*82.0*	*## [4]*	*80.4*
Extraction Internal Standard 13C2 6:2FTS	%		*64.3*	*62.1*	*65.7*	*196 [4]*	*66.1*
Extraction Internal Standard 13C2 8:2FTS	%		*63.1*	*43.3 [4]*	*67.6*	*186 [4]*	*55.9*
Extraction Internal Standard 13C8 FOSA	%		*79.7*	*35.7 [4]*	*75.2*	*33.1 [4]*	*57.5*

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Envirolab ID	Units	PQL	PFF1497-11	PFF1497-12	PFF1497-13	PFF1497-14	PFF1497-15
Your Reference			49	50	51	52	53
Date Sampled			19/06/2024	20/06/2024	18/06/2024	18/06/2024	18/06/2024
Depth			0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15	0.10-0.20
Extraction Internal Standard d3 N MeFOSA	%		*79.6*	*29.9 [4]*	*69.5*	*41.7 [4]*	*53.7*
Extraction Internal Standard d5 N EtFOSA	%		*75.6*	*43.8 [4]*	*72.0*	*35.7 [4]*	*60.6*
Extraction Internal Standard d7 N MeFOSE	%		*76.6*	*38.0 [4]*	*68.0*	*30.2 [4]*	*60.9*
Extraction Internal Standard d9 N EtFOSE	%		*86.3*	*47.0 [4]*	*73.9*	*23.3 [4]*	*64.8*
Extraction Internal Standard d3 N MeFOSAA	%		*68.0*	*44.7 [4]*	*70.3*	*103*	*57.3*
Extraction Internal Standard d5 N EtFOSAA	%		*72.6*	*44.9 [4]*	*71.7*	*81.1*	*63.8*

Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	0.18
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	0.31
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.63	0.17	0.22	0.31	16
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	0.32	0.29	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	0.21
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	0.15	<0.10	<0.10	<0.10	4.3
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	0.11
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*109*	*104*	*110*	*106*	*106*
Surrogate 13C2 PFOA	%		*101*	*103*	*95.0*	*103*	*107*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.63	0.17	0.22	0.31	16
Total +ve PFOA+PFOS	µg/kg	0.10	0.78	0.17	0.22	0.31	20

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Envirolab ID	Units	PQL	PFF1497-16	PFF1497-17	PFF1497-18	PFF1497-19	PFF1497-20
Your Reference			54	55	56	57	58
Date Sampled			20/06/2024	20/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.05-0.15	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.15
Total +ve PFAS	µg/kg	0.10	0.78	0.17	0.54	0.60	21
Extraction Internal Standard 13C3 PFBS	%		*81.2*	*85.4*	*84.6*	*83.1*	*81.0*
Extraction Internal Standard 18O2 PFHxS	%		*70.0*	*73.2*	*69.6*	*69.2*	*65.4*
Extraction Internal Standard 13C4 PFOS	%		*62.2*	*70.3*	*68.3*	*69.1*	*64.7*
Extraction Internal Standard 13C4 PFBA	%		*76.6*	*81.7*	*81.0*	*77.5*	*76.9*
Extraction Internal Standard 13C3 PFPeA	%		*79.6*	*85.2*	*82.4*	*82.1*	*79.2*
Extraction Internal Standard 13C2 PFHxA	%		*71.2*	*78.4*	*73.1*	*73.5*	*69.2*
Extraction Internal Standard 13C4 PFHpA	%		*77.6*	*85.6*	*84.2*	*85.5*	*76.0*
Extraction Internal Standard 13C4 PFOA	%		*74.2*	*77.0*	*77.5*	*75.0*	*67.0*
Extraction Internal Standard 13C5 PFNA	%		*62.1*	*79.7*	*81.5*	*75.9*	*70.2*
Extraction Internal Standard 13C2 PFDA	%		*54.0*	*63.4*	*64.3*	*60.9*	*63.0*
Extraction Internal Standard 13C2 PFUnDA	%		*48.8 [4]*	*68.4*	*47.3 [4]*	*78.6*	*69.7*
Extraction Internal Standard 13C2 PFDoDA	%		*44.2 [4]*	*66.4*	*58.2*	*51.5*	*54.2*
Extraction Internal Standard 13C2 PFTeDA	%		*50.2*	*73.7*	*65.3*	*69.9*	*79.0*
Extraction Internal Standard 13C2 4:2FTS	%		*73.1*	*78.3*	*71.3*	*78.9*	*70.2*
Extraction Internal Standard 13C2 6:2FTS	%		*63.6*	*65.8*	*65.7*	*66.2*	*59.1*
Extraction Internal Standard 13C2 8:2FTS	%		*48.9 [4]*	*56.7*	*73.2*	*57.0*	*74.1*
Extraction Internal Standard 13C8 FOSA	%		*61.1*	*76.8*	*75.9*	*75.1*	*71.0*
Extraction Internal Standard d3 N MeFOSA	%		*54.4*	*73.0*	*78.5*	*76.7*	*62.7*
Extraction Internal Standard d5 N EtFOSA	%		*61.5*	*73.5*	*75.8*	*69.5*	*68.0*
Extraction Internal Standard d7 N MeFOSE	%		*64.7*	*70.1*	*78.2*	*94.8*	*76.9*
Extraction Internal Standard d9 N EtFOSE	%		*66.6*	*79.0*	*78.5*	*76.3*	*71.3*
Extraction Internal Standard d3 N MeFOSAA	%		*54.6*	*68.8*	*62.2*	*65.4*	*62.2*
Extraction Internal Standard d5 N EtFOSAA	%		*56.8*	*69.7*	*71.4*	*71.9*	*64.6*

Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.65	0.21	0.23	0.22	<0.10
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	0.22
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50

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Envirolab ID	Units	PQL	PFF1497-21	PFF1497-22	PFF1497-23	PFF1497-24	PFF1497-25
Your Reference			59	60	61	62	63
Date Sampled			20/06/2024	18/06/2024	18/06/2024	18/06/2024	19/06/2024
Depth			0.05-0.15	0.05-0.15	0.10-0.20	0.10-0.20	0.05-0.15
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*108*	*107*	*101*	*101*	*102*
Surrogate 13C2 PFOA	%		*99.1*	*99.9*	*95.0*	*99.3*	*103*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.65	0.21	0.23	0.22	<0.10
Total +ve PFOA+PFOS	µg/kg	0.10	0.65	0.21	0.23	0.22	<0.10
Total +ve PFAS	µg/kg	0.10	0.65	0.21	0.23	0.22	0.22
Extraction Internal Standard 13C3 PFBS	%		*83.9*	*87.0*	*88.5*	*88.3*	*88.3*
Extraction Internal Standard 18O2 PFHxS	%		*64.8*	*70.7*	*88.8*	*85.5*	*84.8*
Extraction Internal Standard 13C4 PFOS	%		*58.7*	*69.1*	*90.4*	*88.3*	*86.8*
Extraction Internal Standard 13C4 PFBA	%		*76.6*	*80.5*	*98.8*	*95.3*	*95.6*
Extraction Internal Standard 13C3 PFPeA	%		*96.2*	*83.2*	*99.9*	*101*	*97.8*
Extraction Internal Standard 13C2 PFHxA	%		*92.9*	*73.4*	*97.9*	*102*	*99.2*
Extraction Internal Standard 13C4 PFHpA	%		*93.7*	*86.0*	*102*	*117*	*104*
Extraction Internal Standard 13C4 PFOA	%		*77.0*	*73.5*	*111*	*124*	*106*
Extraction Internal Standard 13C5 PFNA	%		*64.1*	*75.3*	*109*	*126*	*110*
Extraction Internal Standard 13C2 PFDA	%		*63.9*	*65.5*	*110*	*121*	*114*
Extraction Internal Standard 13C2 PFUnDA	%		*49.0 [4]*	*69.0*	*120*	*136*	*117*
Extraction Internal Standard 13C2 PFDoDA	%		*41.9 [4]*	*59.3*	*99.1*	*113*	*100*
Extraction Internal Standard 13C2 PFTeDA	%		*42.4 [4]*	*70.1*	*110*	*119*	*112*
Extraction Internal Standard 13C2 4:2FTS	%		*## [4]*	*77.0*	*101*	*110*	*97.8*
Extraction Internal Standard 13C2 6:2FTS	%		*175 [4]*	*67.0*	*96.8*	*139*	*97.8*
Extraction Internal Standard 13C2 8:2FTS	%		*113*	*55.4*	*110*	*127*	*113*
Extraction Internal Standard 13C8 FOSA	%		*39.6 [4]*	*76.7*	*95.2*	*92.5*	*93.2*
Extraction Internal Standard d3 N MeFOSA	%		*37.0 [4]*	*80.6*	*86.0*	*82.1*	*83.4*
Extraction Internal Standard d5 N EtFOSA	%		*37.8 [4]*	*72.9*	*81.7*	*77.1*	*80.2*
Extraction Internal Standard d7 N MeFOSE	%		*35.4 [4]*	*82.3*	*93.9*	*81.7*	*81.8*
Extraction Internal Standard d9 N EtFOSE	%		*26.7 [4]*	*80.6*	*81.8*	*70.0*	*80.2*
Extraction Internal Standard d3 N MeFOSAA	%		*81.3*	*64.9*	*113*	*142*	*122*
Extraction Internal Standard d5 N EtFOSAA	%		*65.5*	*70.1*	*120*	*167 [4]*	*123*

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Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	0.30	0.47	<0.10	0.40
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*100*	*102*	*102*	*101*	*104*
Surrogate 13C2 PFOA	%		*102*	*104*	*99.0*	*96.1*	*106*
Total +ve PFHxS+PFOS	µg/kg	0.10	<0.10	0.30	0.47	<0.10	0.40
Total +ve PFOA+PFOS	µg/kg	0.10	<0.10	0.30	0.47	<0.10	0.40
Total +ve PFAS	µg/kg	0.10	<0.10	0.30	0.47	<0.10	0.40
Extraction Internal Standard 13C3 PFBS	%		*90.0*	*90.3*	*87.8*	*91.0*	*81.0*
Extraction Internal Standard 18O2 PFHxS	%		*85.9*	*86.6*	*86.0*	*87.6*	*67.1*
Extraction Internal Standard 13C4 PFOS	%		*88.5*	*84.9*	*82.6*	*87.6*	*55.8*
Extraction Internal Standard 13C4 PFBA	%		*95.4*	*93.9*	*93.4*	*96.4*	*88.1*
Extraction Internal Standard 13C3 PFPeA	%		*100*	*97.4*	*98.2*	*100*	*108*
Extraction Internal Standard 13C2 PFHxA	%		*98.6*	*94.1*	*97.4*	*102*	*101*
Extraction Internal Standard 13C4 PFHpA	%		*109*	*96.9*	*99.0*	*109*	*91.7*
Extraction Internal Standard 13C4 PFOA	%		*113*	*100*	*113*	*118*	*49.6 [4]*
Extraction Internal Standard 13C5 PFNA	%		*115*	*108*	*89.4*	*116*	*62.1*

PFAS Extended List (Soil) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFF1497-26	PFF1497-27	PFF1497-28	PFF1497-29	PFF1497-30
Your Reference			63	64	65	65	66
Date Sampled			19/06/2024	20/06/2024	20/06/2024	20/06/2024	19/06/2024
Depth			0.50-0.60	0.05-0.15	0.05-0.15	0.90-1.00	0.05-0.10
Extraction Internal Standard 13C2 PFDA	%		*114*	*104*	*106*	*115*	*66.8*
Extraction Internal Standard 13C2 PFUnDA	%		*142*	*130*	*106*	*132*	*42.4 [4]*
Extraction Internal Standard 13C2 PFDoDA	%		*86.3*	*92.1*	*70.6*	*112*	*63.9*
Extraction Internal Standard 13C2 PFTeDA	%		*110*	*108*	*97.2*	*103*	*73.4*
Extraction Internal Standard 13C2 4:2FTS	%		*110*	*101*	*101*	*106*	*## [4]*
Extraction Internal Standard 13C2 6:2FTS	%		*110*	*108*	*139*	*106*	*## [4]*
Extraction Internal Standard 13C2 8:2FTS	%		*119*	*111*	*111*	*107*	*## [4]*
Extraction Internal Standard 13C8 FOSA	%		*94.5*	*96.9*	*81.6*	*93.3*	*23.2 [4]*
Extraction Internal Standard d3 N MeFOSA	%		*85.1*	*87.3*	*74.1*	*82.9*	*24.4 [4]*
Extraction Internal Standard d5 N EtFOSA	%		*79.9*	*79.4*	*72.0*	*78.7*	*## [4]*
Extraction Internal Standard d7 N MeFOSE	%		*86.3*	*90.5*	*81.8*	*79.0*	*20.2 [4]*
Extraction Internal Standard d9 N EtFOSE	%		*83.3*	*88.0*	*75.0*	*76.5*	*## [4]*
Extraction Internal Standard d3 N MeFOSAA	%		*129*	*139*	*109*	*125*	*89.9*
Extraction Internal Standard d5 N EtFOSAA	%		*## [4]*	*## [4]*	*## [4]*	*146*	*79.3*

Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	<0.10	<0.10	0.20	<0.10
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Envirolab ID	Units	PQL	PFF1497-31	PFF1497-32	PFF1497-33	PFF1497-34	PFF1497-35
Your Reference			67	68	69	70	71
Date Sampled			19/06/2024	19/06/2024	19/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.10	0.05-0.10	0.05-0.15	0.05-0.15	0.05-0.10
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*101*	*103*	*101*	*108*	*106*
Surrogate 13C2 PFOA	%		*103*	*106*	*98.5*	*103*	*102*
Total +ve PFHxS+PFOS	µg/kg	0.10	<0.10	<0.10	<0.10	0.20	<0.10
Total +ve PFOA+PFOS	µg/kg	0.10	<0.10	<0.10	<0.10	0.20	<0.10
Total +ve PFAS	µg/kg	0.10	<0.10	<0.10	<0.10	0.20	<0.10
Extraction Internal Standard 13C3 PFBS	%		*89.4*	*88.7*	*79.9*	*88.4*	*86.8*
Extraction Internal Standard 18O2 PFHxS	%		*84.9*	*82.7*	*70.9*	*77.9*	*73.6*
Extraction Internal Standard 13C4 PFOS	%		*86.2*	*75.9*	*68.8*	*75.2*	*71.7*
Extraction Internal Standard 13C4 PFBA	%		*92.6*	*84.5*	*77.5*	*87.6*	*86.9*
Extraction Internal Standard 13C3 PFPeA	%		*92.2*	*84.0*	*74.9*	*86.6*	*83.3*
Extraction Internal Standard 13C2 PFHxA	%		*88.9*	*79.2*	*72.2*	*82.0*	*78.5*
Extraction Internal Standard 13C4 PFHpA	%		*86.1*	*83.7*	*80.2*	*93.3*	*89.4*
Extraction Internal Standard 13C4 PFOA	%		*85.4*	*80.8*	*71.5*	*87.5*	*83.0*
Extraction Internal Standard 13C5 PFNA	%		*87.3*	*80.2*	*72.3*	*84.4*	*84.0*
Extraction Internal Standard 13C2 PFDA	%		*84.5*	*73.1*	*64.1*	*67.5*	*66.5*
Extraction Internal Standard 13C2 PFUnDA	%		*84.9*	*75.4*	*90.8*	*93.9*	*79.5*
Extraction Internal Standard 13C2 PFDoDA	%		*73.8*	*74.9*	*63.7*	*60.9*	*67.1*
Extraction Internal Standard 13C2 PFTeDA	%		*72.1*	*54.4*	*58.3*	*64.4*	*61.6*
Extraction Internal Standard 13C2 4:2FTS	%		*83.2*	*79.2*	*67.6*	*78.9*	*77.7*
Extraction Internal Standard 13C2 6:2FTS	%		*64.5*	*61.9*	*53.1*	*67.8*	*87.0*
Extraction Internal Standard 13C2 8:2FTS	%		*64.3*	*61.8*	*61.6*	*65.1*	*60.6*
Extraction Internal Standard 13C8 FOSA	%		*95.3*	*85.0*	*75.8*	*81.8*	*80.5*
Extraction Internal Standard d3 N MeFOSA	%		*84.2*	*82.2*	*74.3*	*76.6*	*78.7*
Extraction Internal Standard d5 N EtFOSA	%		*82.5*	*77.4*	*56.4*	*73.8*	*74.2*
Extraction Internal Standard d7 N MeFOSE	%		*102*	*84.3*	*73.5*	*78.1*	*77.8*
Extraction Internal Standard d9 N EtFOSE	%		*87.4*	*84.7*	*72.2*	*75.4*	*81.6*
Extraction Internal Standard d3 N MeFOSAA	%		*76.8*	*73.9*	*66.2*	*72.1*	*70.9*
Extraction Internal Standard d5 N EtFOSAA	%		*77.0*	*77.7*	*108*	*74.6*	*81.0*

Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.12	0.25	0.59	0.46	7.7
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	0.31	<0.20	<0.20	<0.20	0.33
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20

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Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	0.16	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	0.17	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	0.11	<0.10	0.18	0.23	1.9
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*106*	*112*	*102*	*112*	*106*
Surrogate 13C2 PFOA	%		*104*	*106*	*101*	*100*	*107*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.12	0.25	0.59	0.46	7.7
Total +ve PFOA+PFOS	µg/kg	0.10	0.23	0.25	0.77	0.69	9.6
Total +ve PFAS	µg/kg	0.10	0.54	0.25	0.77	1.0	10
Extraction Internal Standard 13C3 PFBS	%		*81.5*	*83.9*	*84.8*	*80.4*	*83.1*
Extraction Internal Standard 18O2 PFHxS	%		*66.8*	*70.9*	*72.9*	*72.9*	*73.2*
Extraction Internal Standard 13C4 PFOS	%		*71.9*	*66.9*	*71.0*	*67.7*	*70.2*
Extraction Internal Standard 13C4 PFBA	%		*78.1*	*84.6*	*80.7*	*80.0*	*82.5*
Extraction Internal Standard 13C3 PFPeA	%		*78.8*	*79.8*	*83.2*	*80.6*	*88.3*
Extraction Internal Standard 13C2 PFHxA	%		*77.3*	*75.6*	*80.8*	*77.1*	*84.5*
Extraction Internal Standard 13C4 PFHpA	%		*82.9*	*85.9*	*86.9*	*83.3*	*105*
Extraction Internal Standard 13C4 PFOA	%		*71.4*	*71.5*	*75.7*	*80.6*	*89.7*
Extraction Internal Standard 13C5 PFNA	%		*75.3*	*77.2*	*67.9*	*82.9*	*83.7*
Extraction Internal Standard 13C2 PFDA	%		*55.0*	*61.2*	*59.8*	*63.8*	*70.8*
Extraction Internal Standard 13C2 PFUnDA	%		*72.4*	*85.0*	*77.1*	*95.0*	*97.8*
Extraction Internal Standard 13C2 PFDoDA	%		*59.2*	*53.9*	*31.3 [4]*	*48.6 [4]*	*60.9*
Extraction Internal Standard 13C2 PFTeDA	%		*59.9*	*60.3*	*43.4 [4]*	*56.7*	*62.2*
Extraction Internal Standard 13C2 4:2FTS	%		*75.3*	*75.3*	*74.9*	*76.5*	*110*
Extraction Internal Standard 13C2 6:2FTS	%		*51.4*	*57.9*	*60.1*	*61.3*	*103*
Extraction Internal Standard 13C2 8:2FTS	%		*60.3*	*68.8*	*65.8*	*67.8*	*68.0*
Extraction Internal Standard 13C8 FOSA	%		*76.3*	*79.0*	*73.8*	*77.9*	*71.2*

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Envirolab ID	Units	PQL	PFF1497-36	PFF1497-37	PFF1497-38	PFF1497-39	PFF1497-40
Your Reference			72	73	74	75	76
Date Sampled			19/06/2024	19/06/2024	20/06/2024	20/06/2024	20/06/2024
Depth			0.10-0.20	0.05-0.15	0.05-0.15	0.05-0.15	0.05-0.15
Extraction Internal Standard d3 N MeFOSA	%		*74.9*	*77.9*	*64.9*	*73.6*	*65.4*
Extraction Internal Standard d5 N EtFOSA	%		*71.6*	*73.0*	*56.7*	*65.1*	*57.9*
Extraction Internal Standard d7 N MeFOSE	%		*72.8*	*77.7*	*67.6*	*73.6*	*56.9*
Extraction Internal Standard d9 N EtFOSE	%		*77.8*	*81.9*	*62.2*	*77.4*	*58.8*
Extraction Internal Standard d3 N MeFOSAA	%		*65.2*	*74.8*	*76.2*	*77.4*	*76.9*
Extraction Internal Standard d5 N EtFOSAA	%		*69.3*	*74.1*	*97.5*	*147*	*138*

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-43	PFF1497-44	PFF1497-45
Your Reference			77	Rep 1-1	Rep 2-1	Rep 3-1	Rep 4-1
Date Sampled			20/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.15				
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.14	0.13	<0.10	0.18	0.21
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	0.24	<0.20	<0.20	0.24	<0.20
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Surrogate 13C8 PFOS	%		*112*	*105*	*113*	*108*	*107*
Surrogate 13C2 PFOA	%		*103*	*98.0*	*101*	*103*	*100*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.14	0.13	<0.10	0.18	0.21
Total +ve PFOA+PFOS	µg/kg	0.10	0.14	0.13	<0.10	0.18	0.21

PFAS Extended List (Soil) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFF1497-41	PFF1497-42	PFF1497-43	PFF1497-44	PFF1497-45
Your Reference			77	Rep 1-1	Rep 2-1	Rep 3-1	Rep 4-1
Date Sampled			20/06/2024	18/06/2024	18/06/2024	19/06/2024	19/06/2024
Depth			0.05-0.15				
Total +ve PFAS	µg/kg	0.10	0.38	0.13	<0.10	0.42	0.21
Extraction Internal Standard 13C3 PFBS	%		*82.4*	*84.3*	*77.8*	*82.9*	*82.1*
Extraction Internal Standard 18O2 PFHxS	%		*70.1*	*71.3*	*69.4*	*70.9*	*72.0*
Extraction Internal Standard 13C4 PFOS	%		*66.2*	*70.1*	*65.1*	*71.4*	*72.5*
Extraction Internal Standard 13C4 PFBA	%		*79.9*	*80.8*	*84.2*	*80.0*	*82.5*
Extraction Internal Standard 13C3 PFPeA	%		*82.3*	*81.2*	*78.0*	*79.3*	*82.9*
Extraction Internal Standard 13C2 PFHxA	%		*75.9*	*75.9*	*77.2*	*83.8*	*81.6*
Extraction Internal Standard 13C4 PFHpA	%		*82.0*	*81.9*	*81.0*	*85.7*	*86.3*
Extraction Internal Standard 13C4 PFOA	%		*77.0*	*75.9*	*74.6*	*79.3*	*79.3*
Extraction Internal Standard 13C5 PFNA	%		*76.7*	*81.4*	*81.5*	*83.7*	*76.6*
Extraction Internal Standard 13C2 PFDA	%		*66.5*	*62.2*	*68.2*	*65.5*	*68.6*
Extraction Internal Standard 13C2 PFUnDA	%		*92.5*	*79.5*	*94.0*	*79.2*	*101*
Extraction Internal Standard 13C2 PFDoDA	%		*57.7*	*60.8*	*63.7*	*53.7*	*56.3*
Extraction Internal Standard 13C2 PFTeDA	%		*57.0*	*66.8*	*71.0*	*63.0*	*66.9*
Extraction Internal Standard 13C2 4:2FTS	%		*66.6*	*73.6*	*75.4*	*76.6*	*78.2*
Extraction Internal Standard 13C2 6:2FTS	%		*69.9*	*62.4*	*53.2*	*60.6*	*65.6*
Extraction Internal Standard 13C2 8:2FTS	%		*59.3*	*56.0*	*55.3*	*63.0*	*68.0*
Extraction Internal Standard 13C8 FOSA	%		*79.8*	*80.4*	*80.4*	*79.2*	*81.4*
Extraction Internal Standard d3 N MeFOSA	%		*77.0*	*79.6*	*75.9*	*75.4*	*79.8*
Extraction Internal Standard d5 N EtFOSA	%		*73.3*	*75.3*	*74.8*	*70.0*	*70.5*
Extraction Internal Standard d7 N MeFOSE	%		*79.3*	*74.0*	*70.8*	*74.7*	*78.9*
Extraction Internal Standard d9 N EtFOSE	%		*78.1*	*81.1*	*83.6*	*77.9*	*80.9*
Extraction Internal Standard d3 N MeFOSAA	%		*69.5*	*71.0*	*74.4*	*75.7*	*71.4*
Extraction Internal Standard d5 N EtFOSAA	%		*67.5*	*72.5*	*111*	*74.7*	*134*

Envirolab ID	Units	PQL	PFF1497-46
Your Reference			Rep 5-1
Date Sampled			20/06/2024
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	0.15
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	0.36
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	0.10
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0

PFAS Extended List (Soil) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFF1497-46
Your Reference			Rep 5-1
Date Sampled			20/06/2024
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20
Surrogate 13C8 PFOS	%		*103*
Surrogate 13C2 PFOA	%		*101*
Total +ve PFHxS+PFOS	µg/kg	0.10	0.15
Total +ve PFOA+PFOS	µg/kg	0.10	0.25
Total +ve PFAS	µg/kg	0.10	0.61
Extraction Internal Standard 13C3 PFBS	%		*84.0*
Extraction Internal Standard 18O2 PFHxS	%		*70.9*
Extraction Internal Standard 13C4 PFOS	%		*72.4*
Extraction Internal Standard 13C4 PFBA	%		*81.4*
Extraction Internal Standard 13C3 PFPeA	%		*79.9*
Extraction Internal Standard 13C2 PFHxA	%		*78.0*
Extraction Internal Standard 13C4 PFHpA	%		*82.7*
Extraction Internal Standard 13C4 PFOA	%		*75.5*
Extraction Internal Standard 13C5 PFNA	%		*83.2*
Extraction Internal Standard 13C2 PFDA	%		*62.1*
Extraction Internal Standard 13C2 PFUnDA	%		*99.3*
Extraction Internal Standard 13C2 PFDoDA	%		*59.7*
Extraction Internal Standard 13C2 PFTeDA	%		*60.6*
Extraction Internal Standard 13C2 4:2FTS	%		*75.0*
Extraction Internal Standard 13C2 6:2FTS	%		*61.8*
Extraction Internal Standard 13C2 8:2FTS	%		*60.1*
Extraction Internal Standard 13C8 FOSA	%		*78.8*
Extraction Internal Standard d3 N MeFOSA	%		*79.4*
Extraction Internal Standard d5 N EtFOSA	%		*72.5*
Extraction Internal Standard d7 N MeFOSE	%		*75.9*
Extraction Internal Standard d9 N EtFOSE	%		*85.2*
Extraction Internal Standard d3 N MeFOSAA	%		*75.4*
Extraction Internal Standard d5 N EtFOSAA	%		*122*

Result Comments

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

Method Summary

Method ID	Methodology Summary
INORG-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis can be completed outside of the recommended holding times. Solids are reported from a 1:5 water extract unless otherwise specified. Alternatively, pH is determined in a 1:5 extract using 0.01M calcium chloride or a solid is extracted at a ratio of 1:2.5 (AS1289.4.3.1), pH is measured in the extract.
INORG-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
INORG-137	Determination of Total Nitrogen, Sulphur and Total Carbon in solids, rock, plant material and vegetation via combustion and NDIR.
METALS-020	Determination of various metals by ICP-OES.
METALS-020_008A	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.
METALS-021	Determination of Mercury by Cold Vapour AAS.
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-022_PAH	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and solids using DCM/Acetone/Methanol. For PAHs:- Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, for Total +ve calculations, the PQL is reflective of the lowest individual PQL and therefore, for example, "Total +ve PAHs" is simply a sum of the positive individual PAHs.
ORG-023	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Soils are extracted with Methanol, diluted and analysed by purge and trap GC-MS.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.
ORG-029	Soil/solid and sorbent samples are extracted with basified Methanol. Waters and soil/sorbent extracts are directly injected and/or concentrated/extracted using SPE. TCLP/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MSMS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

Miscellaneous Information

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

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

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFF1497

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	224972.01 - Rockingham
Date Issued	04/07/2024

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	No	LCS Outliers Exist - See detailed list below
Duplicates	No	Duplicate Outliers Exist - See detailed list below
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	No	Surrogates / Extracted ISTD Outliers Exist - See detailed list below
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFF1497

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
vTRH&MBTEXN | Soil	42	18/06/2024	27/06/2024	01/07/2024	Yes
	2-5, 8-10, 13-15, 22-24	18/06/2024	27/06/2024	28/06/2024	Yes
	1, 6-7, 11, 25-26	19/06/2024	27/06/2024	28/06/2024	Yes
	30-37, 44	19/06/2024	27/06/2024	29/06/2024	Yes
	38-39, 41	20/06/2024	27/06/2024	01/07/2024	Yes
	12, 16-21	20/06/2024	27/06/2024	28/06/2024	Yes
	27-29, 40, 46	20/06/2024	27/06/2024	29/06/2024	Yes
BTEX TS | Soil	47	18/06/2024	27/06/2024	02/07/2024	Yes
	48	19/06/2024	27/06/2024	02/07/2024	Yes
	49	20/06/2024	27/06/2024	02/07/2024	Yes
sTRH | Soil	2-3	18/06/2024	27/06/2024	27/06/2024	Yes
	4-5, 8-10, 13-15, 22-24, 42	18/06/2024	27/06/2024	28/06/2024	Yes
	1	19/06/2024	27/06/2024	27/06/2024	Yes
	6-7, 11, 25-26, 30-37, 44	19/06/2024	27/06/2024	28/06/2024	Yes
	12, 16-21, 27-29, 38-41, 46	20/06/2024	27/06/2024	28/06/2024	Yes
PAH | Soil	2-5, 8-10, 13-15, 22-24, 42	18/06/2024	27/06/2024	28/06/2024	Yes
	1, 6-7, 11, 25-26, 30-37, 44	19/06/2024	27/06/2024	28/06/2024	Yes
	12, 16-21, 27-29, 38-41, 46	20/06/2024	27/06/2024	28/06/2024	Yes
Metals | Soil	42	18/06/2024	27/06/2024	01/07/2024	Yes
	2-5, 8-10, 13-15, 22-24	18/06/2024	27/06/2024	28/06/2024	Yes
	30-37, 44	19/06/2024	27/06/2024	01/07/2024	Yes
	1, 6-7, 11, 25-26	19/06/2024	27/06/2024	28/06/2024	Yes
	28-29, 38-41, 46	20/06/2024	27/06/2024	01/07/2024	Yes
	12, 16-21, 27	20/06/2024	27/06/2024	28/06/2024	Yes
Metals-Hg | Soil	2-5, 8-10, 13-15, 22-24	18/06/2024	27/06/2024	01/07/2024	Yes
	42	18/06/2024	27/06/2024	02/07/2024	Yes
	1, 6-7, 11, 25-26	19/06/2024	27/06/2024	01/07/2024	Yes
	30-37, 44	19/06/2024	27/06/2024	02/07/2024	Yes
	12, 16-21, 27	20/06/2024	27/06/2024	01/07/2024	Yes
	28-29, 38-41, 46	20/06/2024	27/06/2024	02/07/2024	Yes
CEC | Soil	33-34	19/06/2024	27/06/2024	28/06/2024	Yes
Exchangeable Cations | Soil	33-34	19/06/2024	27/06/2024	28/06/2024	Yes
TOC by Combustion | Soil	33-34	19/06/2024	27/06/2024	02/07/2024	Yes
pH | Soil	33-34	19/06/2024	28/06/2024	28/06/2024	No
Moisture | Soil	2-5, 8-10, 13-15, 22-24, 42	18/06/2024	27/06/2024	28/06/2024	Yes
	43	18/06/2024	28/06/2024	04/07/2024	Yes
	1, 6-7, 11, 25-26, 30-37, 44	19/06/2024	27/06/2024	28/06/2024	Yes
	45	19/06/2024	28/06/2024	04/07/2024	Yes
	12, 16-21, 27-29, 38-41, 46	20/06/2024	27/06/2024	28/06/2024	Yes
PFAS EXT-ISTD | Soil	2-5, 8-10, 13-15, 22-24, 42-43	18/06/2024	28/06/2024	29/06/2024	Yes
	1, 6-7, 11, 25-26, 30-37, 44-45	19/06/2024	28/06/2024	29/06/2024	Yes
	12, 16-21, 27-29, 38-41, 46	20/06/2024	28/06/2024	29/06/2024	Yes

Data Quality Assessment Summary PFF1497

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
PFAS-Extended | Soil	2-5, 8-10, 13-15, 22-24, 42-43	18/06/2024	28/06/2024	29/06/2024	Yes
	1, 6-7, 11, 25-26, 30-37, 44-45	19/06/2024	28/06/2024	29/06/2024	Yes
	12, 16-21, 27-29, 38-41, 46	20/06/2024	28/06/2024	29/06/2024	Yes

Outliers: Laboratory Control Samples

ORG-020|Semi-volatile TRH (Soil)| Batch BFF4361

Sample ID	Analyte	% Limits	% Recovery
BFF4361-BS1	o-Terphenyl	60 - 140	##[2]

Outliers: Duplicates

METALS-020|Acid Extractable Metals (Soil)| Batch BFF4351

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BFF4351-DUP1#	DUP1	Aluminium	40.00	48.7[6]
BFF4351-DUP3#	DUP3	Nickel	40.00	44.8[6]

METALS-020|Acid Extractable Metals (Soil)| Batch BFF4353

Sample ID	Duplicate ID	Analyte	% Limits	RPD
PFF1497-37	DUP2	Boron	40.00	200[6]
PFF1497-37	DUP2	Nickel	40.00	51.8[6]

ORG-020|Semi-volatile TRH (Soil)| Batch BFF4359

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BFF4359-DUP2#	DUP2	TRH >C16-C34 (F3)	50.00	200[3]
BFF4359-DUP2#	DUP2	TRH >C34-C40 (F4)	50.00	200[3]
BFF4359-DUP2#	DUP2	TRH C15-C28	50.00	200[3]
BFF4359-DUP2#	DUP2	TRH C29-C36	50.00	200[3]

Data Quality Assessment Summary PFF1497

Outliers: Matrix Spike

METALS-020|Acid Extractable Metals (Soil)| Batch BFF4351

Sample ID	Analyte	% Limits	% Recovery
BFF4351-MS1#	Aluminium	70 - 130	##[1]

METALS-020|Acid Extractable Metals (Soil)| Batch BFF4352

Sample ID	Analyte	% Limits	% Recovery
PFF1497-09	Aluminium	70 - 130	##[1]

METALS-020|Acid Extractable Metals (Soil)| Batch BFF4353

Sample ID	Analyte	% Limits	% Recovery
PFF1497-29	Aluminium	70 - 130	##[1]
PFF1497-29	Iron	70 - 130	##[1]

ORG-020|Semi-volatile TRH (Soil)| Batch BFF4361

Sample ID	Analyte	% Limits	% Recovery
PFF1497-29	o-Terphenyl	60 - 140	##[2]

Outliers: Surrogate / Extracted Internal Standards

ORG-029|PFAS Extended List (Matrix)| Batch BFF4725

Sample ID	Analyte	% Limits	% Recovery
PFF1497-12	Extraction Internal Standard d3 N MeFOSA	50 - 150	29.9 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	43.3 [4]
	Extraction Internal Standard d7 N MeFOSE	50 - 150	38.0 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	44.9 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	44.7 [4]
	Extraction Internal Standard d9 N EtFOSE	50 - 150	47.0 [4]
	Extraction Internal Standard 13C8 FOSA	50 - 150	35.7 [4]
	Extraction Internal Standard 13C5 PFNA	50 - 150	40.2 [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	28.2 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	26.2 [4]
	Extraction Internal Standard 13C2 PFDoDA	50 - 150	21.3 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	38.6 [4]
	Extraction Internal Standard d5 N EtFOSA	50 - 150	43.8 [4]
PFF1497-14	Extraction Internal Standard d3 N MeFOSA	50 - 150	41.7 [4]
	Extraction Internal Standard d9 N EtFOSE	50 - 150	23.3 [4]
	Extraction Internal Standard d7 N MeFOSE	50 - 150	30.2 [4]
	Extraction Internal Standard d5 N EtFOSA	50 - 150	35.7 [4]
	Extraction Internal Standard 13C8 FOSA	50 - 150	33.1 [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	38.6 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	186 [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	196 [4]
PFF1497-15	Extraction Internal Standard 13C2 PFDoDA	50 - 150	36.8 [4]
PFF1497-16	Extraction Internal Standard 13C2 PFUnDA	50 - 150	48.8 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	48.9 [4]
	Extraction Internal Standard 13C2 PFDoDA	50 - 150	44.2 [4]
PFF1497-18	Extraction Internal Standard 13C2 PFUnDA	50 - 150	47.3 [4]

ORG-029|PFAS Extended List (Matrix)| Batch BFF4726

Sample ID	Analyte	% Limits	% Recovery
PFF1497-21	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	175 [4]
	Extraction Internal Standard 13C2 PFDoDA	50 - 150	41.9 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	42.4 [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	49.0 [4]
	Extraction Internal Standard 13C8 FOSA	50 - 150	39.6 [4]
	Extraction Internal Standard d3 N MeFOSA	50 - 150	37.0 [4]
	Extraction Internal Standard d5 N EtFOSA	50 - 150	37.8 [4]
	Extraction Internal Standard d7 N MeFOSE	50 - 150	35.4 [4]
	Extraction Internal Standard d9 N EtFOSE	50 - 150	26.7 [4]
PFF1497-24	Extraction Internal Standard d5 N EtFOSAA	50 - 150	167 [4]
PFF1497-26	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
PFF1497-27	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
PFF1497-28	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]

ORG-029|PFAS Extended List (Matrix)| Batch BFF4726

Sample ID	Analyte	% Limits	% Recovery
PFF1497-30	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	42.4 [4]
	Extraction Internal Standard 13C8 FOSA	50 - 150	23.2 [4]
	Extraction Internal Standard d3 N MeFOSA	50 - 150	24.4 [4]
	Extraction Internal Standard d5 N EtFOSA	50 - 150	## [4]
	Extraction Internal Standard d7 N MeFOSE	50 - 150	20.2 [4]
	Extraction Internal Standard d9 N EtFOSE	50 - 150	## [4]
PFF1497-38	Extraction Internal Standard 13C2 PFDoDA	50 - 150	31.3 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	43.4 [4]
PFF1497-39	Extraction Internal Standard 13C2 PFDoDA	50 - 150	48.6 [4]

Outliers: QC Frequency

INORG-008|Inorganics - Moisture (Soil)| Batch BFF4728

Analysis	QC Type	Expected	Reported
Moisture	Duplicate	1	0

Quality Control PFF1497

ORG-023_F1_TOT|Volatile TRH and BTEX (Soil) | Batch BFF4355

Analyte	Units	PQL	Blank	DUP1 BFF4355-DUP1# Samp | QC | RPD %	DUP2 BFF4355-DUP2# Samp | QC | RPD %	LCS %	Spike % BFF4355-MS1#
TRH C6-C9	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	90.1	72.0
TRH C6-C10	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	91.2	73.0
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	[NA]	[NA]
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Benzene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	80.5	65.8
Toluene	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	87.1	71.0
Ethylbenzene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	84.8	68.7
meta+para Xylene	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	81.7	65.2
ortho-Xylene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	80.1	64.2
Total Xylene	mg/kg	3.0	<3.0	<3.0 | <3.0 | [NA]	<3.0 | <3.0 | [NA]	[NA]	[NA]
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	*%*		*116*	*77.0 | 91.9*	*94.9 | 77.8*	*103*	*80.1*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-023_F1_TOT|Volatile TRH and BTEX (Soil) | Batch BFF4356

Analyte	Units	PQL	Blank	DUP1 PFF1497-07 Samp | QC | RPD %	DUP2 PFF1497-17 Samp | QC | RPD %	LCS %	Spike % PFF1497-08
TRH C6-C9	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	96.4	92.2
TRH C6-C10	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	97.5	93.5
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	[NA]	[NA]
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Benzene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	87.7	95.5
Toluene	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	93.5	93.7
Ethylbenzene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	91.1	90.1
meta+para Xylene	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	86.1	86.2
ortho-Xylene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	84.8	84.5
Total Xylene	mg/kg	3.0	<3.0	<3.0 | <3.0 | [NA]	<3.0 | <3.0 | [NA]	[NA]	[NA]
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	*%*		*108*	*113 | 107*	*106 | 93.7*	*112*	*108*

ORG-023_F1_TOT|Volatile TRH and BTEX (Soil) | Batch BFF4357

Analyte	Units	PQL	Blank	DUP1 PFF1497-27 Samp | QC | RPD %	DUP2 PFF1497-37 Samp | QC | RPD %	LCS %	Spike % PFF1497-28
TRH C6-C9	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	104	97.6
TRH C6-C10	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	105	98.9
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25 | <25 | [NA]	<25 | <25 | [NA]	[NA]	[NA]
Methyl tert butyl ether (MTBE)	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Benzene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	96.4	99.5
Toluene	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	104	101
Ethylbenzene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	104	96.6
meta+para Xylene	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	96.1	92.0
ortho-Xylene	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	95.5	90.3
Total Xylene	mg/kg	3.0	<3.0	<3.0 | <3.0 | [NA]	<3.0 | <3.0 | [NA]	[NA]	[NA]
Naphthalene (value used in F2 calc)	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	*%*		*106*	*99.9 | 101*	*114 | 101*	*117*	*117*

Quality Control PFF1497

ORG-020|Semi-volatile TRH (Soil) | Batch BFF4359

Analyte	Units	PQL	Blank	DUP1 BFF4359-DUP1# Samp | QC | RPD %	DUP2 BFF4359-DUP2# Samp | QC | RPD %	LCS %	Spike % BFF4359-MS1#
TRH C10-C14	mg/kg	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	107	109
TRH C15-C28	mg/kg	100	<100	<100 | <100 | [NA] [3]	<100 | <100 | 200 [3]	105	111
TRH C29-C36	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | 200 [3]	102	139
TRH >C10-C16	mg/kg	50	<50	<50 | <50 | [NA] [3]	<50 | <50 | [NA]	105	108
TRH >C16-C34 (F3)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | 200 [3]	106	114
TRH >C34-C40 (F4)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | 200 [3]	99.6	108
Surrogate o-Terphenyl	*%*		*103*	*103 / 99.6*	*101 / 100*	*96.8*	*94.5*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-020|Semi-volatile TRH (Soil) | Batch BFF4360

Analyte	Units	PQL	Blank	DUP1 PFF1497-08 Samp | QC | RPD %	DUP2 PFF1497-18 Samp | QC | RPD %	LCS %	Spike % PFF1497-09
TRH C10-C14	mg/kg	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	99.0	103
TRH C15-C28	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	99.8	99.9
TRH C29-C36	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	110	76.9
TRH >C10-C16	mg/kg	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	96.7	101
TRH >C16-C34 (F3)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	101	98.8
TRH >C34-C40 (F4)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	111	82.8
Surrogate o-Terphenyl	*%*		*102*	*103 / 103*	*102 / 102*	*98.1*	*96.3*

ORG-020|Semi-volatile TRH (Soil) | Batch BFF4361

Analyte	Units	PQL	Blank	DUP1 PFF1497-28 Samp | QC | RPD %	DUP2 PFF1497-38 Samp | QC | RPD %	LCS %	Spike % PFF1497-29
TRH C10-C14	mg/kg	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	98.4	97.6
TRH C15-C28	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	97.5	100
TRH C29-C36	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	87.9	98.6
TRH >C10-C16	mg/kg	50	<50	<50 | <50 | [NA]	<50 | <50 | [NA]	97.2	97.7
TRH >C16-C34 (F3)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA]	97.2	101
TRH >C34-C40 (F4)	mg/kg	100	<100	<100 | <100 | [NA]	<100 | <100 | [NA] [5]	100	98.9
Surrogate o-Terphenyl	*%*		*99.4*	*101 / 100*	*99.6 / 99.3*	*## [2]*	*##[2]*

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Soil) | Batch BFF4359

Analyte	Units	PQL	Blank	DUP1 BFF4359-DUP1# Samp | QC | RPD %	DUP2 BFF4359-DUP2# Samp | QC | RPD %	LCS %	Spike % BFF4359-MS2#
Naphthalene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	91.6	79.1
Acenaphthylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Acenaphthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.1	76.2
Fluorene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	91.2	80.0
Phenanthrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	94.1	80.5
Anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fluoranthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	87.2	78.1
Pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	87.5	78.6
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chrysene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	81.1	71.2
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	81.9	72.7
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*84.6*	*83.1 / 89.4*	*92.5 / 91.4*	*90.7*	*82.3*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFF1497

ORG-022_PAH | Polycyclic Aromatic Hydrocarbons (Soil) | Batch BFF4360

Analyte	Units	PQL	Blank	DUP1 PFF1497-08 Samp | QC | RPD %	DUP2 PFF1497-18 Samp | QC | RPD %	LCS %	Spike % PFF1497-09
Naphthalene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	89.6	91.4
Acenaphthylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Acenaphthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	92.3	93.4
Fluorene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	97.0	98.1
Phenanthrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.5	89.8
Anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fluoranthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	104	105
Pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	104
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chrysene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.7	90.5
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	99.5	89.9
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*99.6*	*98.5 | 99.0*	*97.5 | 100*	*96.8*	*95.4*

ORG-022_PAH | Polycyclic Aromatic Hydrocarbons (Soil) | Batch BFF4361

Analyte	Units	PQL	Blank	DUP1 PFF1497-28 Samp | QC | RPD %	DUP2 PFF1497-38 Samp | QC | RPD %	LCS %	Spike % PFF1497-29
Naphthalene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	83.7	94.2
Acenaphthylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Acenaphthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	86.1	96.4
Fluorene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	90.9	101
Phenanthrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	86.6	96.7
Anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fluoranthene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	92.2	105
Pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	92.5	103
Benzo(a)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chrysene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	80.4	88.9
Benzo(b,j,k)fluoranthene	mg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Benzo(a)pyrene	mg/kg	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	86.8	100
Indeno(1,2,3-c,d)pyrene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*103*	*117 | 114*	*101 | 110*	*98.0*	*101*

Quality Control PFF1497

METALS-020|Acid Extractable Metals (Soil) | Batch BFF4351

Analyte	Units	PQL	Blank	DUP1 BFF4351-DUP1# Samp | QC | RPD %	DUP2 BFF4351-DUP2# Samp | QC | RPD %	LCS %	Spike % BFF4351-MS1#
Aluminium	mg/kg	10	<10	2640 | 4330 | 48.7 [6]	136 | 101 | 29.4	96.0	##[1]
Arsenic	mg/kg	4.0	<4.0	<4.0 | <4.0 | [NA]	<4.0 | <4.0 | [NA]	98.9	88.9
Barium	mg/kg	1.0	<1.0	27.3 | 28.1 | 2.78	7.65 | 7.84 | 2.37	119	128
Beryllium	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.1	105
Boron	mg/kg	10	<10	<10 | <10 | [NA]	<10 | <10 | [NA]	91.0	98.7
Cadmium	mg/kg	0.40	<0.40	<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	98.6	100
Chromium	mg/kg	1.0	<1.0	5.52 | 7.79 | 34.2	<1.0 | <1.0 | [NA]	95.1	98.3
Cobalt	mg/kg	1.0	<1.0	1.30 | 1.72 | 27.4	<1.0 | <1.0 | [NA]	97.8	100
Copper	mg/kg	1.0	<1.0	9.17 | 9.59 | 4.54	<1.0 | <1.0 | [NA]	96.4	102
Lead	mg/kg	1.0	<1.0	5.99 | 6.27 | 4.65	2.00 | 2.26 | 12.0	94.0	96.2
Manganese	mg/kg	1.0	<1.0	36.4 | 40.3 | 10.1	9.16 | 10.4 | 12.9	96.9	108
Mercury	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA] [5]	<0.10 | <0.10 | [NA]	102	98.0
Nickel	mg/kg	1.0	<1.0	3.06 | 4.57 | 39.5	<1.0 | <1.0 | [NA]	93.9	95.9
Selenium	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	94.2	94.7
Vanadium	mg/kg	1.0	<1.0	9.24 | 13.7 | 39.0	<1.0 | <1.0 | [NA]	99.9	104
Zinc	mg/kg	1.0	<1.0	51.7 | 63.6 | 20.7	<1.0 | <1.0 | [NA]	95.4	89.3

Analyte	Units	PQL	Blank	DUP3 BFF4351-DUP3# Samp | QC | RPD %	DUP4 BFF4351-DUP4# Samp | QC | RPD %	LCS %
Aluminium	mg/kg	10		2640 | 3210 | 19.6	136 | 110 | 20.8	[NA]
Arsenic	mg/kg	4		<4.0 | <4.0 | [NA]	<4.0 | <4.0 | [NA]	[NA]
Barium	mg/kg	1		27.3 | 26.5 | 3.10	7.65 | 7.77 | 1.53	[NA]
Beryllium	mg/kg	1		<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]
Boron	mg/kg	10		<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]
Cadmium	mg/kg	0.4		<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	[NA]
Chromium	mg/kg	1		5.52 | 7.50 | 30.5	<1.0 | <1.0 | [NA]	[NA]
Cobalt	mg/kg	1		1.30 | 1.56 | 18.0	<1.0 | <1.0 | [NA]	[NA]
Copper	mg/kg	1		9.17 | 10.4 | 12.6	<1.0 | <1.0 | [NA]	[NA]
Lead	mg/kg	1		5.99 | 6.17 | 3.07	2.00 | 1.97 | 1.58	[NA]
Manganese	mg/kg	1		36.4 | 38.0 | 4.35	9.16 | 8.68 | 5.37	[NA]
Mercury	mg/kg	0.1		<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]
Nickel	mg/kg	1		3.06 | 4.83 | 44.8 [6]	<1.0 | <1.0 | [NA]	[NA]
Selenium	mg/kg	2		<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	[NA]
Vanadium	mg/kg	1		9.24 | 11.3 | 20.4	<1.0 | <1.0 | [NA]	[NA]
Zinc	mg/kg	1		51.7 | 62.8 | 19.4	<1.0 | <1.0 | [NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFF1497

METALS-020|Acid Extractable Metals (Soil) | Batch BFF4352

Analyte	Units	PQL	Blank	DUP1 PFF1497-08 Samp | QC | RPD %	DUP2 PFF1497-18 Samp | QC | RPD %	LCS %	Spike % PFF1497-09
Aluminium	mg/kg	10	<10	1130 | 1180 | 4.84	930 | 898 | 3.60	96.5	##[1]
Arsenic	mg/kg	4.0	<4.0	5.32 | 5.62 | 5.57	5.60 | 5.72 | 2.14	100	94.8
Barium	mg/kg	1.0	<1.0	8.00 | 8.30 | 3.63	8.19 | 7.92 | 3.33	120	114
Beryllium	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	97.1	91.5
Boron	mg/kg	10	<10	<10 | <10 | [NA]	<10 | <10 | [NA]	90.8	87.4
Cadmium	mg/kg	0.40	<0.40	<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	98.8	82.6
Chromium	mg/kg	1.0	<1.0	10.5 | 10.9 | 3.91	9.78 | 9.37 | 4.35	94.9	83.1
Cobalt	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	97.6	83.9
Copper	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	95.4	93.0
Lead	mg/kg	1.0	<1.0	3.03 | 3.02 | 0.220	3.32 | 3.45 | 3.75	94.0	80.2
Manganese	mg/kg	1.0	<1.0	27.9 | 28.5 | 2.08	29.5 | 28.3 | 4.00	96.2	83.1
Mercury	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	103
Nickel	mg/kg	1.0	<1.0	6.04 | 5.45 | 10.2	6.79 | 6.32 | 7.19	94.5	78.9
Selenium	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	94.2	88.8
Vanadium	mg/kg	1.0	<1.0	4.67 | 4.79 | 2.61	4.67 | 4.49 | 3.86	99.7	89.0
Zinc	mg/kg	1.0	<1.0	1.33 | 1.44 | 8.04	1.40 | 1.42 | 1.49	95.4	78.0

Analyte	Units	PQL	Blank	DUP3 PFF1497-08 Samp | QC | RPD %	DUP4 PFF1497-18 Samp | QC | RPD %	LCS %
Aluminium	mg/kg	10		1130 | 1090 | 3.54	930 | 894 | 4.02	[NA]
Arsenic	mg/kg	4		5.32 | 5.06 | 5.03	5.60 | 5.50 | 1.84	[NA]
Barium	mg/kg	1		8.00 | 7.61 | 4.99	8.19 | 7.64 | 7.01	[NA]
Beryllium	mg/kg	1		<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]
Boron	mg/kg	10		<10 | <10 | [NA]	<10 | <10 | [NA]	[NA]
Cadmium	mg/kg	0.4		<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	[NA]
Chromium	mg/kg	1		10.5 | 10.0 | 4.69	9.78 | 9.42 | 3.83	[NA]
Cobalt	mg/kg	1		<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]
Copper	mg/kg	1		<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]
Lead	mg/kg	1		3.03 | 2.85 | 6.11	3.32 | 3.05 | 8.54	[NA]
Manganese	mg/kg	1		27.9 | 25.7 | 8.17	29.5 | 27.5 | 6.74	[NA]
Mercury	mg/kg	0.1		<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]
Nickel	mg/kg	1		6.04 | 4.71 | 24.7	6.79 | 5.16 | 27.2	[NA]
Selenium	mg/kg	2		<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	[NA]
Vanadium	mg/kg	1		4.67 | 4.44 | 5.05	4.67 | 4.44 | 5.06	[NA]
Zinc	mg/kg	1		1.33 | 1.30 | 1.89	1.40 | 1.60 | 13.1	[NA]

Quality Control PFF1497

METALS-020|Acid Extractable Metals (Soil) | Batch BFF4353

Analyte	Units	PQL	Blank	DUP1 PFF1497-28 Samp | QC | RPD %	DUP2 PFF1497-37 Samp | QC | RPD %	LCS %	Spike % PFF1497-29
Aluminium	mg/kg	10	<10	1340 | 1430 | 6.35	1260 | 1370 | 8.37	96.0	##[1]
Arsenic	mg/kg	4.0	<4.0	7.04 | 7.45 | 5.56	7.88 | 8.40 | 6.42	105	101
Barium	mg/kg	1.0	<1.0	12.4 | 13.0 | 4.60	9.32 | 10.2 | 8.53	123	129
Beryllium	mg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	104	104
Boron	mg/kg	10	<10	17.0 | 17.5 | 3.27	<10 | 10.9 | 200 [6]	103	94.1
Cadmium	mg/kg	0.40	<0.40	<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	108	86.3
Chromium	mg/kg	1.0	<1.0	12.5 | 12.7 | 1.79	13.4 | 13.9 | 3.68	104	89.1
Cobalt	mg/kg	1.0	<1.0	1.08 | 1.34 | 21.8	<1.0 | <1.0 | [NA]	107	89.5
Copper	mg/kg	1.0	<1.0	4.87 | 5.44 | 11.2	2.43 | 3.48 | 35.6	103	111
Iron	mg/kg	10	<10	2230 | 2290 | 2.71	2630 | 2740 | 4.01	109	##[1]
Lead	mg/kg	1.0	<1.0	6.45 | 6.59 | 2.12	7.44 | 9.10 | 20.1	104	87.4
Manganese	mg/kg	1.0	<1.0	37.8 | 38.4 | 1.63	48.9 | 51.5 | 5.15	102	73.6
Mercury	mg/kg	0.10	<0.10	0.104 | <0.10 | 18.8	<0.10 | <0.10 | [NA]	119	107
Nickel	mg/kg	1.0	<1.0	62.2 | 71.0 | 13.1	28.6 | 48.5 | 51.8 [6]	104	85.6
Selenium	mg/kg	2.0	<2.0	<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	98.9	95.5
Vanadium	mg/kg	1.0	<1.0	5.94 | 6.11 | 2.70	7.16 | 7.60 | 5.97	107	96.3
Zinc	mg/kg	1.0	<1.0	7.34 | 8.80 | 18.1	3.31 | 4.21 | 24.0	104	79.6

Analyte	Units	PQL	Blank	DUP3 PFF1497-28 Samp | QC | RPD %	DUP4 PFF1497-37 Samp | QC | RPD %	LCS %
Aluminium	mg/kg	10		1340 | 1270 | 5.88	1260 | 1290 | 2.16	[NA]
Arsenic	mg/kg	4		7.04 | 6.43 | 9.17	7.88 | 8.18 | 3.77	[NA]
Barium	mg/kg	1		12.4 | 11.6 | 6.77	9.32 | 9.55 | 2.47	[NA]
Beryllium	mg/kg	1		<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	[NA]
Boron	mg/kg	10		17.0 | 15.5 | 8.72	<10 | <10 | [NA]	[NA]
Cadmium	mg/kg	0.4		<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	[NA]
Chromium	mg/kg	1		12.5 | 11.4 | 8.99	13.4 | 13.1 | 2.16	[NA]
Cobalt	mg/kg	1		1.08 | 1.03 | 4.38	<1.0 | <1.0 | [NA]	[NA]
Copper	mg/kg	1		4.87 | 4.66 | 4.33	2.43 | 2.93 | 18.8	[NA]
Iron	mg/kg	10		2230 | 2120 | 5.14	2630 | 2650 | 0.581	[NA]
Lead	mg/kg	1		6.45 | 5.84 | 9.86	7.44 | 7.67 | 3.04	[NA]
Manganese	mg/kg	1		37.8 | 34.7 | 8.61	48.9 | 48.4 | 1.04	[NA]
Mercury	mg/kg	0.1		0.104 | <0.10 | 35.2	<0.10 | <0.10 | [NA]	[NA]
Nickel	mg/kg	1		62.2 | 62.5 | 0.451	28.6 | 34.7 | 19.4	[NA]
Selenium	mg/kg	2		<2.0 | <2.0 | [NA]	<2.0 | <2.0 | [NA]	[NA]
Vanadium	mg/kg	1		5.94 | 5.48 | 8.16	7.16 | 7.25 | 1.23	[NA]
Zinc	mg/kg	1		7.34 | 7.08 | 3.59	3.31 | 3.67 | 10.4	[NA]

METALS-020_008A|Exchangeable Cations (Soil) | Batch BFF4350

Analyte	Units	PQL	Blank	DUP1 PFF1497-33 Samp | QC | RPD %	LCS %	Spike % PFF1497-34
Calcium	meq/100g	0.10	<0.10	5.37 | 5.38 | 0.186	85.6	113
Potassium	meq/100g	0.10	<0.10	<0.10 | <0.10 | [NA]	94.9	100
Magnesium	meq/100g	0.10	<0.10	0.150 | 0.140 | 6.90	82.1	86.0
Sodium	meq/100g	0.10	<0.10	<0.10 | <0.10 | [NA]	85.2	89.4
Cation Exchange Capacity (CEC)	meq/100g	0.10	<0.10		[NA]	[NA]

INORG-137|Inorganics - Carbon, Nitrogen and Sulfur Species (Soil) | Batch BFF4426

Analyte	Units	PQL	Blank	DUP1 PFF1497-33 Samp | QC | RPD %	LCS %
Total Organic Carbon	%	0.010	<0.010	1.05 | 1.05 | 0.381	[NA]

Quality Control PFF1497

INORG-001 | Inorganics - General Physical Parameters (Soil) | Batch BFF4594

Analyte	Units	PQL	Blank	DUP1 BFF4594-DUP1# Samp | QC | RPD %	LCS %
pH	pH units		5.6	9.2 | 9.3 | 0.865	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-008 | Inorganics - Moisture (Soil) | Batch BFF4344

Analyte	Units	PQL	Blank	DUP1 BFF4344-DUP1# Samp | QC | RPD %	DUP2 BFF4344-DUP2# Samp | QC | RPD %	LCS %
Moisture	%	0.1		6.91 | 6.62 | 4.29	18.6 | 18.6 | 0.108	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-008 | Inorganics - Moisture (Soil) | Batch BFF4345

Analyte	Units	PQL	Blank	DUP1 PFF1497-08 Samp | QC | RPD %	DUP2 PFF1497-18 Samp | QC | RPD %	LCS %
Moisture	%	0.1		11.1 | 11.2 | 1.08	11.0 | 10.8 | 1.84	[NA]

INORG-008 | Inorganics - Moisture (Soil) | Batch BFF4346

Analyte	Units	PQL	Blank	DUP1 PFF1497-28 Samp | QC | RPD %	DUP2 PFF1497-38 Samp | QC | RPD %	LCS %
Moisture	%	0.1		12.9 | 12.9 | 0.543	16.0 | 16.0 | 0.313	[NA]

Quality Control PFF1497

ORG-029|PFAS Extended List (Soil) | Batch BFF4725

Analyte	Units	PQL	Blank	DUP1 PFF1497-01 Samp | QC | RPD %	DUP2 PFF1497-11 Samp | QC | RPD %	LCS %	Spike % PFF1497-02
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	105
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	104
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	101	101
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	106	104
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	0.347 | 0.382 | 9.44	0.162 | 0.186 | 13.9	104	100
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	90.5	93.5
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	94.7	97.2
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	98.8	98.6
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	97.4	99.7
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	100
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	0.165 | 0.215 | 26.1	89.6	96.7
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	90.5	91.9
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	95.4	95.8
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	88.6	93.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	106	112
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	112	101
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	76.8	106
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	101	96.6
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	98.5	98.8
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	91.0	97.9
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	83.7	96.1
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	99.3	95.8
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	100	102
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	106	101
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	94.3	104
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	113	107
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	96.5	105
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	97.8	96.6
Surrogate 13C8 PFOS	%		*100*	*103 | 98.1*	*110 | 107*	*100*	*95.2*
Surrogate 13C2 PFOA	%		*101*	*102 | 102*	*99.9 | 99.9*	*97.6*	*98.6*
Extraction Internal Standard 13C3 PFBS	%		*96.2*	*93.1 | 90.0 | 3.37*	*85.2 | 86.8 | 1.94*	[NA]	[NA]
Extraction Internal Standard 18O2 PFHxS	%		*95.2*	*89.3 | 89.0 | 0.348*	*78.8 | 75.3 | 4.54*	[NA]	[NA]
Extraction Internal Standard 13C4 PFOS	%		*99.0*	*93.0 | 93.5 | 0.525*	*69.5 | 69.8 | 0.416*	[NA]	[NA]
Extraction Internal Standard 13C4 PFBA	%		*101*	*97.6 | 98.1 | 0.531*	*83.3 | 85.1 | 2.16*	[NA]	[NA]
Extraction Internal Standard 13C3 PFPeA	%		*109*	*101 | 101 | 0.327*	*84.9 | 86.5 | 1.77*	[NA]	[NA]
Extraction Internal Standard 13C2 PFHxA	%		*98.0*	*99.2 | 95.6 | 3.68*	*78.0 | 75.3 | 3.47*	[NA]	[NA]
Extraction Internal Standard 13C4 PFHpA	%		*101*	*97.0 | 95.6 | 1.46*	*84.8 | 85.8 | 1.16*	[NA]	[NA]
Extraction Internal Standard 13C4 PFOA	%		*104*	*99.5 | 99.4 | 0.0704*	*79.4 | 81.8 | 3.01*	[NA]	[NA]
Extraction Internal Standard 13C5 PFNA	%		*111*	*102 | 102 | 0.206*	*83.3 | 84.1 | 0.980*	[NA]	[NA]
Extraction Internal Standard 13C2 PFDA	%		*105*	*96.6 | 107 | 9.89*	*69.2 | 68.1 | 1.67*	[NA]	[NA]
Extraction Internal Standard 13C2 PFUnDA	%		*110*	*105 | 105 | 0.542*	*80.9 | 83.4 | 2.98*	[NA]	[NA]
Extraction Internal Standard 13C2 PFDoDA	%		*102*	*99.4 | 96.7 | 2.76*	*69.3 | 70.7 | 2.03*	[NA]	[NA]
Extraction Internal Standard 13C2 PFTeDA	%		*116*	*117 | 112 | 4.90*	*77.4 | 76.6 | 1.16*	[NA]	[NA]
Extraction Internal Standard 13C2 4:2FTS	%		*104*	*91.5 | 91.6 | 0.0546*	*75.5 | 81.8 | 7.98*	[NA]	[NA]
Extraction Internal Standard 13C2 6:2FTS	%		*101*	*89.4 | 90.0 | 0.624*	*64.3 | 67.2 | 4.32*	[NA]	[NA]
Extraction Internal Standard 13C2 8:2FTS	%		*102*	*103 | 87.2 | 16.5*	*63.1 | 68.9 | 8.76*	[NA]	[NA]
Extraction Internal Standard 13C8 FOSA	%		*105*	*98.4 | 95.8 | 2.69*	*79.7 | 80.9 | 1.49*	[NA]	[NA]
Extraction Internal Standard d3 N MeFOSA	%		*100*	*93.0 | 91.0 | 2.14*	*79.6 | 77.1 | 3.24*	[NA]	[NA]
Extraction Internal Standard d5 N EtFOSA	%		*94.3*	*86.6 | 84.6 | 2.24*	*75.6 | 73.3 | 3.02*	[NA]	[NA]
Extraction Internal Standard d7 N MeFOSE	%		*104*	*98.0 | 95.0 | 3.15*	*76.6 | 85.1 | 10.6*	[NA]	[NA]
Extraction Internal Standard d9 N EtFOSE	%		*101*	*87.3 | 87.5 | 0.286*	*86.3 | 80.0 | 7.54*	[NA]	[NA]
Extraction Internal Standard d3 N MeFOSAA	%		*97.8*	*95.6 | 94.2 | 1.53*	*68.0 | 80.0 | 16.2*	[NA]	[NA]
Extraction Internal Standard d5 N EtFOSAA	%		*97.3*	*99.2 | 98.3 | 0.932*	*72.6 | 73.3 | 0.932*	[NA]	[NA]

Quality Control PFF1497

ORG-029|PFAS Extended List (Soil) | Batch BFF4726

Analyte	Units	PQL	Blank	DUP1 PFF1497-21 Samp | QC | RPD %	DUP2 PFF1497-31 Samp | QC | RPD %	LCS %	Spike % PFF1497-22
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	96.0	102
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	108	114
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	94.9	92.7
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	98.3	105
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	0.652 | 0.722 | 10.2	<0.10 | <0.10 | [NA]	105	111
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	94.0	99.6
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	102	109
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	100	103
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	101	114
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	92.6	100
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	99.5	97.1
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	95.7	96.2
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	97.1	104
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	98.6	82.1
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	105	109
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	95.7	102
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	75.0	87.0
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	93.2	102
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	93.8	93.2
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	97.7	91.6
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	94.8	80.7
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.8	107
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	106	107
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	104	102
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	116	130
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	93.0	106
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	99.6	103
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	90.0	97.3
Surrogate 13C8 PFOS	*%*		*109*	*108 | 109*	*101 | 106*	*110*	*110*
Surrogate 13C2 PFOA	*%*		*97.8*	*99.1 | 103*	*103 | 108*	*103*	*94.2*
Extraction Internal Standard 13C3 PFBS	*%*		*97.1*	*83.9 | 81.5 | 2.85*	*89.4 | 89.7 | 0.380*	*[NA]*	*[NA]*
Extraction Internal Standard 18O2 PFHxS	*%*		*79.9*	*64.8 | 65.6 | 1.18*	*84.9 | 87.1 | 2.49*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOS	*%*		*77.4*	*58.7 | 59.8 | 1.81*	*86.2 | 80.8 | 6.43*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFBA	*%*		*91.8*	*76.6 | 75.1 | 1.98*	*92.6 | 88.1 | 5.05*	*[NA]*	*[NA]*
Extraction Internal Standard 13C3 PFPeA	*%*		*93.8*	*96.2 | 91.7 | 4.77*	*92.2 | 88.0 | 4.68*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFHxA	*%*		*87.1*	*92.9 | 94.4 | 1.61*	*88.9 | 83.2 | 6.64*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFHpA	*%*		*95.4*	*93.7 | 88.3 | 5.96*	*86.1 | 84.3 | 2.19*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOA	*%*		*84.1*	*77.0 | 71.0 | 8.19*	*85.4 | 80.0 | 6.51*	*[NA]*	*[NA]*
Extraction Internal Standard 13C5 PFNA	*%*		*88.2*	*64.1 | 65.7 | 2.56*	*87.3 | 85.6 | 2.06*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFDA	*%*		*64.3*	*63.9 | 61.0 | 4.65*	*84.5 | 77.9 | 8.14*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFUnDA	*%*		*77.4*	*49.0 | 38.7 | 23.4 [4]*	*84.9 | 84.8 | 0.189*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFDoDA	*%*		*64.9*	*41.9 | 38.2 | 9.11 [4]*	*73.8 | 72.5 | 1.68*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFTeDA	*%*		*63.2*	*42.4 | 38.9 | 8.46 [4]*	*72.1 | 72.4 | 0.457*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 4:2FTS	*%*		*82.1*	*## | ## | [NA] [4]*	*83.2 | 72.6 | 13.6*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 6:2FTS	*%*		*70.1*	*175 | 170 | 2.75 [4]*	*64.5 | 62.0 | 4.03*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 8:2FTS	*%*		*73.2*	*113 | 129 | 12.9*	*64.3 | 73.9 | 13.9*	*[NA]*	*[NA]*
Extraction Internal Standard 13C8 FOSA	*%*		*81.9*	*39.6 | 37.6 | 5.08 [4]*	*95.3 | 92.7 | 2.78*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSA	*%*		*83.6*	*37.0 | 35.7 | 3.47 [4]*	*84.2 | 85.5 | 1.56*	*[NA]*	*[NA]*
Extraction Internal Standard d5 N EtFOSA	*%*		*75.5*	*37.8 | 36.0 | 4.94 [4]*	*82.5 | 80.4 | 2.63*	*[NA]*	*[NA]*
Extraction Internal Standard d7 N MeFOSE	*%*		*91.8*	*35.4 | 31.0 | 13.4 [4]*	*102 | 90.4 | 12.4*	*[NA]*	*[NA]*
Extraction Internal Standard d9 N EtFOSE	*%*		*86.1*	*26.7 | 24.7 | 7.75 [4]*	*87.4 | 88.9 | 1.77*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSAA	*%*		*74.7*	*81.3 | 73.9 | 9.64*	*76.8 | 74.9 | 2.53*	*[NA]*	*[NA]*
Extraction Internal Standard d5 N EtFOSAA	*%*		*74.0*	*65.5 | 69.8 | 6.33*	*77.0 | 73.4 | 4.84*	*[NA]*	*[NA]*

Quality Control PFF1497

ORG-029|PFAS Extended List (Soil) | Batch BFF4727

Analyte	Units	PQL	Blank	DUP1 PFF1497-41 Samp | QC | RPD %	LCS %	Spike % PFF1497-42
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	105	98.2
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	104	112
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	98.9	94.3
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	105	103
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	0.139 | 0.111 | 22.1	102	114
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	94.9	103
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	0.237 | 0.233 | 1.86	95.5	107
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	98.2	101
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	92.6	99.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	103	97.5
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	96.7	108
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	92.2	91.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	102	117
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	97.4	83.4
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	105	110
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	99.4	114
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	77.0	106
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	103	100
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	101	104
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	111	97.0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	114	95.7
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	96.5	99.3
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	100	102
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	102	103
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	<1.0 | <1.0 | [NA]	102	118
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	<5.0 | <5.0 | [NA]	104	111
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	109	118
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	<0.20 | <0.20 | [NA]	103	92.0
Surrogate 13C8 PFOS	%		*96.6*	*112 | 109*	*99.7*	*110*
Surrogate 13C2 PFOA	%		*103*	*103 | 110*	*101*	*102*
Extraction Internal Standard 13C3 PFBS	%		*97.9*	*82.4 | 82.4 | 0.0728*	[NA]	[NA]
Extraction Internal Standard 18O2 PFHxS	%		*95.9*	*70.1 | 69.1 | 1.44*	[NA]	[NA]
Extraction Internal Standard 13C4 PFOS	%		*102*	*66.2 | 67.9 | 2.48*	[NA]	[NA]
Extraction Internal Standard 13C4 PFBA	%		*104*	*79.9 | 77.7 | 2.79*	[NA]	[NA]
Extraction Internal Standard 13C3 PFPeA	%		*106*	*82.3 | 80.4 | 2.37*	[NA]	[NA]
Extraction Internal Standard 13C2 PFHxA	%		*105*	*75.9 | 73.4 | 3.39*	[NA]	[NA]
Extraction Internal Standard 13C4 PFHpA	%		*104*	*82.0 | 80.5 | 1.92*	[NA]	[NA]
Extraction Internal Standard 13C4 PFOA	%		*105*	*77.0 | 73.6 | 4.40*	[NA]	[NA]
Extraction Internal Standard 13C5 PFNA	%		*110*	*76.7 | 73.9 | 3.78*	[NA]	[NA]
Extraction Internal Standard 13C2 PFDA	%		*109*	*66.5 | 64.6 | 2.99*	[NA]	[NA]
Extraction Internal Standard 13C2 PFUnDA	%		*125*	*92.5 | 75.1 | 20.8*	[NA]	[NA]
Extraction Internal Standard 13C2 PFDoDA	%		*115*	*57.7 | 58.5 | 1.45*	[NA]	[NA]
Extraction Internal Standard 13C2 PFTeDA	%		*110*	*57.0 | 55.8 | 2.22*	[NA]	[NA]
Extraction Internal Standard 13C2 4:2FTS	%		*105*	*66.6 | 74.3 | 10.9*	[NA]	[NA]
Extraction Internal Standard 13C2 6:2FTS	%		*97.8*	*69.9 | 66.6 | 4.87*	[NA]	[NA]
Extraction Internal Standard 13C2 8:2FTS	%		*98.4*	*59.3 | 57.0 | 3.95*	[NA]	[NA]
Extraction Internal Standard 13C8 FOSA	%		*106*	*79.8 | 78.0 | 2.33*	[NA]	[NA]
Extraction Internal Standard d3 N MeFOSA	%		*102*	*77.0 | 76.6 | 0.625*	[NA]	[NA]
Extraction Internal Standard d5 N EtFOSA	%		*95.6*	*73.3 | 70.3 | 4.08*	[NA]	[NA]
Extraction Internal Standard d7 N MeFOSE	%		*107*	*79.3 | 77.9 | 1.83*	[NA]	[NA]
Extraction Internal Standard d9 N EtFOSE	%		*96.8*	*78.1 | 79.2 | 1.50*	[NA]	[NA]
Extraction Internal Standard d3 N MeFOSAA	%		*104*	*69.5 | 65.4 | 6.04*	[NA]	[NA]
Extraction Internal Standard d5 N EtFOSAA	%		*101*	*67.5 | 73.4 | 8.29*	[NA]	[NA]

Quality Control PFF1497

ORG-029|PFAS Extended List (Soil) | Batch BFF4727

Analyte	Units	PQL	Blank	LCS %
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.10	<0.10	116
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.10	<0.10	109
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.10	<0.10	94.9
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.10	<0.10	113
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.10	<0.10	106
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.20	<0.20	86.6
Perfluorobutanoic acid (PFBA)	µg/kg	0.20	<0.20	110
Perfluoropentanoic acid (PFPeA)	µg/kg	0.20	<0.20	128
Perfluorohexanoic acid (PFHxA)	µg/kg	0.10	<0.10	95.4
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.10	<0.10	94.4
Perfluorooctanoic acid (PFOA)	µg/kg	0.10	<0.10	97.1
Perfluorononanoic acid (PFNA)	µg/kg	0.10	<0.10	129
Perfluorodecanoic acid (PFDA)	µg/kg	0.50	<0.50	90.7
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.50	<0.50	65.1
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.50	<0.50	106
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.50	<0.50	133
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5.0	<5.0	83.1
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.10	<0.10	104
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.10	<0.10	83.3
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.20	<0.20	121
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.20	<0.20	94.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1.0	<1.0	89.6
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1.0	<1.0	102
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1.0	<1.0	94.4
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1.0	<1.0	95.1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5.0	<5.0	119
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	96.0
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.20	<0.20	110
Surrogate 13C8 PFOS	%		*101*	*101*
Surrogate 13C2 PFOA	%		*110*	*107*
Extraction Internal Standard 13C3 PFBS	%		*80.5*	[NA]
Extraction Internal Standard 18O2 PFHxS	%		*92.0*	[NA]
Extraction Internal Standard 13C4 PFOS	%		*93.9*	[NA]
Extraction Internal Standard 13C4 PFBA	%		*105*	[NA]
Extraction Internal Standard 13C3 PFPeA	%		*79.4*	[NA]
Extraction Internal Standard 13C2 PFHxA	%		*107*	[NA]
Extraction Internal Standard 13C4 PFHpA	%		*115*	[NA]
Extraction Internal Standard 13C4 PFOA	%		*76.4*	[NA]
Extraction Internal Standard 13C5 PFNA	%		*92.1*	[NA]
Extraction Internal Standard 13C2 PFDA	%		*106*	[NA]
Extraction Internal Standard 13C2 PFUnDA	%		*119*	[NA]
Extraction Internal Standard 13C2 PFDoDA	%		*87.4*	[NA]
Extraction Internal Standard 13C2 PFTeDA	%		*135*	[NA]
Extraction Internal Standard 13C2 4:2FTS	%		*108*	[NA]
Extraction Internal Standard 13C2 6:2FTS	%		*142*	[NA]
Extraction Internal Standard 13C2 8:2FTS	%		*114*	[NA]
Extraction Internal Standard 13C8 FOSA	%		*114*	[NA]
Extraction Internal Standard d3 N MeFOSA	%		*127*	[NA]
Extraction Internal Standard d5 N EtFOSA	%		*130*	[NA]
Extraction Internal Standard d7 N MeFOSE	%		*141*	[NA]
Extraction Internal Standard d9 N EtFOSE	%		*98.6*	[NA]
Extraction Internal Standard d3 N MeFOSAA	%		*117*	[NA]
Extraction Internal Standard d5 N EtFOSAA	%		*108*	[NA]

Quality Control PFF1497

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[2]	Surrogate recovery is outside routine acceptance criteria (60-140%) as a result of the high concentration of analyte(s) in the sample.
[3]	The comparison of sample chromatograms and the in-house hydrocarbon product library are a purely subjective suggestion and are therefore NOT confirmation of the presence of a particular hydrocarbon product.
[4]	For PFAS Extracted Internal Standards denoted with ## or being outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).
[5]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.
[6]	The laboratory duplicate RPD acceptance criteria has been exceeded. Sample heterogeneity suspected. 3 sets of data have been provided to help demonstrate the degree of non-homogeneity within the sample as well as assessing the analytical precision.

CHAIN OF CUSTODY DESPATCH SHEET

Douglas PARTNERS

Project No: 224972.01	**Suburb:** Rockingham		**To:** MPL
Project Manager: RS	**Order Number:** PE251560	**Sampler:** VH	Hayden Crt, Myaree
Email rob.shapland@douglaspartners.com.au			**Attn:** Sample Receipt
Turnaround time ☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			93172505 Lab email
Prior Storage ☑ Fridge ☐ Freezer ☐ Esky ☐ Shelf	**Do samples contain 'potential' HBM?** ☑ No ☐ Yes (If YES, handle, transport, store in accordance with FPM HAZID)		

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Metals (16)	TRH	BTEXN	PAH	PFAS (ong suite)	pH	TOC	CEC	Total Iron	V-TRH		Notes/ Preservation/ Additional Requirements
1	39	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
2	40	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
3	41	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
4	42	0.1	0.2	18/06	S	G/P	✓	✓	✓	✓	✓							
5	43	0.1	0.2	18/06	S	G/P	✓	✓	✓	✓	✓							
6	44	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
7	45	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
8	46	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
9	47	0.1	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
10	48	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
11	49	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							
12	50	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
13	51	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
14	52	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							

Empl Laboratories ENVIROLAB
Job No.: PFF1497
Date Rec - 24 JUN 2024
Time Rec - 9:30
Rec By -
TAT Req - SAME 1 / 2 / 3 / STD
Temp - Cool / ambient
Cooling - Ice / Ice pack / None
Security Seal - Yes / No

Metals to analyse: Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Mn, Hg, Ni, Pb, Se, V, Zn			**LAB RECEIPT**
Number of samples in container:	**Transported to laboratory by:** Courier		**Lab Ref. No:**
Send results to: Douglas Partners Pty Ltd			**Received by:**
Addr 36 O'Malley Street, Osborne Park	**Phone:** 92043511		**Date & Time** 24 JUN 2024
Relinquished by: VH RS	**Date:** 25/6/	**Signed:**	**Signed:**

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 224972.01 | **Suburb:** Mackingham | **To:** MPL

Project Manager: RS | **Dispatch date:**

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M -	Container Type: G - glass P - plastic	Analytes: Metals (16)	TRH	BTEXN	PAH	PFAS (ong suite)	pH	TOC	CEC	Total Iron	V-TRH		Notes/ Preservation/ Additional Requirements
15	53	0.1	0.2	18/06	S	G/P	✓	✓	✓	✓	✓							
16	54	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
17	55	0.05	0.1	20/06	S	G/P	✓	✓	✓	✓	✓							
18	56	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
19	57	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
20	58	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
21	59	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
22	60	0.05	0.15	18/06	S	G/P	✓	✓	✓	✓	✓							
23	61	0.1	0.2	18/06	S	G/P	✓	✓	✓	✓	✓							
24	62	0.1	0.2	18/06	S	G/P	✓	✓	✓	✓	✓							
25	63	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
26	63	0.5	0.6	19/06	S	G/P	✓	✓	✓	✓	✓							
27	64	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
28	65	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
29	65	0.9	1	20/06	S	G/P	✓	✓	✓	✓	✓							
30	66	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							
31	67	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							
32	68	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 224972.01 **Suburb:** Rodeyhan **To:** MPL

Project Manager: RS **Dispatch date:**

Lab ID	Sample ID: Location / Other ID	Sample ID: Depth From	Sample ID: Depth To	Date Sampled	Sample Type: S - soil W - water M -	Container Type: G - glass P - plastic	Analytes: Metals (16)	TRH	BTEXN	PAH	PFAS (ong suite)	pH	TOC	CEC	Total Iron	V-TRH		Notes/ Preservation/ Additional Requirements
33	69	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓	✓	✓	✓	✓			
34	70	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓	✓	✓	✓	✓			
35	71	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							
36	72	0.1	0.2	19/06	S	G/P	✓	✓	✓	✓	✓							
37	73	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
38	74	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
39	75	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
40	76	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
41	77	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
42	Rep 1-1			18/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 1-2			18/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL
43	Rep 2-1			18/06	S	G/P					✓							
-	Rep 2-2			18/06	S	G/P					✓							Send to ARL
44	Rep 3-1			19/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 3-2			19/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL
45	Rep 4-1			19/06	S	G/P					✓							
-	Rep 4-2			19/06	S	G/P					✓							Send to ARL
46	Rep 5-1			20/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 5-2			20/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL

Project No: 224972.01 **Suburb:** **To:** MPL

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project Manager: RS

Dispatch date:

Lab ID	Sample ID: Location / Other ID	Sample ID: Depth From	Sample ID: Depth To	Date Sampled	Sample Type: S - soil W - water M -	Container Type: G - glass P - plastic	Analytes: Metals (16)	TRH	BTEXN	PAH	PFAS (ong suite)	pH	TOC	CEC	Total Iron	V-TRH		Notes/ Preservation/ Additional Requirements
	~~Trip Blank~~			~~18/06~~	S	G										~~✓~~		
47	Trip Spike			18/06	S	G										✓		
	~~Trip Blank~~			~~19/06~~	S	G										~~✓~~		
48	Trip Spike			19/06	S	G										✓		
	~~Trip Blank~~			~~20/06~~	S	G										~~✓~~		
49	Trip Spike			20/06	S	G										✓		

Douglas PARTNERS | GROUNDED EXPERTISE

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

PURCHASE ORDER

Date	25-Jun-24
PO No.	PE251560

Vendor/ Subcontractor:
MPL
Contact Name: Kiara

Deliver To:
Douglas Partners Pty Ltd
Requisitioner: RS

This order covers the supply of goods, materials or services shown here, subject to the terms and conditions of the purchase order.

PO number or **Project number** and **Requisitioner** should always be quoted in your invoice.

To ensure prompt payment, please attach this PO to your invoice and **email** it directly to **apinvoices@douglaspartners.com.au** in PDF format.

Item	Description	Quantity	Unit Price	Total	Project No. & G/L Code
	As per CoC				512
					224972.01

Comments or Special Instructions

SUBTOTAL	
GST/TAX	
SHIPPING/ OTHER	
TOTAL	

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 224972.01 **Suburb:** Rockdale **To:** MPL

Project Manager: RS **Dispatch date:**

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M -	Container Type: G - glass P - plastic	Analytes: Metals (16)	TRH	BTEXN	PAH	PFAS (ong suite)	pH	TOC	CEC	Total Iron	V-TRH		Notes/ Preservation/ Additional Requirements
33	69	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓	✓	✓	✓	✓			
34	70	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓	✓	✓	✓	✓			
35	71	0.05	0.1	19/06	S	G/P	✓	✓	✓	✓	✓							
36	72	0.1	0.2	19/06	S	G/P	✓	✓	✓	✓	✓							
37	73	0.05	0.15	19/06	S	G/P	✓	✓	✓	✓	✓							
38	74	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
39	75	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
40	76	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
41	77	0.05	0.15	20/06	S	G/P	✓	✓	✓	✓	✓							
42	Rep 1-1			18/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 1-2			18/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL
43	Rep 2-1			18/06	S	G/P					✓							
-	Rep 2-2			18/06	S	G/P					✓							Send to ARL
44	Rep 3-1			19/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 3-2			19/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL
45	Rep 4-1			19/06	S	G/P					✓							
-	Rep 4-2			19/06	S	G/P					✓							Send to ARL
46	Rep 5-1			20/06	S	G/P	✓	✓	✓	✓	✓							
-	Rep 5-2			20/06	S	G/P	✓	✓	✓	✓	✓							Send to ARL

Project No: 224972.01 **Suburb:** **To:** MPL

ML 2083

CR 26/6/24 1400

www.eurofins.com.au EnviroSales@eurofins.com

Eurofins ARL Pty Ltd ABN: 91 05 0159 898

Perth
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Site# 2370

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NATA# 1261
Site# 20794 & 2780

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Mayfield West
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IANZ# 1290

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1277 Cameron Road,
Gate Pa,
Tauranga 3112
+64 9 525 0568
IANZ# 1402

Sample Receipt Advice

Company name: Douglas Partners Pty Ltd
Contact name: - Invoices Only
Project name: Not provided
Project ID: 224972.01
Turnaround time: 5 Day
Date/Time received Apr 26, 2026 2:00 PM
Eurofins reference 1112083

Sample Information

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

Notes

Contact

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

Celeste Chinnery on phone : or by email: celestechinnery@eurofins.com

Results will be delivered electronically via email to - Invoices Only - accounts.payable.invoices@douglaspartners.com.au.

Note: A copy of these results will also be delivered to the general Douglas Partners Pty Ltd email address.

Global Leader - Results you can trust

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

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NATA# 2377
Site# 2370

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NATA# 1261
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NATA# 1261
Site# 25079 & 25289

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Auckland 1061
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IANZ# 1308

Christchurch
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Rolleston,
Christchurch 7675
+64 3 343 5201
IANZ# 1290

Tauranga
1277 Cameron Road,
Gate Pa,
Tauranga 3112
+64 9 525 0568
IANZ# 1402

Company Name: Douglas Partners Pty Ltd
Address: 36 O'Malley Street
Osborne Park
WA 6017

Project Name:
Project ID: 224972.01

Order No.:
Report #: 1112083
Phone: 08 9204 3511
Fax:

Received: Apr 26, 2026 2:00 PM
Due: To Be Advised
Priority: 5 Day
Contact Name: - Invoices Only

Eurofins Analytical Services Manager : Celeste Chinnery

Sample Detail						Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc	Moisture Set	Eurofins Suite B4	Per- and Polyfluoroalkyl Substances (PFASs)
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																			
1	Rep 1-2	Jun 18, 2024		Soil	L24-Jn0068989	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Rep 2-2	Jun 18, 2024		Soil	L24-Jn0068990																	X		X
3	Rep 3-2	Jun 19, 2024		Soil	L24-Jn0068991	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Rep 4-2	Jun 19, 2024		Soil	L24-Jn0068992																	X		X
5	Rep 5-2	Jun 20, 2024		Soil	L24-Jn0068993	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	3	5

Douglas Partners Pty Ltd
36 O'Malley Street
Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370

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

Attention: **- Invoices Only**

Report **1112083-S**
Project name
Project ID 224972.01
Received Date Jun 26, 2024

Client Sample ID			**Rep 1-2**	**Rep 2-2**	**Rep 3-2**	**Rep 4-2**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**L24-Jn0068989**	**L24-Jn0068990**	**L24-Jn0068991**	**L24-Jn0068992**
Date Sampled			**Jun 18, 2024**	**Jun 18, 2024**	**Jun 19, 2024**	**Jun 19, 2024**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	< 20	-	< 20	-
TRH C10-C14	20	mg/kg	< 20	-	< 20	-
TRH C15-C28	50	mg/kg	< 50	-	< 50	-
TRH C29-C36	50	mg/kg	< 50	-	< 50	-
TRH C10-C36 (Total)	50	mg/kg	< 50	-	< 50	-
TRH C6-C10	20	mg/kg	< 20	-	< 20	-
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	< 20	-
TRH >C10-C16	50	mg/kg	< 50	-	< 50	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	< 50	-
TRH >C16-C34	100	mg/kg	< 100	-	< 100	-
TRH >C34-C40	100	mg/kg	< 100	-	< 100	-
TRH >C10-C40 (total)*	100	mg/kg	< 100	-	< 100	-
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	< 0.1	-
Toluene	0.1	mg/kg	< 0.1	-	< 0.1	-
Ethylbenzene	0.1	mg/kg	< 0.1	-	< 0.1	-
m&p-Xylenes	0.2	mg/kg	< 0.2	-	< 0.2	-
o-Xylene	0.1	mg/kg	< 0.1	-	< 0.1	-
Xylenes - Total*	0.3	mg/kg	< 0.3	-	< 0.3	-
BTEX						
4-Bromofluorobenzene (surr.)	1	%	116	-	106	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	< 0.5	-
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	-	< 0.5	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	-	0.6	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	-	1.2	-
Acenaphthene	0.5	mg/kg	< 0.5	-	< 0.5	-
Acenaphthylene	0.5	mg/kg	< 0.5	-	< 0.5	-
Anthracene	0.5	mg/kg	< 0.5	-	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	< 0.5	-	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	< 0.5	-	< 0.5	-
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	-	< 0.5	-
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	-	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	-	< 0.5	-

Client Sample ID			Rep 1-2	Rep 2-2	Rep 3-2	Rep 4-2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L24-Jn0068989	L24-Jn0068990	L24-Jn0068991	L24-Jn0068992
Date Sampled			Jun 18, 2024	Jun 18, 2024	Jun 19, 2024	Jun 19, 2024
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Chrysene	0.5	mg/kg	< 0.5	-	< 0.5	-
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	-	< 0.5	-
Fluoranthene	0.5	mg/kg	< 0.5	-	< 0.5	-
Fluorene	0.5	mg/kg	< 0.5	-	< 0.5	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	-	< 0.5	-
Naphthalene	0.5	mg/kg	< 0.5	-	< 0.5	-
Phenanthrene	0.5	mg/kg	< 0.5	-	< 0.5	-
Pyrene	0.5	mg/kg	< 0.5	-	< 0.5	-
Total PAH*	0.5	mg/kg	< 0.5	-	< 0.5	-
2-Fluorobiphenyl (surr.)	1	%	60	-	83	-
p-Terphenyl-d14 (surr.)	1	%	55	-	81	-
Heavy Metals						
Aluminium	20	mg/kg	580	-	540	-
Arsenic	2	mg/kg	2.2	-	2.5	-
Barium	10	mg/kg	< 10	-	< 10	-
Beryllium	2	mg/kg	< 2	-	< 2	-
Boron	10	mg/kg	< 10	-	< 10	-
Cadmium	0.1	mg/kg	0.1	-	< 0.1	-
Chromium	1	mg/kg	7.1	-	6.5	-
Cobalt	5	mg/kg	< 5	-	< 5	-
Copper	1	mg/kg	< 1	-	< 1	-
Lead	1	mg/kg	1.3	-	3.0	-
Manganese	5	mg/kg	21	-	33	-
Mercury	0.02	mg/kg	< 0.02	-	< 0.02	-
Nickel	1	mg/kg	2.8	-	11	-
Selenium	2	mg/kg	< 2	-	< 2	-
Vanadium	10	mg/kg	< 10	-	< 10	-
Zinc	5	mg/kg	< 5	-	< 5	-
Sample Properties						
% Moisture	1	%	8.9	11	11	8.7
Perfluoroalkyl carboxylic acids (PFCAs)						
Perfluorobutanoic acid (PFBA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoropentanoic acid (PFPeA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorohexanoic acid (PFHxA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoroheptanoic acid (PFHpA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorooctanoic acid (PFOA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorononanoic acid (PFNA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorodecanoic acid (PFDA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoroundecanoic acid (PFUnDA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorododecanoic acid (PFDoDA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorotridecanoic acid (PFTrDA)[N15]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorotetradecanoic acid (PFTeDA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
13C4-PFBA (surr.)	1	%	109	99	101	107
13C5-PFPeA (surr.)	1	%	116	106	107	109
13C5-PFHxA (surr.)	1	%	108	100	103	106
13C4-PFHpA (surr.)	1	%	112	99	96	108
13C8-PFOA (surr.)	1	%	121	105	107	113
13C5-PFNA (surr.)	1	%	110	101	103	110
13C6-PFDA (surr.)	1	%	118	103	107	115

Client Sample ID			Rep 1-2	Rep 2-2	Rep 3-2	Rep 4-2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L24-Jn0068989	L24-Jn0068990	L24-Jn0068991	L24-Jn0068992
Date Sampled			Jun 18, 2024	Jun 18, 2024	Jun 19, 2024	Jun 19, 2024
Test/Reference	LOR	Unit				
Perfluoroalkyl carboxylic acids (PFCAs)						
13C2-PFUnDA (surr.)	1	%	116	103	104	108
13C2-PFDoDA (surr.)	1	%	124	105	111	119
13C2-PFTeDA (surr.)	1	%	181	131	129	142
Perfluoroalkyl sulfonamido substances						
Perfluorooctane sulfonamide (FOSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	10	ug/kg	< 10	< 10	< 10	< 10
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	10	ug/kg	< 10	< 10	< 10	< 10
13C8-FOSA (surr.)	1	%	111	101	103	106
D3-N-MeFOSA (surr.)	1	%	124	114	120	118
D5-N-EtFOSA (surr.)	1	%	137	128	128	133
D7-N-MeFOSE (surr.)	1	%	109	103	102	113
D9-N-EtFOSE (surr.)	1	%	110	102	100	109
D5-N-EtFOSAA (surr.)	1	%	116	103	115	120
D3-N-MeFOSAA (surr.)	1	%	110	93	103	111
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	10	ug/kg	< 10	< 10	< 10	< 10
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
13C2-4:2 FTSA (surr.)	1	%	127	104	110	110
13C2-6:2 FTSA (surr.)	1	%	113	105	103	107
13C2-8:2 FTSA (surr.)	1	%	143	122	121	122
13C2-10:2 FTSA (surr.)	1	%	150	112	121	146
Perfluoroalkyl sulfonic acids (PFSAs)						
Perfluorobutanesulfonic acid (PFBS)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorononanesulfonic acid (PFNS)*[N15]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoropropanesulfonic acid (PFPrS)*[N15]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoropentanesulfonic acid (PFPeS)[N15]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorohexanesulfonic acid (PFHxS)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluoroheptanesulfonic acid (PFHpS)[N15]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorooctanesulfonic acid (PFOS)[N11]	5	ug/kg	< 5	< 5	< 5	< 5
Perfluorodecanesulfonic acid (PFDS)[N15]	5	ug/kg	< 5	< 5	< 5	< 5
13C3-PFBS (surr.)	1	%	104	89	95	100
18O2-PFHxS (surr.)	1	%	104	85	92	103
13C8-PFOS (surr.)	1	%	104	96	97	98

Client Sample ID			Rep 1-2	Rep 2-2	Rep 3-2	Rep 4-2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L24-Jn0068989	L24-Jn0068990	L24-Jn0068991	L24-Jn0068992
Date Sampled			Jun 18, 2024	Jun 18, 2024	Jun 19, 2024	Jun 19, 2024
Test/Reference	LOR	Unit				
PFASs Summations						
Sum (PFHxS + PFOS)*	5	ug/kg	< 5	< 5	< 5	< 5
Sum of PFASs (n=30)*	50	ug/kg	< 50	< 50	< 50	< 50
Sum of US EPA PFAS (PFOS + PFOA)*	5	ug/kg	< 5	< 5	< 5	< 5
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	5	ug/kg	< 5	< 5	< 5	< 5
Sum of WA DWER PFAS (n=10)*	10	ug/kg	< 10	< 10	< 10	< 10

Client Sample ID			Rep 5-2
Sample Matrix			Soil
Eurofins Sample No.			L24-Jn0068993
Date Sampled			Jun 20, 2024
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100
BTEX			
Benzene	0.1	mg/kg	< 0.1
Toluene	0.1	mg/kg	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2
o-Xylene	0.1	mg/kg	< 0.1
Xylenes - Total*	0.3	mg/kg	< 0.3
BTEX			
4-Bromofluorobenzene (surr.)	1	%	97
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.5	mg/kg	< 0.5
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5

Client Sample ID			Rep 5-2
Sample Matrix			Soil
Eurofins Sample No.			L24-Jn0068993
Date Sampled			Jun 20, 2024
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	67
p-Terphenyl-d14 (surr.)	1	%	70
Heavy Metals			
Aluminium	20	mg/kg	390
Arsenic	2	mg/kg	< 2
Barium	10	mg/kg	< 10
Beryllium	2	mg/kg	< 2
Boron	10	mg/kg	< 10
Cadmium	0.1	mg/kg	< 0.1
Chromium	1	mg/kg	4.5
Cobalt	5	mg/kg	< 5
Copper	1	mg/kg	< 1
Lead	1	mg/kg	1.4
Manganese	5	mg/kg	22
Mercury	0.02	mg/kg	< 0.02
Nickel	1	mg/kg	2.8
Selenium	2	mg/kg	< 2
Vanadium	10	mg/kg	< 10
Zinc	5	mg/kg	< 5
Sample Properties			
% Moisture	1	%	11
Perfluoroalkyl carboxylic acids (PFCAs)			
Perfluorobutanoic acid (PFBA)[N11]	5	ug/kg	< 5
Perfluoropentanoic acid (PFPeA)[N11]	5	ug/kg	< 5
Perfluorohexanoic acid (PFHxA)[N11]	5	ug/kg	< 5
Perfluoroheptanoic acid (PFHpA)[N11]	5	ug/kg	< 5
Perfluorooctanoic acid (PFOA)[N11]	5	ug/kg	< 5
Perfluorononanoic acid (PFNA)[N11]	5	ug/kg	< 5
Perfluorodecanoic acid (PFDA)[N11]	5	ug/kg	< 5
Perfluoroundecanoic acid (PFUnDA)[N11]	5	ug/kg	< 5
Perfluorododecanoic acid (PFDoDA)[N11]	5	ug/kg	< 5
Perfluorotridecanoic acid (PFTrDA)[N15]	5	ug/kg	< 5
Perfluorotetradecanoic acid (PFTeDA)[N11]	5	ug/kg	< 5
13C4-PFBA (surr.)	1	%	101
13C5-PFPeA (surr.)	1	%	104
13C5-PFHxA (surr.)	1	%	104
13C4-PFHpA (surr.)	1	%	99
13C8-PFOA (surr.)	1	%	110
13C5-PFNA (surr.)	1	%	102
13C6-PFDA (surr.)	1	%	103
13C2-PFUnDA (surr.)	1	%	97

Client Sample ID			Rep 5-2
Sample Matrix			Soil
Eurofins Sample No.			L24-Jn0068993
Date Sampled			Jun 20, 2024
Test/Reference	LOR	Unit	
Perfluoroalkyl carboxylic acids (PFCAs)			
13C2-PFDoDA (surr.)	1	%	111
13C2-PFTeDA (surr.)	1	%	131
Perfluoroalkyl sulfonamido substances			
Perfluorooctane sulfonamide (FOSA)[N11]	5	ug/kg	< 5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	5	ug/kg	< 5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	5	ug/kg	< 5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	5	ug/kg	< 5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	5	ug/kg	< 5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	10	ug/kg	< 10
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	10	ug/kg	< 10
13C8-FOSA (surr.)	1	%	101
D3-N-MeFOSA (surr.)	1	%	116
D5-N-EtFOSA (surr.)	1	%	131
D7-N-MeFOSE (surr.)	1	%	105
D9-N-EtFOSE (surr.)	1	%	107
D5-N-EtFOSAA (surr.)	1	%	113
D3-N-MeFOSAA (surr.)	1	%	106
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	5	ug/kg	< 5
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	10	ug/kg	< 10
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	5	ug/kg	< 5
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	5	ug/kg	< 5
13C2-4:2 FTSA (surr.)	1	%	109
13C2-6:2 FTSA (surr.)	1	%	103
13C2-8:2 FTSA (surr.)	1	%	110
13C2-10:2 FTSA (surr.)	1	%	122
Perfluoroalkyl sulfonic acids (PFSAs)			
Perfluorobutanesulfonic acid (PFBS)[N11]	5	ug/kg	< 5
Perfluorononanesulfonic acid (PFNS)*[N15]	5	ug/kg	< 5
Perfluoropropanesulfonic acid (PFPrS)*[N15]	5	ug/kg	< 5
Perfluoropentanesulfonic acid (PFPeS)[N15]	5	ug/kg	< 5
Perfluorohexanesulfonic acid (PFHxS)[N11]	5	ug/kg	< 5
Perfluoroheptanesulfonic acid (PFHpS)[N15]	5	ug/kg	< 5
Perfluorooctanesulfonic acid (PFOS)[N11]	5	ug/kg	< 5
Perfluorodecanesulfonic acid (PFDS)[N15]	5	ug/kg	< 5
13C3-PFBS (surr.)	1	%	92
18O2-PFHxS (surr.)	1	%	89
13C8-PFOS (surr.)	1	%	92
PFASs Summations			
Sum (PFHxS + PFOS)*	5	ug/kg	< 5
Sum of PFASs (n=30)*	50	ug/kg	< 50
Sum of US EPA PFAS (PFOS + PFOA)*	5	ug/kg	< 5
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	5	ug/kg	< 5
Sum of WA DWER PFAS (n=10)*	10	ug/kg	< 10

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Welshpool	Jun 29, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jun 29, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jun 29, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Jun 29, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Welshpool	Jun 29, 2024	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Heavy Metals	Welshpool	Jun 29, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Welshpool	Jun 26, 2024	14 Days
- Method: ARL135 Moisture in Solids			
Perfluoroalkyl carboxylic acids (PFCAs)	Welshpool	Jun 29, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl sulfonamido substances	Welshpool	Jun 29, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Welshpool	Jun 29, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl sulfonic acids (PFSAs)	Welshpool	Jun 29, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
PFASs Summations	Welshpool	Jun 29, 2024	
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			

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Project ID: 224972.01

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Priority: 5 Day
Contact Name: - Invoices Only

Eurofins Analytical Services Manager : Celeste Chinnery

Sample Detail						Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc	Moisture Set	Eurofins Suite B4	Per- and Polyfluoroalkyl Substances (PFASs)
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																			
1	Rep 1-2	Jun 18, 2024		Soil	L24-Jn0068989	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Rep 2-2	Jun 18, 2024		Soil	L24-Jn0068990																	X		X
3	Rep 3-2	Jun 19, 2024		Soil	L24-Jn0068991	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Rep 4-2	Jun 19, 2024		Soil	L24-Jn0068992																	X		X
5	Rep 5-2	Jun 20, 2024		Soil	L24-Jn0068993	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	3	5

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/kg	< 20			20	Pass	
Arsenic	mg/kg	< 2			2	Pass	
Barium	mg/kg	< 10			10	Pass	
Beryllium	mg/kg	< 2			2	Pass	
Boron	mg/kg	< 10			10	Pass	
Cadmium	mg/kg	< 0.1			0.1	Pass	
Chromium	mg/kg	< 1			1	Pass	
Cobalt	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 1			1	Pass	
Lead	mg/kg	< 1			1	Pass	
Manganese	mg/kg	< 5			5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Mercury	mg/kg	< 0.02			0.02	Pass	
Nickel	mg/kg	< 1			1	Pass	
Selenium	mg/kg	< 2			2	Pass	
Vanadium	mg/kg	< 10			10	Pass	
Zinc	mg/kg	< 5			5	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	ug/kg	< 5			5	Pass	
Perfluoropentanoic acid (PFPeA)	ug/kg	< 5			5	Pass	
Perfluorohexanoic acid (PFHxA)	ug/kg	< 5			5	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/kg	< 5			5	Pass	
Perfluorooctanoic acid (PFOA)	ug/kg	< 5			5	Pass	
Perfluorononanoic acid (PFNA)	ug/kg	< 5			5	Pass	
Perfluorodecanoic acid (PFDA)	ug/kg	< 5			5	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/kg	< 5			5	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/kg	< 5			5	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/kg	< 5			5	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/kg	< 5			5	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	ug/kg	< 5			5	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/kg	< 5			5	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/kg	< 5			5	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	ug/kg	< 5			5	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	ug/kg	< 5			5	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/kg	< 10			10	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/kg	< 10			10	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/kg	< 5			5	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	ug/kg	< 10			10	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/kg	< 5			5	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/kg	< 5			5	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	ug/kg	< 5			5	Pass	
Perfluorononanesulfonic acid (PFNS)*	ug/kg	< 5			5	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	ug/kg	< 5			5	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/kg	< 5			5	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/kg	< 5			5	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/kg	< 5			5	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	< 5			5	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	106			70-130	Pass	
TRH C10-C14	%	100			70-130	Pass	
TRH C6-C10	%	101			70-130	Pass	
TRH >C10-C16	%	99			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	100			70-130	Pass	
Toluene	%	104			70-130	Pass	
Ethylbenzene	%	98			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
m&p-Xylenes	%	102			70-130	Pass	
o-Xylene	%	100			70-130	Pass	
Xylenes - Total*	%	101			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	102			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			70-130	Pass	
Acenaphthylene	%	96			70-130	Pass	
Anthracene	%	98			70-130	Pass	
Benz(a)anthracene	%	87			70-130	Pass	
Benzo(a)pyrene	%	86			70-130	Pass	
Benzo(b&j)fluoranthene	%	92			70-130	Pass	
Benzo(g.h.i)perylene	%	99			70-130	Pass	
Benzo(k)fluoranthene	%	97			70-130	Pass	
Chrysene	%	89			70-130	Pass	
Dibenz(a.h)anthracene	%	81			70-130	Pass	
Fluoranthene	%	99			70-130	Pass	
Fluorene	%	89			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	94			70-130	Pass	
Naphthalene	%	92			70-130	Pass	
Phenanthrene	%	91			70-130	Pass	
Pyrene	%	96			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	89			80-120	Pass	
Arsenic	%	104			80-120	Pass	
Barium	%	107			80-120	Pass	
Beryllium	%	97			80-120	Pass	
Boron	%	102			80-120	Pass	
Cadmium	%	105			80-120	Pass	
Chromium	%	92			80-120	Pass	
Cobalt	%	90			80-120	Pass	
Copper	%	86			80-120	Pass	
Lead	%	97			80-120	Pass	
Manganese	%	93			80-120	Pass	
Mercury	%	106			80-120	Pass	
Nickel	%	89			80-120	Pass	
Selenium	%	105			80-120	Pass	
Vanadium	%	95			80-120	Pass	
Zinc	%	93			80-120	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	%	89			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	76			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	95			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	84			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	93			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	92			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	95			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	101			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	93			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	83			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorotetradecanoic acid (PFTeDA)	%	92			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	%	84			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	91			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	83			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	%	85			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	%	84			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	79			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	91			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	86			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	%	91			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	83			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	89			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	%	85			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)*	%	83			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	%	82			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	80			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	88			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	91			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	88			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	87			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C6-C9	L24-Jn0068798	NCP	%	115			70-130	Pass	
TRH C10-C14	L24-Jn0076008	NCP	%	94			70-130	Pass	
TRH C6-C10	L24-Jn0068798	NCP	%	113			70-130	Pass	
TRH >C10-C16	L24-Jn0076008	NCP	%	93			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	L24-Jn0068798	NCP	%	102			70-130	Pass	
Toluene	L24-Jn0068798	NCP	%	104			70-130	Pass	
Ethylbenzene	L24-Jn0068798	NCP	%	101			70-130	Pass	
m&p-Xylenes	L24-Jn0068798	NCP	%	101			70-130	Pass	
o-Xylene	L24-Jn0068798	NCP	%	104			70-130	Pass	
Xylenes - Total*	L24-Jn0068798	NCP	%	102			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	L24-Jn0068798	NCP	%	102			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	L24-Jn0076008	NCP	%	100			70-130	Pass	
Acenaphthylene	L24-Jn0076008	NCP	%	96			70-130	Pass	
Anthracene	L24-Jn0076008	NCP	%	98			70-130	Pass	
Benz(a)anthracene	L24-Jn0076008	NCP	%	87			70-130	Pass	
Benzo(a)pyrene	L24-Jn0076008	NCP	%	86			70-130	Pass	
Benzo(b&j)fluoranthene	L24-Jn0076008	NCP	%	92			70-130	Pass	
Benzo(g.h.i)perylene	L24-Jn0076008	NCP	%	99			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(k)fluoranthene	L24-Jn0076008	NCP	%	97			70-130	Pass	
Chrysene	L24-Jn0076008	NCP	%	89			70-130	Pass	
Dibenz(a.h)anthracene	L24-Jn0076008	NCP	%	81			70-130	Pass	
Fluoranthene	L24-Jn0076008	NCP	%	99			70-130	Pass	
Fluorene	L24-Jn0076008	NCP	%	89			70-130	Pass	
Indeno(1.2.3-cd)pyrene	L24-Jn0076008	NCP	%	94			70-130	Pass	
Naphthalene	L24-Jn0076008	NCP	%	92			70-130	Pass	
Phenanthrene	L24-Jn0076008	NCP	%	91			70-130	Pass	
Pyrene	L24-Jn0076008	NCP	%	96			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	L24-Jn0068795	NCP	%	66			75-125	Fail	Q08
Barium	L24-Jn0068795	NCP	%	82			75-125	Pass	
Beryllium	L24-Jn0068795	NCP	%	71			75-125	Fail	Q08
Boron	L24-Jn0068795	NCP	%	72			75-125	Fail	Q08
Cadmium	L24-Jn0068795	NCP	%	82			75-125	Pass	
Chromium	L24-Jn0070556	NCP	%	68			75-125	Fail	Q08
Cobalt	L24-Jn0068795	NCP	%	72			75-125	Fail	Q08
Copper	L24-Jn0068795	NCP	%	67			75-125	Fail	Q08
Lead	L24-Jn0068795	NCP	%	85			75-125	Pass	
Manganese	L24-Jn0070556	NCP	%	61			75-125	Fail	Q08
Mercury	L24-Jn0068795	NCP	%	81			75-125	Pass	
Nickel	L24-Jn0068795	NCP	%	56			75-125	Fail	Q08
Selenium	L24-Jn0070556	NCP	%	65			75-125	Fail	Q08
Vanadium	L24-Jn0068795	NCP	%	53			75-125	Fail	Q08
Zinc	L24-Jn0068795	NCP	%	74			75-125	Fail	Q08
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1					
Perfluorobutanoic acid (PFBA)	L24-Jn0070556	NCP	%	92			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	L24-Jn0070556	NCP	%	89			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	L24-Jn0070556	NCP	%	94			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	L24-Jn0070556	NCP	%	85			50-150	Pass	
Perfluorooctanoic acid (PFOA)	L24-Jn0070556	NCP	%	93			50-150	Pass	
Perfluorononanoic acid (PFNA)	L24-Jn0070556	NCP	%	94			50-150	Pass	
Perfluorodecanoic acid (PFDA)	L24-Jn0070556	NCP	%	100			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	L24-Jn0070556	NCP	%	105			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	L24-Jn0070556	NCP	%	97			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	L24-Jn0070556	NCP	%	89			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	L24-Jn0070556	NCP	%	92			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances				Result 1					
Perfluorooctane sulfonamide (FOSA)	L24-Jn0070556	NCP	%	86			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L24-Jn0070556	NCP	%	89			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L24-Jn0070556	NCP	%	85			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L24-Jn0070556	NCP	%	87			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L24-Jn0070556	NCP	%	89			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L24-Jn0070556	NCP	%	87			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L24-Jn0070556	NCP	%	92			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L24-Jn0070556	NCP	%	93			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L24-Jn0070556	NCP	%	98			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L24-Jn0070556	NCP	%	99			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L24-Jn0070556	NCP	%	98			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	L24-Jn0070556	NCP	%	92			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)*	L24-Jn0070556	NCP	%	83			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	L24-Jn0070556	NCP	%	88			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	L24-Jn0070556	NCP	%	88			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	L24-Jn0070556	NCP	%	89			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	L24-Jn0070556	NCP	%	93			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	L24-Jn0070556	NCP	%	89			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	L24-Jn0070556	NCP	%	91			50-150	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L24-Jn0076008	NCP	%	69			75-125	Fail	Q08
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	L24-Jn0068936	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	L24-Jn0068936	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	L24-Jn0068936	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	L24-Jn0068936	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C6-C10	L24-Jn0068936	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	L24-Jn0068936	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	L24-Jn0068936	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	L24-Jn0068936	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	L24-Jn0068936	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	L24-Jn0068936	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	L24-Jn0068936	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	L24-Jn0068936	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	L24-Jn0068936	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	L24-Jn0068936	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	L24-Jn0068936	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L24-Jn0068794	NCP	mg/kg	3700	4200	11	30%	Pass	
Arsenic	L24-Jn0068794	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Barium	L24-Jn0068794	NCP	mg/kg	42	47	11	30%	Pass	
Beryllium	L24-Jn0068794	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Boron	L24-Jn0068794	NCP	mg/kg	26	28	5.8	30%	Pass	
Cadmium	L24-Jn0068794	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Chromium	L24-Jn0068794	NCP	mg/kg	100	130	22	30%	Pass	
Cobalt	L24-Jn0068794	NCP	mg/kg	10	10	4.2	30%	Pass	
Copper	L24-Jn0068794	NCP	mg/kg	9.4	10	7.5	30%	Pass	
Lead	L24-Jn0068794	NCP	mg/kg	3.7	4.2	13	30%	Pass	
Manganese	L24-Jn0068794	NCP	mg/kg	170	180	7.9	30%	Pass	
Mercury	L24-Jn0068794	NCP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Nickel	L24-Jn0068794	NCP	mg/kg	69	78	13	30%	Pass	
Selenium	L24-Jn0068794	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Vanadium	L24-Jn0068794	NCP	mg/kg	22	27	21	30%	Pass	
Zinc	L24-Jn0068794	NCP	mg/kg	20	21	6.8	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L24-Jn0068794	NCP	%	7.5	7.7	3.0	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonamido substances				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L24-Jn0076112	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L24-Jn0076112	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L24-Jn0076112	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)*	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	L24-Jn0076112	NCP	ug/kg	14	13	9.3	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	L24-Jn0076112	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Celeste Chinnery	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Douglas Todd	Senior Analyst-Sample Properties
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
Paul Nottle	Senior Analyst-PFAS



Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request

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Appendix H

Summary of Groundwater Analytical Results

Laboratory Reports and Chain of Custody Forms

Table H-1: Summary of Groundwater Analytical Results

Analyte Group / Analyte	Unit	LOR	Adopted Assessment Criteria						MW101	MW102	MW103	MW104	MW105	BH1	BH7
			MW [1]	NPUG [2]	HSL-D [3]	NEMP MW [6]	NEMP DW [7]	NEMP RW [8]	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Inorganics															
Bicarbonate HCO3 as CaCO3	mg/L	5	-	-	-	-	-	-	**310**	**300**	**330**	**460**	**310**	**350**	**460**
Carbonate CO32- as CaCO3	mg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5
Hydroxide OH- as CaCO3	mg/L	5	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	-	-	-	-	-	-	**310**	**300**	**330**	**460**	**310**	**350**	**460**
Chloride	mg/L	5	-	250	-	-	-	-	**200**	**300** NPUG	**200**	**390** NPUG	**250** NPUG	**150**	**130**
Sulfate	mg/L	5	-	1000	-	-	-	-	**160**	**170**	**120**	**110**	**220**	**120**	**120**
Calcium	mg/L	5	-	-	-	-	-	-	**120**	**130**	**100**	**130**	**130**	**120**	**110**
Magnesium	mg/L	5	-	-	-	-	-	-	**39**	**49**	**45**	**52**	**52**	**39**	**36**
Potassium	mg/L	5	-	-	-	-	-	-	**2.5**	**2.5**	**6.3**	**6.2**	**1.8**	**2.3**	**7.1**
Sodium	mg/L	5	-	-	-	-	-	-	**110**	**140**	**110**	**220**	**130**	**85**	**120**
Hardness	mg/L	5	-	-	-	-	-	-	**470**	**530**	**450**	**530**	**540**	**450**	**430**
Ionic Balance	%	-	-	-	-	-	-	-	**-3.5**	**-3.2**	**-3.2**	**-5.1**	**-3.7**	**-3.2**	**-4.3**
Total Anions	mg/L	5	-	-	-	-	-	-	**670**	**770**	**650**	**960**	**770**	**620**	**700**
Total Cations	mg/L	5	-	-	-	-	-	-	**270**	**330**	**270**	**410**	**310**	**240**	**270**
Nutrients															
Ammonia as N	mg/L	0.005	0.91	0.41	-	-	-	-	**0.39**	**0.22**	**0.11**	**0.17**	**0.24**	**1** MW, NPUG	**0.3**
Nitrate as N	mg/L	0.005	-	113	-	-	-	-	<0.005	**0.0071**	<0.005	<0.005	<0.005	**1.3**	**1.4**
Nitrate as NO3	mg/L	0.02	-	500	-	-	-	-	<0.02	**0.031**	<0.02	<0.02	<0.02	**5.6**	**6**
Nitrite as N	mg/L	0.005	-	9.13	-	-	-	-	**0.013**	<0.005	<0.005	<0.005	<0.005	**0.025**	**0.028**
Nitrite as NO2	mg/L	0.02	-	30	-	-	-	-	**0.042**	<0.02	<0.02	<0.02	<0.02	**0.082**	**0.093**
Nox as N	mg/L	0.005	0.008	-	-	-	-	-	**0.014** MW	**0.0076**	<0.005	<0.005	<0.005	**1.3** MW	**1.4** MW
TKN as N	mg/L	0.1	-	-	-	-	-	-	**0.69**	**0.55**	**0.35**	**0.56**	**0.54**	**1.7**	**30**
Organic Nitrogen	mg/L	0.1	-	-	-	-	-	-	**0.3**	**0.33**	**0.23**	**0.39**	**0.3**	**0.65**	**29**
Total Nitrogen	mg/L	0.1	0.23	-	-	-	-	-	**0.7** MW	**0.56** MW	**0.35** MW	**0.56** MW	**0.54** MW	**3** MW	**31** MW
Phophate as P	mg/L	0.005	0.005	-	-	-	-	-	<0.005	**0.0071** MW	<0.005	<0.005	<0.005	**0.062** MW	**0.014** MW
Total Phosphorus	mg/L	0.05	0.02	-	-	-	-	-	<0.050	**0.062** MW	**0.053** MW	<0.050	<0.050	**0.11** MW	**0.08** MW
Dissolved Metals															
Aluminium-Dissolved	µg/L	10	55 (pH>6.5)	200	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Arsenic-Dissolved	µg/L	1	13	100	-	-	-	-	**43** MW	**4.8**	**1.7**	**8.4**	**22** MW	**16** MW	**4.3**
Boron-Dissolved	µg/L	20	940	40000	-	-	-	-	**80**	**84**	**110**	**140**	**76**	**84**	**200**
Barium-Dissolved	µg/L	1	-	20000	-	-	-	-	**14**	**81**	**11**	**12**	**8.6**	**27**	**330**
Beryllium-Dissolved	µg/L	0.5	-	600	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium-Dissolved	µg/L	0.1	5.5	20	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt-Dissolved	µg/L	1	1	500	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**8** MW
Chromium-Dissolved	µg/L	1	27	500	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper-Dissolved	µg/L	1	1.3	1000	-	-	-	-	<1.0	<1.0	**13** MW	**1.9** MW	**1.1**	<1.0	**1.9** MW
Mercury-Dissolved	µg/L	0.05	0.4	10	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese-Dissolved	µg/L	1	1900	5000	-	-	-	-	**25**	**230**	**14**	**14**	**17**	**20**	**2600** MW
Nickel-Dissolved	µg/L	1	70	200	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**6.8**
Lead-Dissolved	µg/L	1	4.4	100	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium-Dissolved	µg/L	1	11	100	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	**3.9**	**1.2**
Vanadium-Dissolved	µg/L	1	100	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.4**
Zinc-Dissolved	µg/L	1	8	3000	-	-	-	-	<1.0	**9.9** MW	**2.3**	**2.3**	**3.1**	<1.0	**4.7**
Total Recoverable Hydrocarbons															
TRH C6 - C9	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
TRH C6 - C10	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	-	-	6000	-	-	-	<10	<10	<10	<10	<10	<10	<10
TRH C10 - C14	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	**80**	**660**
TRH C15 - C28	µg/L	100	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	**790**
TRH C29 - C36	µg/L	100	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100
TRH >C10 - C16	µg/L	50	-	-	-	-	-	-	<50	<50	<50	<50	<50	**120**	**1200**
TRH >C10-C16 less N (F2)	µg/L	50	-	-	NL	-	-	-	<50	<50	<50	<50	<50	**120**	**1200**
TRH >C16 - C34 (F3)	µg/L	100	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	**180**
TRH >C34 - C40 (F4)	µg/L	100	-	-	-	-	-	-	<100	<100	<100	<100	<100	<100	<100
Total Recoverable Hydrocarbons (Silica Gel Cleanup)															
TRH (Silica) C10 - C14	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	<50	<50
TRH (Silica) C15 - C28	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	<100	<100
TRH (Silica) C29 - C36	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	<100	<100
TRH (Silica) >C10 - C16	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	<50	<50
TRH (Silica) >C16 - C34	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	<100	<100
TRH (Silica) >C34 - C40	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	<100	<100
Monocyclic Aromatic Hydrocarbons															
MTBE	µg/L	1	-	20	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Benzene	µg/L	1	700	10	5000	-	-	-	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	180	25	NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	80	3	NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	µg/L	2	200	20	NL	-	-	-	<2	<2	<2	<2	<2	<2	<2
o-xylene	µg/L	1	350		NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
Naphthalene (used in F2 calc)	µg/L	1	70	-	NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons															
Naphthalene	µg/L	0.1	70	-	NL	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	0.1	2	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	0.1	0.4	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	0.1	1.4	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	0.2	-	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	0.1	0.2	0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Volatile Organic Compunds															
2,2-dichloropropane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	900	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
cis-1,3-dichloropropene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
trans-1,3-dichloropropene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2-dibromoethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Benzene	µg/L	1	700	10	5000	-	-	-	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	180	25	NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	80	3	NL	-	-	-	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	µg/L	2	200	20	-	-	-	-	<2	<2	<2	<2	<2	<2	<2
Styrene	µg/L	1	-	4	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
o-xylene	µg/L	1	350	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Isopropylbenzene	µg/L	1	30	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
n-propyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,3,5-trimethyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Tert-butyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2,4-trimethyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Sec-butyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
4-isopropyl toluene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
n-butyl benzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Dichlorodifluoromethane	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Chloromethane	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Vinyl Chloride	µg/L	10	100	3	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Bromomethane	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Chloroethane	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
Trichlorofluoromethane	µg/L	10	-	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10
1,1-Dichloroethene	µg/L	1	-	300	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene	µg/L	1	-	600	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1-dichloroethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	770	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L	1	270	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1-dichloropropene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Carbon tetrachloride	µg/L	1	240	30	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2-dichloroethane	µg/L	1	1900	30	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Dibromomethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane	µg/L	1	1900	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,3-dichloropropane	µg/L	1	1100	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene	µg/L	1	-	500	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Dibromochloromethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1,1,2-tetrachloroethane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Bromoform	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	1	400	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2,3-trichloropropane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	µg/L	1	-	7	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Chlorobenzene	µg/L	1	55	10	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Bromobenzene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
2-chlorotoluene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
4-chlorotoluene	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene	µg/L	1	260	20	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene	µg/L	1	60	0.3	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene	µg/L	1	160	1	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	1	80	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
1,2,3-trichlorobenzene	µg/L	1	10	5	-	-	-	-	<1	<1	<1	<1	<1	<1	<1
Cyclohexane	µg/L	1	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1

Table H-1: Summary of Groundwater Analytical Results

Analyte Group / Analyte	Unit	LOR	Adopted Assessment Criteria						MW101	MW102	MW103	MW104	MW105	BH1	BH7
			MW [1]	NPUG [2]	HSL-D [3]	NEMP MW [6]	NEMP DW [7]	NEMP RW [8]	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Per- and Poly-Fluoroalkyl Substances															
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	**0.0035**	**0.0018**	<0.0010	<0.0010	**0.0017**
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	**0.0015**	**0.0024**	<0.0010	<0.0010	<0.0010
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.001	-	-	-	0.00023	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0021** [MW]
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorobutanoic acid (PFBA)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	**0.0029**	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanoic acid (PFHpA)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanoic acid (PFOA)	µg/L	0.001	-	5.6 [7]	-	19	0.56	10	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorononanoic acid (PFNA)	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanoic acid (PFDA)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorododecanoic acid (PFDoDA)	µg/L	0.005	-	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.01	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	-	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.001	-	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.002	-	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorooctane sulfonamide (FOSA)	µg/L	0.01	-	-	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.1	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.05	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.5	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	-	-	-	-	-	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total +ve PFHxS+PFOS	µg/L	0.001	-	0.7 [7]	-	-	0.07	2	<0.010	<0.010	**0.0015**	**0.0024**	<0.010	<0.010	<0.010
Total +ve PFOA+PFOS	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total +ve PFAS	µg/L	0.001	-	-	-	-	-	-	<0.0010	<0.0010	**0.0079**	**0.0042**	<0.0010	<0.0010	<0.0010
Radiological															
Gross Alpha	Bq/L	-	-	0.5	-	-	-	-	-	-	<0.041	**0.077**	-	-	-
Gross Beta	Bq/L	-	-	0.5	-	-	-	-	-	-	<0.07	<0.078	-	-	-

Note:

[1] ANZG (2018), Australian and New Zealand Guidelines for Marinewater Quality 2018, 95% Species Protection Level, Australian and New Zealand Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

[2] Drinking Non-Potable (DoH [2014] Contaminated Sites Ground and Surface Water Chemical Screening Guidelines).

[3] Groundwater HSLs for vapour intrusion HSL-D For Commerical and Industrial Land Uses (2m to < 4m), (NEPM - Schedule B1, 2013).

[4] HEPA (2020: Table 5) PFAS freshwater ecological guideline values for 99% species protection.

[5] HEPA (2020: Table 1) PFAS human health drinking water guideline values developed by DoH.

[6] HEPA (2020: Table 1) PFAS human health recreational water guideline values developed by NHMRC (2019).

[7] NPUG criteria derived based on 10 x drinking water

[8] Screening criteria for Gross Alpha and Gross Beta sourced from ADWG (NHMRC, 2022)

2 Exceedance of adopted assessment criteria.

Where high reliability criteria were not provided for either Fresh or Marine, the lowest of fresh and marine waters low reliabliity criteria were adopted.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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Sample Receipt Advice PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Hannah Meredith

Sample Login Details

Your Reference	224972.01 - Rockingham
Envirolab Reference	PFG1479
Date Sample Received	24/07/2024
Date Instructions Received	24/07/2024
Date Interim Results Expected	31/07/2024
Date Final Results Expected	09/08/2024

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	10 Water
Turnaround Time	12 Days
Temperatures / Cooling Methods	6.0°C On Ice

Additional Info

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

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

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

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

Please direct any queries to:

Heram Halim

Phone 08 9317 2505
Email hhalim@mpl.com.au

Meredith Conroy

Phone 08 9317 2505
Email mconroy@mpl.com.au

Analysis underway, details on the following page

Sample Receipt Advice PFG1479

Analysis Grid

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

	TRH & BTEXN NEPM w/ MTBE	Ion Balance	Nutrient Suite	PFAS - Extended (LL)	VOC Suite	BTEX	BTEX TS	PAH	Dissolved Metals (LL)	Dissolved Metals (LL)-Hg	Gross alpha & beta
PFG1479-01 Water | 23/07/2024 MW101	•	•	•	•	•			•	•	•	
PFG1479-02 Water | 23/07/2024 MW102	•	•	•	•	•			•	•	•	
PFG1479-03 Water | 23/07/2024 MW103	•	•	•	•	•			•	•	•	
PFG1479-04 Water | 23/07/2024 MW104	•	•	•	•	•			•	•	•	•
PFG1479-05 Water | 23/07/2024 MW105	•	•	•	•	•			•	•	•	•
PFG1479-06 Water | 23/07/2024 BH1	•	•	•	•	•			•	•	•	
PFG1479-07 Water | 23/07/2024 BH7	•	•	•	•	•			•	•	•	
PFG1479-08 Water | 23/07/2024 Rep1-1	•	•	•	•	•			•	•	•	
PFG1479-09 Water | 23/07/2024 Trip Blank						•					
PFG1479-10 Water | 23/07/2024 Trip Spike							•				

Suite Details

Suite Name	Suite Analyses
TRH & BTEXN NEPM w/ MTBE|Water	vTRH&MBTEXN, sTRH
Ion Balance|Water	Alkalinity Suite, Cations - Dissolved, Chloride, Ion Balance, Sulfate
Nutrient Suite|Water	P - Total, Nitrogen - Ammonia, Nitrogen - Nitrate, Nitrogen - Nitrite, Nitrogen - NOx, Nitrogen - Total N, Organic Nitrogen, Phosphate as P, TKN as N calc
PFAS - Extended (LL)|Water	PFAS EXT LL -ISTD, PFAS-Extended (LL)
VOC Suite|Water	Fumigants, VOC - MAH, Halogenated Aliphatics, Halogenated Aromatics, Other VOC, VOC - Surrogates

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Work Amendment Advice PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	224972.01 - Rockingham
Envirolab Reference	PFG1479
Date Sample Received	24/07/2024
Date Instructions Received	24/07/2024
Date Interim Results Expected	31/07/2024
Date Final Results Expected	09/08/2024

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	10 Water
Turnaround Time	12 Days
Temperatures / Cooling Methods	6.0°C On Ice

Additional Info

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

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

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

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

Please direct any queries to:

Heram Halim

Phone	08 9317 2505
Email	hhalim@mpl.com.au

Meredith Conroy

Phone	08 9317 2505
Email	mconroy@mpl.com.au

Analysis underway, details on the following page

Work Amendment Advice PFG1479

Analysis Grid

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

	TRH & BTEXN NEPM w/ MTBE	Ion Balance	Nutrient Suite	PFAS - Extended (LL)	VOC Suite	BTEX	BTEX TS	PAH	Dissolved Metals (LL)	Dissolved Metals (LL)-Hg	Gross alpha & beta
PFG1479-01 Water | 23/07/2024 MW101	•	•	•	•	•			•	•	•	
PFG1479-02 Water | 23/07/2024 MW102	•	•	•	•	•			•	•	•	
PFG1479-03 Water | 23/07/2024 MW103	•	•	•	•	•			•	•	•	•
PFG1479-04 Water | 23/07/2024 MW104	•	•	•	•	•			•	•	•	•
PFG1479-05 Water | 23/07/2024 MW105	•	•	•	•	•			•	•	•	
PFG1479-06 Water | 23/07/2024 BH1	•	•	•	•	•			•	•	•	
PFG1479-07 Water | 23/07/2024 BH7	•	•	•	•	•			•	•	•	
PFG1479-08 Water | 23/07/2024 Rep1-1	•	•	•	•	•			•	•	•	
PFG1479-09 Water | 23/07/2024 Trip Blank						•					
PFG1479-10 Water | 23/07/2024 Trip Spike							•				

Suite Details

Suite Name	Suite Analyses
TRH & BTEXN NEPM w/ MTBE|Water	vTRH&MBTEXN, sTRH
Ion Balance|Water	Alkalinity Suite, Cations - Dissolved, Chloride, Ion Balance, Sulfate
Nutrient Suite|Water	P - Total, Nitrogen - Ammonia, Nitrogen - Nitrate, Nitrogen - Nitrite, Nitrogen - NOx, Nitrogen - Total N, Organic Nitrogen, Phosphate as P, TKN as N calc
PFAS - Extended (LL)|Water	PFAS EXT LL -ISTD, PFAS-Extended (LL)
VOC Suite|Water	Fumigants, VOC - MAH, Halogenated Aliphatics, Halogenated Aromatics, Other VOC, VOC - Surrogates

Work Amendment Advice PFG1479

Work Order Amendment History

Revision	Reason for Amendment
R-01	Gross Alpha/Beta on COC updated.

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Certificate of Analysis PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	224972.01 - Rockingham
Number of Samples	10 Water
Date Samples Received	23/07/2024
Date Instructions Received	24/07/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	09/08/2024
Date of Issue	01/08/2024

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Authorisation Details

Results Approved By	Ben Carpenter, Metals Technician Hien Luong, Organics Technician Lien Tang, Assistant Operations Manager Lucas Yii, Inorganics Team Leader Michael Mowle, Inorganics Supervisor Sean McAlary, Chemist Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PFG1479-01	MW101	Water	23/07/2024	24/07/2024
PFG1479-02	MW102	Water	23/07/2024	24/07/2024
PFG1479-03	MW103	Water	23/07/2024	24/07/2024
PFG1479-04	MW104	Water	23/07/2024	24/07/2024
PFG1479-05	MW105	Water	23/07/2024	24/07/2024
PFG1479-06	BH1	Water	23/07/2024	24/07/2024
PFG1479-07	BH7	Water	23/07/2024	24/07/2024
PFG1479-08	Rep1-1	Water	23/07/2024	24/07/2024
PFG1479-09	Trip Blank	Water	23/07/2024	24/07/2024
PFG1479-10	Trip Spike	Water	23/07/2024	24/07/2024

Volatile Organic Compounds - Fumigants (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
2,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
2,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - MAH (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Styrene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Propylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tert-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
sec-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/L	1.0	<1.0	3.6	<1.0	<1.0	<1.0
n-Butyl benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Benzene	µg/L	1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0
Styrene	µg/L	1.0	<1.0	<1.0	<1.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
n-Propylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
tert-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
sec-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/L	1.0	<1.0	<1.0	<1.0
n-Butyl benzene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aliphatics (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	<10	<10	<10	<10
Chloromethane	µg/L	10	<10	<10	<10	<10	<10
Vinyl chloride	µg/L	10	<10	<10	<10	<10	<10
Bromomethane	µg/L	10	<10	<10	<10	<10	<10
Chloroethane	µg/L	10	<10	<10	<10	<10	<10
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	<10	<10	<10	<10
1,1-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	<10	<10
Chloromethane	µg/L	10	<10	<10	<10
Vinyl chloride	µg/L	10	<10	<10	<10
Bromomethane	µg/L	10	<10	<10	<10
Chloroethane	µg/L	10	<10	<10	<10
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	<10	<10
1,1-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0
Chloroform	µg/L	1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aliphatics (Water)

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
1,1-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
Trichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/L	1.0	<1.0	<1.0	<1.0
Bromodichloromethane	µg/L	1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
Tetrachloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Dibromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0
Bromoform	µg/L	1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aromatics (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Chlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Chlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/L	1.0	<1.0	<1.0	<1.0
2-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Other VOCs (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Cyclohexane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Cyclohexane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Surrogates (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Surrogate Dibromofluoromethane	%		*102*	*100*	*101*	*98.4*	*101*
Surrogate Toluene-D8	%		*101*	*98.7*	*98.3*	*97.0*	*98.3*
Surrogate 4-Bromofluorobenzene	%		*103*	*105*	*101*	*100*	*101*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Surrogate Dibromofluoromethane	%		*98.6*	*100*	*98.5*
Surrogate Toluene-D8	%		*99.2*	*102*	*94.5*
Surrogate 4-Bromofluorobenzene	%		*100*	*100*	*100*

Volatile TRH and BTEX (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C6-C9	µg/L	10	<10	<10	<10	<10	<10
TRH C6-C10	µg/L	10	<10	<10	<10	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10	<10	<10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	µg/L	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate Dibromofluoromethane	%		*103*	*106*	*105*	*102*	*106*
Surrogate Toluene-D8	%		*101*	*102*	*100*	*99.1*	*102*
Surrogate 4-Bromofluorobenzene	%		*98.5*	*101*	*97.5*	*96.4*	*97.3*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08	PFG1479-09
Your Reference			BH1	BH7	Rep1-1	Trip Blank
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C6-C9	µg/L	10	<10	<10	<10	<10
TRH C6-C10	µg/L	10	<10	<10	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10	<10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	µg/L	3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Surrogate Dibromofluoromethane	%		*99.2*	*104*	*105*	*100*
Surrogate Toluene-D8	%		*98.0*	*104*	*104*	*99.3*
Surrogate 4-Bromofluorobenzene	%		*96.3*	*96.1*	*96.1*	*94.5*

BTEX Trip Spike (Water)

Envirolab ID	Units	PQL	PFG1479-10
Your Reference			Trip Spike
Date Sampled			23/07/2024
Benzene	%		115
Toluene	%		113
Ethylbenzene	%		113
meta+para Xylene	%		114
ortho-Xylene	%		113
Surrogate Dibromofluoromethane	%		*103*
Surrogate Toluene-D8	%		*102*
Surrogate 4-Bromofluorobenzene	%		*106*

Semi-volatile TRH (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C10-C14	µg/L	50	<50	<50	<50	<50	<50
TRH C15-C28	µg/L	100	<100	<100	<100	<100	<100
TRH C29-C36	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	µg/L	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*97.2*	*104*	*86.9*	*96.3*	*85.4*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
TRH C10-C14	µg/L	50	80	660	<50
TRH C15-C28	µg/L	100	<100	790	<100
TRH C29-C36	µg/L	100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	80	1400	<50
TRH >C10-C16	µg/L	50	120	1200	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	120	1200	<50
TRH >C16-C34 (F3)	µg/L	100	<100	180	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	120	1400	<50
Surrogate o-Terphenyl	%		*97.6*	*47.8 [3]*	*85.3*

Polycyclic Aromatic Hydrocarbons (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Naphthalene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Surrogate p-Terphenyl-D14	%		*85.3*	*94.7*	*83.0*	*84.4*	*71.3*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Naphthalene	µg/L	0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/L	0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/L	0.10	<0.10	<0.10	<0.10
Fluorene	µg/L	0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/L	0.10	<0.10	<0.10	<0.10
Anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/L	0.10	<0.10	<0.10	<0.10
Pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Chrysene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10	<0.10
Total +ve PAH	µg/L	0.10	<0.10	<0.10	<0.10
Surrogate p-Terphenyl-D14	%		*91.3*	*36.8 [3]*	*72.0*

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Phosphorus	mg/L	0.050	<0.050	0.062	0.053	<0.050	<0.050

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Phosphorus	mg/L	0.050	0.11	0.080	<0.050

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Aluminium	µg/L	10	<10	<10	<10	<10	<10
Arsenic	µg/L	1.0	43	4.8	1.7	8.4	22
Boron	µg/L	20	80	84	110	140	76
Barium	µg/L	1.0	14	81	11	12	8.6
Beryllium	µg/L	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper	µg/L	1.0	<1.0	<1.0	13	1.9	1.1
Mercury	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese	µg/L	1.0	25	230	14	14	17
Nickel	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	µg/L	1.0	<1.0	9.9	2.3	2.3	3.1

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Aluminium	µg/L	10	<10	<10	<10
Arsenic	µg/L	1.0	16	4.3	32
Boron	µg/L	20	84	200	89
Barium	µg/L	1.0	27	330	15
Beryllium	µg/L	0.50	<0.50	<0.50	<0.50
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10
Cobalt	µg/L	1.0	<1.0	8.0	<1.0
Chromium	µg/L	1.0	<1.0	<1.0	<1.0
Copper	µg/L	1.0	<1.0	1.9	1.2
Mercury	µg/L	0.050	<0.050	<0.050	<0.050
Manganese	µg/L	1.0	20	2600	25
Nickel	µg/L	1.0	<1.0	6.8	<1.0
Lead	µg/L	1.0	<1.0	<1.0	<1.0
Selenium	µg/L	1.0	3.9	1.2	<1.0
Vanadium	µg/L	1.0	<1.0	2.4	<1.0
Zinc	µg/L	1.0	<1.0	4.7	2.3

Inorganics - Ionic Balance and Indexes (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	310	300	330	460	310
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	310	300	330	460	310
Chloride	mg/L	1.0	200	300	200	390	250
Sulfate	mg/L	1.0	160	170	120	110	220
Calcium	mg/L	0.50	120	130	100	130	130
Magnesium	mg/L	0.50	39	49	45	52	52
Potassium	mg/L	0.50	2.5	2.5	6.3	6.2	1.8
Sodium	mg/L	0.50	110	140	110	220	130
Hardness (calc) equivalent CaCO3	mg/L	3.0	470	530	450	530	540
Ionic Balance	%		-3.5	-3.2	-3.2	-5.1	-3.7
Total Anions	mg/L	7.0	670	770	650	960	770
Anions as meq	meq/L	0.59	14	17	14	21	17
Total Cations	mg/L	2.0	270	330	270	410	310
Cations as meq	meq/L	0.10	14	17	14	20	17

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	350	460	300
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	350	460	300
Chloride	mg/L	1.0	150	130	210
Sulfate	mg/L	1.0	120	120	160
Calcium	mg/L	0.50	120	110	130
Magnesium	mg/L	0.50	39	36	39
Potassium	mg/L	0.50	2.3	7.1	2.5
Sodium	mg/L	0.50	85	120	110
Hardness (calc) equivalent CaCO3	mg/L	3.0	450	430	480
Ionic Balance	%		-3.2	-4.3	-2.5
Total Anions	mg/L	7.0	620	700	670
Anions as meq	meq/L	0.59	12	13	14
Total Cations	mg/L	2.0	240	270	280
Cations as meq	meq/L	0.10	13	14	15

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Ammonia as N	mg/L	0.0050	0.39	0.22	0.11	0.17	0.24
Nitrate as N	mg/L	0.0050	<0.0050	0.0071	<0.0050	<0.0050	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	<0.020	0.031	<0.020	<0.020	<0.020
Nitrite as N	mg/L	0.0050	0.013	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	0.042	<0.020	<0.020	<0.020	<0.020
NOx as N	mg/L	0.0050	0.014	0.0076	<0.0050	<0.0050	<0.0050
TKN as N by calculation	mg/L	0.10	0.69	0.55	0.35	0.56	0.54
Organic Nitrogen by calc.	mg/L	0.10	0.30	0.33	0.23	0.39	0.30
Total Nitrogen	mg/L	0.10	0.70	0.56	0.35	0.56	0.54
Phosphate as P	mg/L	0.0050	<0.0050	0.0071	<0.0050	<0.0050	<0.0050

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Ammonia as N	mg/L	0.0050	1.0	0.30	0.35
Nitrate as N	mg/L	0.0050	1.3	1.4	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	5.6	6.0	<0.020
Nitrite as N	mg/L	0.0050	0.025	0.028	0.0098
Nitrite as NO2 by calculation	mg/L	0.020	0.082	0.093	0.032
NOx as N	mg/L	0.0050	1.3	1.4	0.013
TKN as N by calculation	mg/L	0.10	1.7	30	0.71
Organic Nitrogen by calc.	mg/L	0.10	0.65	29	0.36
Total Nitrogen	mg/L	0.10	3.0	31	0.72
Phosphate as P	mg/L	0.0050	0.062	0.014	<0.0050

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	<0.0010	0.0035	0.0018	<0.0010
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010	0.0015	0.0024	<0.0010
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Surrogate 13C8 PFOS	%		*104*	*105*	*104*	*105*	*102*
Surrogate 13C2 PFOA	%		*104*	*106*	*106*	*98.8*	*101*
Total +ve PFHxS+PFOS	µg/L	0.0010	<0.0010	<0.0010	0.0015	0.0024	<0.0010
Total +ve PFOA+PFOS	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total +ve PFAS	µg/L	0.0010	<0.0010	<0.0010	0.0079	0.0042	<0.0010
Extraction Internal Standard 13C3 PFBS	%		*67.0*	*74.0*	*75.0*	*77.0*	*82.0*
Extraction Internal Standard 18O2 PFHxS	%		*88.0*	*99.0*	*97.0*	*95.0*	*100*
Extraction Internal Standard 13C4 PFOS	%		*82.0*	*86.0*	*86.0*	*84.0*	*87.0*
Extraction Internal Standard 13C4 PFBA	%		*47.0 [4]*	*41.0 [4]*	*53.0*	*46.0 [4]*	*40.0 [4]*
Extraction Internal Standard 13C3 PFPeA	%		*87.0*	*90.0*	*96.0*	*91.0*	*90.0*
Extraction Internal Standard 13C2 PFHxA	%		*121*	*123*	*129*	*119*	*126*
Extraction Internal Standard 13C4 PFHpA	%		*140*	*150 [4]*	*151 [4]*	*147*	*157 [4]*
Extraction Internal Standard 13C4 PFOA	%		*92.0*	*98.0*	*98.0*	*97.0*	*99.0*
Extraction Internal Standard 13C5 PFNA	%		*113*	*121*	*115*	*110*	*116*
Extraction Internal Standard 13C2 PFDA	%		*152 [4]*	*161 [4]*	*170 [4]*	*164 [4]*	*166 [4]*

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Extraction Internal Standard 13C2 PFUnDA	%		*166 [4]*	*181 [4]*	*185 [4]*	*182 [4]*	*174 [4]*
Extraction Internal Standard 13C2 PFDoDA	%		*127*	*130*	*123*	*129*	*134*
Extraction Internal Standard 13C2 PFTeDA	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 4:2FTS	%		*187 [4]*	*196 [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 6:2FTS	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 8:2FTS	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C8 FOSA	%		*114*	*125*	*124*	*123*	*126*
Extraction Internal Standard d3 N MeFOSA	%		*98.0*	*95.0*	*95.0*	*95.0*	*96.0*
Extraction Internal Standard d5 N EtFOSA	%		*105*	*105*	*102*	*105*	*103*
Extraction Internal Standard d7 N MeFOSE	%		*91.0*	*92.0*	*93.0*	*91.0*	*97.0*
Extraction Internal Standard d9 N EtFOSE	%		*97.0*	*94.0*	*96.0*	*98.0*	*96.0*
Extraction Internal Standard d3 N MeFOSAA	%		*182 [4]*	*189 [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard d5 N EtFOSAA	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	0.0017	<0.0010
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	0.0021	<0.0010
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050	<0.0050
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050	<0.050
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10	<0.10
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50	<0.50
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Surrogate 13C8 PFOS	%		*103*	*101*	*103*
Surrogate 13C2 PFOA	%		*110*	*98.6*	*107*
Total +ve PFHxS+PFOS	µg/L	0.0010	<0.0010	0.0021	<0.0010
Total +ve PFOA+PFOS	µg/L	0.0010	<0.0010	0.0021	<0.0010
Total +ve PFAS	µg/L	0.0010	<0.0010	0.0038	<0.0010
Extraction Internal Standard 13C3 PFBS	%		*70.0*	*74.0*	*75.0*
Extraction Internal Standard 18O2 PFHxS	%		*89.0*	*91.0*	*98.0*
Extraction Internal Standard 13C4 PFOS	%		*81.0*	*81.0*	*87.0*
Extraction Internal Standard 13C4 PFBA	%		*60.0*	*45.0 [4]*	*47.0 [4]*
Extraction Internal Standard 13C3 PFPeA	%		*93.0*	*82.0*	*94.0*
Extraction Internal Standard 13C2 PFHxA	%		*123*	*109*	*123*
Extraction Internal Standard 13C4 PFHpA	%		*136*	*139*	*144*
Extraction Internal Standard 13C4 PFOA	%		*94.0*	*93.0*	*91.0*
Extraction Internal Standard 13C5 PFNA	%		*99.0*	*103*	*108*
Extraction Internal Standard 13C2 PFDA	%		*154 [4]*	*136*	*144*
Extraction Internal Standard 13C2 PFUnDA	%		*154 [4]*	*141*	*177 [4]*
Extraction Internal Standard 13C2 PFDoDA	%		*111*	*77.0*	*115*
Extraction Internal Standard 13C2 PFTeDA	%		*182 [4]*	*126*	*## [4]*
Extraction Internal Standard 13C2 4:2FTS	%		*184 [4]*	*162 [4]*	*190 [4]*
Extraction Internal Standard 13C2 6:2FTS	%		*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 8:2FTS	%		*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C8 FOSA	%		*115*	*106*	*125*
Extraction Internal Standard d3 N MeFOSA	%		*95.0*	*98.0*	*93.0*
Extraction Internal Standard d5 N EtFOSA	%		*103*	*98.0*	*103*
Extraction Internal Standard d7 N MeFOSE	%		*91.0*	*100*	*92.0*
Extraction Internal Standard d9 N EtFOSE	%		*96.0*	*93.0*	*96.0*
Extraction Internal Standard d3 N MeFOSAA	%		*165 [4]*	*176 [4]*	*175 [4]*
Extraction Internal Standard d5 N EtFOSAA	%		*## [4]*	*## [4]*	*## [4]*

Subcontracted Radiological - Certificate: ME365152 - Analysed By SGS Environment Services (VIC) (Water)

Envirolab ID	Units	PQL	PFG1479-03	PFG1479-04
Your Reference			MW103	MW104
Date Sampled			23/07/2024	23/07/2024
Gross alpha	Bq/L		<0.041 [6]	0.077 [6]
Gross beta	Bq/L		<0.07 [6]	<0.078 [6]

Result Comments

Identifier	Description
[3]	Surrogate recovery was low due to sample(s) emulsifying during liquid liquid extraction.
[4]	For PFAS Extracted Internal Standards denoted with ## or being outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).
[6]	The sub-contracting laboratory did not provide analysis and/or preparation and/or sample receipt dates. The date(s) the sample(s) was/were received at the sub-contracting laboratory has/have been used to assess holding time(s).

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - ION	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-006	Alkalinity - determined titrimetrically based on APHA latest edition 2320-B. Solids reported from a 1:5 water extract unless otherwise specified. Total Carbon Dioxide - determined by calculation in accordance with APHA latest edition,4500-CO2 D.
INORG-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% i.e. total anions = total cations +/-15%.
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-081	Anions determined by Ion Chromatography. Waters samples are filtered on receipt prior to analysis. Solids are analysed from a water extract. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.Salt forms and/or anion/cation forms (e.g. FeO, PbO, ZnO, BO3) are determined stoichiometrically from the base metal concentration.
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-022_PAH	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and solids using DCM/Acetone/Methanol. For PAHs:- Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, for Total +ve calculations, the PQL is reflective of the lowest individual PQL and therefore, for example, "Total +ve PAHs" is simply a sum of the positive individual PAHs.
ORG-023	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Soils are extracted with Methanol, diluted and analysed by purge and trap GC-MS.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.
ORG-029	Soil/solid and sorbent samples are extracted with basified Methanol. Waters and soil/sorbent extracts are directly injected and/or concentrated/extracted using SPE. TCLP/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MSMS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.
SUB-027_GAB1	Subcontracted to SGS - Accreditation number 2562

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

Miscellaneous Information

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

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

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	224972.01 - Rockingham
Date Issued	01/08/2024

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	No	Surrogates / Extracted ISTD Outliers Exist - See detailed list below
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFG1479

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Fumigants | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
VOC - MAH | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Halogenated Aliphatics | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Halogenated Aromatics | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Other VOC | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
VOC - Surrogates | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
vTRH&MBTEXN | Water	9	23/07/2024	24/07/2024	25/07/2024	Yes
	1-7	23/07/2024	25/07/2024	25/07/2024	Yes
	8	23/07/2024	25/07/2024	26/07/2024	Yes
BTEX TS | Water	10	23/07/2024	29/07/2024	29/07/2024	Yes
sTRH | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
PAH | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Total Phosphorus | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Dissolved Metals (LL) | Water	1-6	23/07/2024	25/07/2024	25/07/2024	Yes
	7-8	23/07/2024	25/07/2024	26/07/2024	Yes
Dissolved Metals (LL)-Hg | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Alkalinity Suite | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Chloride | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Dissolved Cations | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Ion Balance | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
	1-8	23/07/2024	25/07/2024	31/07/2024	Yes
Sulfate | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Nitrogen - Ammonia | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Nitrate | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Nitrite | Water	1-8	23/07/2024	26/07/2024	26/07/2024	No
Nitrogen - NOx | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Total N | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Phosphate as P | Water	1-8	23/07/2024	26/07/2024	26/07/2024	No
TKN as N calc | Water	1-8	23/07/2024	25/07/2024	31/07/2024	Yes
PFAS EXT LL -ISTD | Water	1-8	23/07/2024	30/07/2024	30/07/2024	Yes
PFAS-Extended (LL) | Water	1-8	23/07/2024	30/07/2024	30/07/2024	Yes
Gross alpha & beta | Water	3-4	23/07/2024	24/07/2024	31/07/2024	Yes

Data Quality Assessment Summary PFG1479

Outliers: Matrix Spike

ORG-020|Semi-volatile TRH (Water)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
BFG4173-MS1#	TRH >C16-C34 (F3)	60 - 140	##[1]
BFG4173-MS1#	TRH >C34-C40 (F4)	60 - 140	##[1]
BFG4173-MS1#	TRH C15-C28	60 - 140	##[1]
BFG4173-MS1#	TRH C29-C36	60 - 140	##[1]

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Water)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
BFG4173-MS2#	Benzo(a)pyrene	60 - 140	##[2]

Outliers: Surrogate / Extracted Internal Standards

ORG-020|Semi-volatile TRH (Matrix)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
PFG1479-07	o-Terphenyl	60 - 140	47.8% [3]

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Matrix)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
PFG1479-07	p-Terphenyl-D14	60 - 140	36.8% [3]

ORG-029|PFAS Extended List (Low Level) (Matrix)| Batch BFG5026

Sample ID	Analyte	% Limits	% Recovery
PFG1479-01	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	152 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	166 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	47.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	182 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	187 [4]
PFG1479-02	Extraction Internal Standard 13C4 PFBA	50 - 150	41.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	189 [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	181 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	161 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	196 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
PFG1479-03	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	185 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	170 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C4 PFHpA	50 - 150	151 [4]
PFG1479-04	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	164 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	182 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	46.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]

Data Quality Assessment Summary PFG1479

ORG-029|PFAS Extended List (Low Level) (Matrix)| Batch BFG5026

Sample ID	Analyte	% Limits	% Recovery
PFG1479-05	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	166 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	174 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	40.0 [4]
	Extraction Internal Standard 13C4 PFHpA	50 - 150	157 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
PFG1479-06	Extraction Internal Standard 13C2 PFTeDA	50 - 150	182 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	154 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	184 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	165 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	154 [4]
PFG1479-07	Extraction Internal Standard 13C4 PFBA	50 - 150	45.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	176 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	162 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
PFG1479-08	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	190 [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	177 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	47.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	175 [4]

Data Quality Assessment Summary PFG1479

Outliers: QC Frequency

ORG-023|Volatile Organic Compounds - Fumigants (Water)| Batch BFG4231

Analysis	QC Type	Expected	Reported
Fumigants	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aliphatics	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aromatics	Duplicate	1	0
	Matrix Spike	1	0
Other VOC	Duplicate	1	0
	Matrix Spike	1	0

ORG-023_F1_TOT|Volatile Organic Compounds - MAH (Water)| Batch BFG4231

Analysis	QC Type	Expected	Reported
VOC - MAH	Duplicate	1	0
	Matrix Spike	1	0
vTRH&MBTEXN	Duplicate	2	0
	Matrix Spike	1	0

ORG-023_F1_TOT|Volatile TRH and BTEX (Water)| Batch BFG5292

Analysis	QC Type	Expected	Reported
	Duplicate	1	0
	Matrix Spike	1	0

Quality Control PFG1479

ORG-023|Volatile Organic Compounds - Fumigants (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
2,2-Dichloropropane	µg/L	1.0	<1.0	[NA]
1,2-Dichloropropane	µg/L	1.0	<1.0	114
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	114
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	118
1,2-Dibromoethane	µg/L	1.0	<1.0	107

ORG-023_F1_TOT|Volatile Organic Compounds - MAH (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Benzene	µg/L	1.0	<1.0	119
Toluene	µg/L	1.0	<1.0	117
Ethylbenzene	µg/L	1.0	<1.0	119
meta+para Xylene	µg/L	2.0	<2.0	111
Styrene	µg/L	1.0	<1.0	[NA]
ortho-Xylene	µg/L	1.0	<1.0	116
Isopropylbenzene	µg/L	1.0	<1.0	[NA]
n-Propylbenzene	µg/L	1.0	<1.0	[NA]
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
tert-Butylbenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
sec-Butylbenzene	µg/L	1.0	<1.0	[NA]
4-Isopropyltoluene	µg/L	1.0	<1.0	[NA]
n-Butyl benzene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	[NA]
Chloromethane	µg/L	10	<10	[NA]
Vinyl chloride	µg/L	10	<10	[NA]
Bromomethane	µg/L	10	<10	[NA]
Chloroethane	µg/L	10	<10	[NA]
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	[NA]
1,1-Dichloroethene	µg/L	1.0	<1.0	[NA]
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
1,1-Dichloroethane	µg/L	1.0	<1.0	120
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
Bromochloromethane	µg/L	1.0	<1.0	[NA]
Chloroform	µg/L	1.0	<1.0	120
1,1,1-Trichloroethane	µg/L	1.0	<1.0	117
1,1-Dichloropropene	µg/L	1.0	<1.0	[NA]
Carbon Tetrachloride	µg/L	1.0	<1.0	[NA]
1,2-Dichloroethane	µg/L	1.0	<1.0	117
Trichloroethene	µg/L	1.0	<1.0	118
Dibromomethane	µg/L	1.0	<1.0	[NA]
Bromodichloromethane	µg/L	1.0	<1.0	119
1,1,2-Trichloroethane	µg/L	1.0	<1.0	[NA]
1,3-Dichloropropane	µg/L	1.0	<1.0	[NA]
Tetrachloroethene	µg/L	1.0	<1.0	120
Dibromochloromethane	µg/L	1.0	<1.0	112
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
Bromoform	µg/L	1.0	<1.0	116
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
1,2,3-Trichloropropane	µg/L	1.0	<1.0	[NA]

Quality Control PFG1479

ORG-023|Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	[NA]
Hexachlorobutadiene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Halogenated Aromatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Chlorobenzene	µg/L	1.0	<1.0	[NA]
Bromobenzene	µg/L	1.0	<1.0	[NA]
2-Chlorotoluene	µg/L	1.0	<1.0	[NA]
4-Chlorotoluene	µg/L	1.0	<1.0	[NA]
1,3-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,4-Dichlorobenzene	µg/L	1.0	<1.0	115
1,2-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	104
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Other VOCs (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Cyclohexane	µg/L	1.0	<1.0	119

ORG-023|Volatile Organic Compounds - Surrogates (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Surrogate Dibromofluoromethane	*%*		*99.3*	*100*
Surrogate Toluene-D8	*%*		*99.1*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*99.8*	*101*

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	119
TRH C6-C10	µg/L	10	<10	112
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	110
Toluene	µg/L	1.0	<1.0	112
Ethylbenzene	µg/L	1.0	<1.0	102
meta+para Xylene	µg/L	2.0	<2.0	103
ortho-Xylene	µg/L	1.0	<1.0	103
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	*%*		*103*	*105*
Surrogate Toluene-D8	*%*		*101*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*95.8*	*93.2*

Quality Control PFG1479

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BFG5292

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	118
TRH C6-C10	µg/L	10	<10	113
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	110
Toluene	µg/L	1.0	<1.0	112
Ethylbenzene	µg/L	1.0	<1.0	102
meta+para Xylene	µg/L	2.0	<2.0	103
ortho-Xylene	µg/L	1.0	<1.0	103
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	*%*		*103*	*105*
Surrogate Toluene-D8	*%*		*101*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*95.8*	*93.2*

ORG-020|Semi-volatile TRH (Water) | Batch BFG4173

Analyte	Units	PQL	Blank	DUP1 BFG4173-DUP1# Samp | QC | RPD %	DUP2 BFG4173-DUP2# Samp | QC | RPD %	LCS %	Spike % BFG4173-MS1#
TRH C10-C14	µg/L	50	<50	74.1 | 69.8 | [NA]	67.4 | 60.5 | [NA]	104	92.9
TRH C15-C28	µg/L	100	<100	1670 | 1760 | 5.21	<100 | <100 | [NA]	117	##[1]
TRH C29-C36	µg/L	100	<100	633 | 796 | 22.8	<100 | <100 | [NA]	119	##[1]
TRH >C10-C16	µg/L	50	<50	105 | 99.3 | [NA]	56.8 | 50.6 | [NA]	111	102
TRH >C16-C34 (F3)	µg/L	100	<100	2160 | 2400 | 10.3	<100 | <100 | [NA]	120	##[1]
TRH >C34-C40 (F4)	µg/L	100	<100	230 | 318 | [NA]	<100 | <100 | [NA]	118	##[1]
Surrogate o-Terphenyl	*%*		*103*	*79.0 | 77.8*	*78.7 | 79.7*	*103*	*100*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Water) | Batch BFG4173

Analyte	Units	PQL	Blank	DUP1 BFG4173-DUP1# Samp | QC | RPD %	DUP2 BFG4173-DUP2# Samp | QC | RPD %	LCS %	Spike % BFG4173-MS2#
Naphthalene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	81.8	83.1
Acenaphthylene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Acenaphthene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	83.4	72.0
Fluorene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.3	85.2
Phenanthrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	90.8	90.1
Anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fluoranthene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	93.8	92.1
Pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	91.6	90.7
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chrysene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	87.0	78.1
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	83.3	##[2]
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*96.7*	*83.7 | 79.6*	*70.6 | 71.9*	*76.2*	*82.6*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

METALS-020|Acid Extractable Metals (Water) | Batch BFG4119

Analyte	Units	PQL	Blank	DUP1 BFG4119-DUP1# Samp | QC | RPD %	DUP2 PFG1479-02 Samp | QC | RPD %	LCS %	Spike % BFG4119-MS1#
Phosphorus	mg/L	0.050	<0.050	0.200 | 0.193 | [NA]	0.0621 | <0.050 | [NA] [5]	105	99.3

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Dissolved Low Level Metals (Water) | Batch BFG4174

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4174-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Aluminium	µg/L	10	<10	<10 | <10 | [NA]	23.7 | 28.2 | [NA]	98.6	103
Arsenic	µg/L	1.0	<1.0	43.3 | 43.9 | 1.55	<1.0 | <1.0 | [NA]	102	111
Barium	µg/L	1.0	<1.0	14.3 | 14.1 | 0.930	1.70 | 2.15 | [NA] [5]	96.8	94.9
Beryllium	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	86.3	88.8
Boron	µg/L	20	<20	80.2 | 83.8 | [NA]	<20 | <20 | [NA]	89.0	90.7
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	103
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	100	101
Cobalt	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	103
Copper	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	22.8 | 26.4 | 14.5	99.5	97.1
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	96.9	93.2
Manganese	µg/L	1.0	<1.0	24.8 | 25.0 | 0.929	1.04 | 1.20 | [NA]	98.3	85.4
Nickel	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.1	96.4
Selenium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	102	121
Vanadium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.5	103
Zinc	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	16.8 | 19.3 | 13.8	97.7	76.7

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021|Dissolved Low Level Metals (Water) | Batch BFG4315

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4315-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	112	105

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-081|Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4115

Analyte	Units	PQL	Blank	DUP1 BFG4115-DUP1# Samp | QC | RPD %	DUP2 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % BFG4115-MS1#
Chloride	mg/L	1.0	<1.0	3.79 | 3.78 | [NA]	200 | 202 | 0.598	98.0	98.2
Sulfate	mg/L	1.0	<1.0	1.08 | 1.05 | [NA]	155 | 156 | 0.527	94.4	101

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-006|Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4166

Analyte	Units	PQL	Blank	DUP1 BFG4166-DUP1# Samp | QC | RPD %	DUP2 BFG4166-DUP2# Samp | QC | RPD %	LCS %
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	261 | 256 | 1.79	169 | 176 | 4.03	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	261 | 256 | 1.80	169 | 176 | 4.03	97.6

Analyte	Units	PQL	Blank	LCS %
Total Alkalinity as CaCO3	mg/L as CaCO3	5		109

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

INORG-006 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4167

Analyte	Units	PQL	Blank	DUP1 BFG4167-DUP1# Samp | QC | RPD %	LCS %
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	150 | 151 | 0.412	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	150 | 151 | 0.416	93.4

Analyte	Units	PQL	Blank	LCS %
Total Alkalinity as CaCO3	mg/L as CaCO3	5		112

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4170

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4170-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Calcium	mg/L	0.50	<0.50	123 | 123 | 0.252	<0.50 | <0.50 | [NA]	100	94.7
Magnesium	mg/L	0.50	<0.50	38.5 | 38.2 | 0.910	<0.50 | <0.50 | [NA]	100	106
Potassium	mg/L	0.50	<0.50	2.49 | 2.45 | [NA]	<0.50 | <0.50 | [NA]	99.8	99.7
Sodium	mg/L	0.50	<0.50	107 | 106 | 1.05	6.99 | 7.01 | 0.251	97.0	86.7
Hardness (calc) equivalent CaCO3	mg/L	3.0	<3.0	467 | 464 | 0.475	<3.0 | <3.0 | [NA]	[NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127 | Inorganics - Nutrients (Water) | Batch BFG4277

Analyte	Units	PQL	Blank	DUP1 BFG4277-DUP1# Samp | QC | RPD %	DUP2 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % BFG4277-MS1#
Total Nitrogen	mg/L	0.10	<0.10	1.58 | 1.49 | [NA]	0.702 | 0.694 | 1.22	110	115

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-057 | Inorganics - Nutrients (Water) | Batch BFG4492

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4492-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Ammonia as N	mg/L	0.0050	<0.0050	0.392 | 0.395 | 0.737	0.0452 | 0.0467 | 3.14	96.0	82.9
Nitrate as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	0.0100 | 0.0103 | [NA]	108	98.8
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	0.0129 | 0.0127 | [NA]	<0.0050 | <0.0050 | [NA]	[NA]	111
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	0.0139 | 0.0147 | [NA]	0.0103 | 0.0107 | [NA]	108	98.7
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	103	108

Analyte	Units	PQL	Blank	LCS %
Nitrite as N	mg/L	0.005		86.7

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

ORG-029|PFAS Extended List (Low Level) (Water) | Batch BFG5026

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	104	122
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	103	109
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	91.3	84.5
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	110	119
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	95.0	101
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	96.0	100
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	99.7	113
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	105	115
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	87.3	85.8
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	91.0	88.1
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	104	106
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	110	120
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	86.1	82.3
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	80.4	87.0
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	106	100
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010 | <0.010 | [NA]	125	122
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	96.6	79.5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	92.8	89.5
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	88.6	98.3
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	92.3	103
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	118	135
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010 | <0.010 | [NA]	84.7	84.3
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	104	99.4
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	96.7	90.4
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	104	104
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	104	108
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	97.9	124
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	99.3	100
Surrogate 13C8 PFOS	*%*		*101*	*104 | 103*	*99.6*	*101*
Surrogate 13C2 PFOA	*%*		*102*	*104 | 99.2*	*105*	*96.5*
Extraction Internal Standard 13C3 PFBS	*%*		*63.0*	*67.0 | 71.0 | 5.80*	*[NA]*	*[NA]*
Extraction Internal Standard 18O2 PFHxS	*%*		*87.0*	*88.0 | 90.0 | 2.25*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOS	*%*		*80.0*	*82.0 | 83.0 | 1.21*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFBA	*%*		*107*	*47.0 | 51.0 | 8.16*	*[NA]*	*[NA]*
Extraction Internal Standard 13C3 PFPeA	*%*		*92.0*	*87.0 | 91.0 | 4.49*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFHxA	*%*		*118*	*121 | 121 | 0.00*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFHpA	*%*		*117*	*140 | 135 | 3.64*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOA	*%*		*90.0*	*92.0 | 93.0 | 1.08*	*[NA]*	*[NA]*
Extraction Internal Standard 13C5 PFNA	*%*		*103*	*113 | 112 | 0.889*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFDA	*%*		*142*	*152 | 149 | 1.99*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFUnDA	*%*		*149*	*166 | 160 | 3.68 [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard 13C2 PFDoDA	*%*		*116*	*127 | 117 | 8.20*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFTeDA	*%*		*127*	*## | ## | [NA] [4]*	*[NA]*	*##[4]*
Extraction Internal Standard 13C2 4:2FTS	*%*		*157 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard 13C2 6:2FTS	*%*		*163 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*##[4]*
Extraction Internal Standard 13C2 8:2FTS	*%*		*199 [4]*	*## | ## | [NA] [4]*	*## [4]*	*##[4]*
Extraction Internal Standard 13C8 FOSA	*%*		*99.0*	*114 | 115 | 0.873*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSA	*%*		*99.0*	*98.0 | 96.0 | 2.06*	*[NA]*	*[NA]*
Extraction Internal Standard d5 N EtFOSA	*%*		*106*	*105 | 106 | 0.948*	*[NA]*	*[NA]*
Extraction Internal Standard d7 N MeFOSE	*%*		*96.0*	*91.0 | 95.0 | 4.30*	*[NA]*	*[NA]*
Extraction Internal Standard d9 N EtFOSE	*%*		*100*	*97.0 | 103 | 6.00*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSAA	*%*		*158 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard d5 N EtFOSAA	*%*		*## [4]*	*## | ## | [NA] [4]*	*## [4]*	*##[4]*

Quality Control PFG1479

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[2]	Spike recovery is outside routine acceptance criteria (60-140%), this may be due to suspected non-homogeneity and/or matrix interference effects. However, an acceptable recovery was achieved for the LCS.
[4]	For PFAS Extracted Internal Standards denoted with ## or being outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).
[5]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.

Douglas PARTNERS

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 224972.01	**Suburb:** Rockingha		**To:** MPL
Project Manager: RS	**Order Number:** PE251619	**Sampler:** VH	Hayden Crt, Myaree
Email: rob.shapland@douglaspartners.com.au			**Attn:** Sample Receipt
Turnaround time: ☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			93172505 Lab email
Prior Storage: ☑ Fridge ☐ Freezer ☐ Esky ☐ Shelf	**Do samples contain 'potential' HBM?** ☑ No ☐ Yes (If YES, handle, transport, store in accordance with FPM HAZID)		

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Dissolved Metals (16)	TRH/BTEX	PAH	VOC	Nutrient Suite	PFAS (long suite)	Gross Alpha Beta	Anions and Cations	v-TRH			Notes/ Preservation/ Additional Requirements
1	MW101			23/7/2024	W	G/P	X	X	X	X	X	X		X				
2	MW102			23/7/2024	W	G/P	X	X	X	X	X	X		X				
3	MW103			23/7/2024	W	G/P	X	X	X	X	X	X	X	X				
4	MW104			23/7/2024	W	G/P	X	X	X	X	X	X	X	X				
5	MW105			23/7/2024	W	G/P	X	X	X	X	X	X	X	X				
6	BH1			23/7/2024	W	G/P	X	X	X	X	X	X		X				
7	BH7			23/7/2024	W	G/P	X	X	X	X	X	X		X				
8	Rep1-1			23/7/2024	W	G/P	X	X	X	X	X	X		X				
—	Rep1-2			23/7/2024	W	G/P	X	X	X	X	X	X		X				Send to ARL/Eurofins
9	Trip Blank				W	G									X			
10	Trip Spike				W	G									X			

EMPL Laboratories ENVIROLAB
Job No - 4FG1479
Date Rec - 23-7
Time Rec - 1805
Rec By - mc
TAT Req - SAME 1 / 2 / 3 STD
Temp - Cool / ambient 6°C
Cooling - Ice / Ice pack / None
Security Seal - Yes / No

Metals to analyse: Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Mn, Hg, Ni, Pb, Se, V, Zn

Number of samples in container:

Transported to laboratory by: Courier

Send results to: Douglas Partners Pty Ltd

Addr 36 O'Malley Street, Osborne Park **Phone:** 92043511

Relinquished by: VH **Date:** 7/23/2024 **Signed:**

LAB RECEIPT

Lab Ref. No:

Received by: mc

Date & Time 23-7-24 1805

Signed:

Cecilia Tadena

From: Rob Shapland <rob.shapland@douglaspartners.com.au>
Sent: Wednesday, 24 July 2024 12:04 PM
To: Cecilia Tadena
Cc: Sample Receipt WA
Subject: RE: 224972.01 Rockingham - PFAS analysis

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Cecilia,

Please analyse for low level.

Kind regards,

Rob Shapland | Environmental Chemist / Senior Associate

08 9204 3511 +61 412 448 485 Rob.Shapland@douglaspartners.com.au

www.douglaspartners.com.au 36 O'Malley Street, Osborne Park, WA 6017 | Whadjuk Country

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From: Cecilia Tadena <CTadena@mpl.com.au>
Sent: Wednesday, July 24, 2024 11:48 AM
To: Rob Shapland <rob.shapland@douglaspartners.com.au>
Cc: Sample Receipt WA <SampleReceiptWA@mpl.com.au>
Subject: 224972.01 Rockingham - PFAS analysis

Good morning Rob,

Just want to ask which PFAS level in water do you require for this job (COC attached) . We can do Routine Level, Low Level and Trace Level?

Thank you.

Kind Regards,

Cecilia Tadena | Customer Service | MPL Laboratories

Great Science. Great Service.

16-18 Hayden Court Myaree WA 6154 | PO Box 4023 Myaree BC, WA 6960
T 08 9317 2505

E CTadena@mpl.com.au | W www.mpl.com.au

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Price Increase: *We will be having a CPI increase July 2024. Your on-line price list will be updated automatically.*

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Samples will be analysed per our T&C's.

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lab@mpl.com.au
www.mpl.com.au

Work Amendment Advice PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	224972.01 - Rockingham
Envirolab Reference	PFG1479
Date Sample Received	24/07/2024
Date Instructions Received	02/08/2024
Date Final Results Expected	09/08/2024

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	10 Water
Turnaround Time	5 Days
Temperatures / Cooling Methods	6.0°C On Ice

Additional Info

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

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

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

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

Please direct any queries to:

Heram Halim

Phone 08 9317 2505
Email hhalim@mpl.com.au

Meredith Conroy

Phone 08 9317 2505
Email mconroy@mpl.com.au

Analysis underway, details on the following page

Work Amendment Advice PFG1479

Analysis Grid

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

	TRH & BTEXN NEPM w/ MTBE	Ion Balance	Nutrient Suite	PFAS - Extended (LL)	VOC Suite	vTRH&MBTEXN	BTEX TS	sTRH Silica Gel Cleanup step	PAH	Dissolved Metals (LL)	Dissolved Metals (LL)-Hg	Gross alpha & beta
PFG1479-01 Water | 23/07/2024 MW101	•	•	•	•	•				•	•	•	
PFG1479-02 Water | 23/07/2024 MW102	•	•	•	•	•				•	•	•	
PFG1479-03 Water | 23/07/2024 MW103	•	•	•	•	•				•	•	•	•
PFG1479-04 Water | 23/07/2024 MW104	•	•	•	•	•				•	•	•	•
PFG1479-05 Water | 23/07/2024 MW105	•	•	•	•	•				•	•	•	
PFG1479-06 Water | 23/07/2024 BH1	•	•	•	•	•			•	•	•	•	
PFG1479-07 Water | 23/07/2024 BH7	•	•	•	•	•			•	•	•	•	
PFG1479-08 Water | 23/07/2024 Rep1-1	•	•	•	•	•				•	•	•	
PFG1479-09 Water | 23/07/2024 Trip Blank						•						
PFG1479-10 Water | 23/07/2024 Trip Spike							•					

Suite Details

Suite Name	Suite Analyses
TRH & BTEXN NEPM w/ MTBE|Water	vTRH&MBTEXN, sTRH
Ion Balance|Water	Alkalinity Suite, Cations - Dissolved, Chloride, Ion Balance, Sulfate
Nutrient Suite|Water	P - Total, Nitrogen - Ammonia, Nitrogen - Nitrate, Nitrogen - Nitrite, Nitrogen - NOx, Nitrogen - Total N, Organic Nitrogen, Phosphate as P, TKN as N calc
PFAS - Extended (LL)|Water	PFAS EXT LL -ISTD, PFAS-Extended (LL)
VOC Suite|Water	Fumigants, VOC - MAH, Halogenated Aliphatics, Halogenated Aromatics, Other VOC, VOC - Surrogates

Work Amendment Advice PFG1479

Work Order Amendment History

Revision	Reason for Amendment
R-01	Gross Alpha/Beta on COC updated.
R-02	Additional analysis requested - 2/08/2024

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www.mpl.com.au

Certificate of Analysis PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	224972.01 - Rockingham
Number of Samples	10 Water
Date Samples Received	23/07/2024
Date Instructions Received	02/08/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	09/08/2024
Date of Reissue	09/08/2024 - This report supercedes previous report, see amendment history for details

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Authorisation Details

Results Approved By	Ben Carpenter, Metals Technician Hien Luong, Organics Technician Lien Tang, Assistant Operations Manager Lucas Yii, Inorganics Team Leader Michael Mowle, Inorganics Supervisor Sean McAlary, Chemist Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Report Amendment History

Revision	Reason for Amendment
R-01	Additional analysis requested - 2/08/2024

Certificate of Analysis PFG1479

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PFG1479-01	MW101	Water	23/07/2024	24/07/2024
PFG1479-02	MW102	Water	23/07/2024	24/07/2024
PFG1479-03	MW103	Water	23/07/2024	24/07/2024
PFG1479-04	MW104	Water	23/07/2024	24/07/2024
PFG1479-05	MW105	Water	23/07/2024	24/07/2024
PFG1479-06	BH1	Water	23/07/2024	24/07/2024
PFG1479-07	BH7	Water	23/07/2024	24/07/2024
PFG1479-08	Rep1-1	Water	23/07/2024	24/07/2024
PFG1479-09	Trip Blank	Water	23/07/2024	24/07/2024
PFG1479-10	Trip Spike	Water	23/07/2024	24/07/2024

Volatile Organic Compounds - Fumigants (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
2,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
2,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dibromoethane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - MAH (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Styrene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Propylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tert-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
sec-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/L	1.0	<1.0	3.6	<1.0	<1.0	<1.0
n-Butyl benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Benzene	µg/L	1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0
Styrene	µg/L	1.0	<1.0	<1.0	<1.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
n-Propylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
tert-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
sec-Butylbenzene	µg/L	1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/L	1.0	<1.0	<1.0	<1.0
n-Butyl benzene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aliphatics (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	<10	<10	<10	<10
Chloromethane	µg/L	10	<10	<10	<10	<10	<10
Vinyl chloride	µg/L	10	<10	<10	<10	<10	<10
Bromomethane	µg/L	10	<10	<10	<10	<10	<10
Chloroethane	µg/L	10	<10	<10	<10	<10	<10
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	<10	<10	<10	<10
1,1-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	<10	<10
Chloromethane	µg/L	10	<10	<10	<10
Vinyl chloride	µg/L	10	<10	<10	<10
Bromomethane	µg/L	10	<10	<10	<10
Chloroethane	µg/L	10	<10	<10	<10
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	<10	<10
1,1-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0
Chloroform	µg/L	1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aliphatics (Water)

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
1,1-Dichloropropene	µg/L	1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
Trichloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/L	1.0	<1.0	<1.0	<1.0
Bromodichloromethane	µg/L	1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	µg/L	1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
Tetrachloroethene	µg/L	1.0	<1.0	<1.0	<1.0
Dibromochloromethane	µg/L	1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0
Bromoform	µg/L	1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Halogenated Aromatics (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Chlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Chlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/L	1.0	<1.0	<1.0	<1.0
2-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/L	1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Other VOCs (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Cyclohexane	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Cyclohexane	µg/L	1.0	<1.0	<1.0	<1.0

Volatile Organic Compounds - Surrogates (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Surrogate Dibromofluoromethane	%		*102*	*100*	*101*	*98.4*	*101*
Surrogate Toluene-D8	%		*101*	*98.7*	*98.3*	*97.0*	*98.3*
Surrogate 4-Bromofluorobenzene	%		*103*	*105*	*101*	*100*	*101*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Surrogate Dibromofluoromethane	%		*98.6*	*100*	*98.5*
Surrogate Toluene-D8	%		*99.2*	*102*	*94.5*
Surrogate 4-Bromofluorobenzene	%		*100*	*100*	*100*

Volatile TRH and BTEX (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C6-C9	µg/L	10	<10	<10	<10	<10	<10
TRH C6-C10	µg/L	10	<10	<10	<10	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10	<10	<10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	µg/L	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Surrogate Dibromofluoromethane	%		*103*	*106*	*105*	*102*	*106*
Surrogate Toluene-D8	%		*101*	*102*	*100*	*99.1*	*102*
Surrogate 4-Bromofluorobenzene	%		*98.5*	*101*	*97.5*	*96.4*	*97.3*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08	PFG1479-09
Your Reference			BH1	BH7	Rep1-1	Trip Blank
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C6-C9	µg/L	10	<10	<10	<10	<10
TRH C6-C10	µg/L	10	<10	<10	<10	<10
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10	<10	<10
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Toluene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
meta+para Xylene	µg/L	2.0	<2.0	<2.0	<2.0	<2.0
ortho-Xylene	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Total Xylene	µg/L	3.0	<3.0	<3.0	<3.0	<3.0
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	<1.0	<1.0	<1.0
Surrogate Dibromofluoromethane	%		*99.2*	*104*	*105*	*100*
Surrogate Toluene-D8	%		*98.0*	*104*	*104*	*99.3*
Surrogate 4-Bromofluorobenzene	%		*96.3*	*96.1*	*96.1*	*94.5*

BTEX Trip Spike (Water)

Envirolab ID	Units	PQL	PFG1479-10
Your Reference			Trip Spike
Date Sampled			23/07/2024
Benzene	%		115
Toluene	%		113
Ethylbenzene	%		113
meta+para Xylene	%		114
ortho-Xylene	%		113
Surrogate Dibromofluoromethane	%		*103*
Surrogate Toluene-D8	%		*102*
Surrogate 4-Bromofluorobenzene	%		*106*

Semi-volatile TRH (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
TRH C10-C14	µg/L	50	<50	<50	<50	<50	<50
TRH C15-C28	µg/L	100	<100	<100	<100	<100	<100
TRH C29-C36	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16	µg/L	50	<50	<50	<50	<50	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	<50	<50	<50	<50	<50
TRH >C16-C34 (F3)	µg/L	100	<100	<100	<100	<100	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%		*97.2*	*104*	*86.9*	*96.3*	*85.4*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
TRH C10-C14	µg/L	50	80	660	<50
TRH C15-C28	µg/L	100	<100	790	<100
TRH C29-C36	µg/L	100	<100	<100	<100
Total +ve TRH C10-C36	µg/L	50	80	1400	<50
TRH >C10-C16	µg/L	50	120	1200	<50
TRH >C10-C16 less Naphthalene F2	µg/L	50	120	1200	<50
TRH >C16-C34 (F3)	µg/L	100	<100	180	<100
TRH >C34-C40 (F4)	µg/L	100	<100	<100	<100
Total +ve TRH >C10-C40	µg/L	50	120	1400	<50
Surrogate o-Terphenyl	%		*97.6*	*47.8 [3]*	*85.3*

Semi-volatile TRH with Silica Gel Cleanup (Water)

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07
Your Reference			BH1	BH7
Date Sampled			23/07/2024	23/07/2024
TRH (Silica) C10-C14	µg/L	50	<50	<50
TRH (Silica) C15-C28	µg/L	100	<100	<100
TRH (Silica) C29-C36	µg/L	100	<100	<100
TRH (Silica) >C10-C16	µg/L	50	<50	<50
TRH (Silica) >C16-C34	µg/L	100	<100	<100
TRH (Silica) >C34-C40	µg/L	100	<100	<100
Surrogate o-Terphenyl	%		*89.5*	*44.1 [3]*

Polycyclic Aromatic Hydrocarbons (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Naphthalene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total +ve PAH	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Surrogate p-Terphenyl-D14	%		*85.3*	*94.7*	*83.0*	*84.4*	*71.3*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Naphthalene	µg/L	0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/L	0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/L	0.10	<0.10	<0.10	<0.10
Fluorene	µg/L	0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/L	0.10	<0.10	<0.10	<0.10
Anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/L	0.10	<0.10	<0.10	<0.10
Pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Chrysene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10	<0.10
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10	<0.10
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10	<0.10
Total +ve PAH	µg/L	0.10	<0.10	<0.10	<0.10
Surrogate p-Terphenyl-D14	%		*91.3*	*36.8 [3]*	*72.0*

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Phosphorus	mg/L	0.050	<0.050	0.062	0.053	<0.050	<0.050

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Phosphorus	mg/L	0.050	0.11	0.080	<0.050

Certificate of Analysis PFG1479

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Aluminium	µg/L	10	<10	<10	<10	<10	<10
Arsenic	µg/L	1.0	43	4.8	1.7	8.4	22
Boron	µg/L	20	80	84	110	140	76
Barium	µg/L	1.0	14	81	11	12	8.6
Beryllium	µg/L	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cobalt	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper	µg/L	1.0	<1.0	<1.0	13	1.9	1.1
Mercury	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese	µg/L	1.0	25	230	14	14	17
Nickel	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	µg/L	1.0	<1.0	9.9	2.3	2.3	3.1

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Aluminium	µg/L	10	<10	<10	<10
Arsenic	µg/L	1.0	16	4.3	32
Boron	µg/L	20	84	200	89
Barium	µg/L	1.0	27	330	15
Beryllium	µg/L	0.50	<0.50	<0.50	<0.50
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10
Cobalt	µg/L	1.0	<1.0	8.0	<1.0
Chromium	µg/L	1.0	<1.0	<1.0	<1.0
Copper	µg/L	1.0	<1.0	1.9	1.2
Mercury	µg/L	0.050	<0.050	<0.050	<0.050
Manganese	µg/L	1.0	20	2600	25
Nickel	µg/L	1.0	<1.0	6.8	<1.0
Lead	µg/L	1.0	<1.0	<1.0	<1.0
Selenium	µg/L	1.0	3.9	1.2	<1.0
Vanadium	µg/L	1.0	<1.0	2.4	<1.0
Zinc	µg/L	1.0	<1.0	4.7	2.3

Inorganics - Ionic Balance and Indexes (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	310	300	330	460	310
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	310	300	330	460	310
Chloride	mg/L	1.0	200	300	200	390	250
Sulfate	mg/L	1.0	160	170	120	110	220
Calcium	mg/L	0.50	120	130	100	130	130
Magnesium	mg/L	0.50	39	49	45	52	52
Potassium	mg/L	0.50	2.5	2.5	6.3	6.2	1.8
Sodium	mg/L	0.50	110	140	110	220	130
Hardness (calc) equivalent CaCO3	mg/L	3.0	470	530	450	530	540
Ionic Balance	%		-3.5	-3.2	-3.2	-5.1	-3.7
Total Anions	mg/L	7.0	670	770	650	960	770
Anions as meq	meq/L	0.59	14	17	14	21	17
Total Cations	mg/L	2.0	270	330	270	410	310
Cations as meq	meq/L	0.10	14	17	14	20	17

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	350	460	300
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	350	460	300
Chloride	mg/L	1.0	150	130	210
Sulfate	mg/L	1.0	120	120	160
Calcium	mg/L	0.50	120	110	130
Magnesium	mg/L	0.50	39	36	39
Potassium	mg/L	0.50	2.3	7.1	2.5
Sodium	mg/L	0.50	85	120	110
Hardness (calc) equivalent CaCO3	mg/L	3.0	450	430	480
Ionic Balance	%		-3.2	-4.3	-2.5
Total Anions	mg/L	7.0	620	700	670
Anions as meq	meq/L	0.59	12	13	14
Total Cations	mg/L	2.0	240	270	280
Cations as meq	meq/L	0.10	13	14	15

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Ammonia as N	mg/L	0.0050	0.39	0.22	0.11	0.17	0.24
Nitrate as N	mg/L	0.0050	<0.0050	0.0071	<0.0050	<0.0050	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	<0.020	0.031	<0.020	<0.020	<0.020
Nitrite as N	mg/L	0.0050	0.013	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	0.042	<0.020	<0.020	<0.020	<0.020
NOx as N	mg/L	0.0050	0.014	0.0076	<0.0050	<0.0050	<0.0050
TKN as N by calculation	mg/L	0.10	0.69	0.55	0.35	0.56	0.54
Organic Nitrogen by calc.	mg/L	0.10	0.30	0.33	0.23	0.39	0.30
Total Nitrogen	mg/L	0.10	0.70	0.56	0.35	0.56	0.54
Phosphate as P	mg/L	0.0050	<0.0050	0.0071	<0.0050	<0.0050	<0.0050

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Ammonia as N	mg/L	0.0050	1.0	0.30	0.35
Nitrate as N	mg/L	0.0050	1.3	1.4	<0.0050
Nitrate as NO3 by calculation	mg/L	0.020	5.6	6.0	<0.020
Nitrite as N	mg/L	0.0050	0.025	0.028	0.0098
Nitrite as NO2 by calculation	mg/L	0.020	0.082	0.093	0.032
NOx as N	mg/L	0.0050	1.3	1.4	0.013
TKN as N by calculation	mg/L	0.10	1.7	30	0.71
Organic Nitrogen by calc.	mg/L	0.10	0.65	29	0.36
Total Nitrogen	mg/L	0.10	3.0	31	0.72
Phosphate as P	mg/L	0.0050	0.062	0.014	<0.0050

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	<0.0010	0.0035	0.0018	<0.0010
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010	0.0015	0.0024	<0.0010
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50	<0.50	<0.50	<0.50
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Surrogate 13C8 PFOS	%		*104*	*105*	*104*	*105*	*102*
Surrogate 13C2 PFOA	%		*104*	*106*	*106*	*98.8*	*101*
Total +ve PFHxS+PFOS	µg/L	0.0010	<0.0010	<0.0010	0.0015	0.0024	<0.0010
Total +ve PFOA+PFOS	µg/L	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total +ve PFAS	µg/L	0.0010	<0.0010	<0.0010	0.0079	0.0042	<0.0010
Extraction Internal Standard 13C3 PFBS	%		*67.0*	*74.0*	*75.0*	*77.0*	*82.0*
Extraction Internal Standard 18O2 PFHxS	%		*88.0*	*99.0*	*97.0*	*95.0*	*100*
Extraction Internal Standard 13C4 PFOS	%		*82.0*	*86.0*	*86.0*	*84.0*	*87.0*
Extraction Internal Standard 13C4 PFBA	%		*47.0 [4]*	*41.0 [4]*	*53.0*	*46.0 [4]*	*40.0 [4]*
Extraction Internal Standard 13C3 PFPeA	%		*87.0*	*90.0*	*96.0*	*91.0*	*90.0*
Extraction Internal Standard 13C2 PFHxA	%		*121*	*123*	*129*	*119*	*126*
Extraction Internal Standard 13C4 PFHpA	%		*140*	*150 [4]*	*151 [4]*	*147*	*157 [4]*
Extraction Internal Standard 13C4 PFOA	%		*92.0*	*98.0*	*98.0*	*97.0*	*99.0*
Extraction Internal Standard 13C5 PFNA	%		*113*	*121*	*115*	*110*	*116*
Extraction Internal Standard 13C2 PFDA	%		*152 [4]*	*161 [4]*	*170 [4]*	*164 [4]*	*166 [4]*

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-01	PFG1479-02	PFG1479-03	PFG1479-04	PFG1479-05
Your Reference			MW101	MW102	MW103	MW104	MW105
Date Sampled			23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Extraction Internal Standard 13C2 PFUnDA	%		*166 [4]*	*181 [4]*	*185 [4]*	*182 [4]*	*174 [4]*
Extraction Internal Standard 13C2 PFDoDA	%		*127*	*130*	*123*	*129*	*134*
Extraction Internal Standard 13C2 PFTeDA	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 4:2FTS	%		*187 [4]*	*196 [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 6:2FTS	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 8:2FTS	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C8 FOSA	%		*114*	*125*	*124*	*123*	*126*
Extraction Internal Standard d3 N MeFOSA	%		*98.0*	*95.0*	*95.0*	*95.0*	*96.0*
Extraction Internal Standard d5 N EtFOSA	%		*105*	*105*	*102*	*105*	*103*
Extraction Internal Standard d7 N MeFOSE	%		*91.0*	*92.0*	*93.0*	*91.0*	*97.0*
Extraction Internal Standard d9 N EtFOSE	%		*97.0*	*94.0*	*96.0*	*98.0*	*96.0*
Extraction Internal Standard d3 N MeFOSAA	%		*182 [4]*	*189 [4]*	*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard d5 N EtFOSAA	%		*## [4]*	*## [4]*	*## [4]*	*## [4]*	*## [4]*

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	0.0017	<0.0010
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	0.0021	<0.0010
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050	<0.0050
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010	<0.010
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050	<0.050
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010	<0.0010
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10	<0.10
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050	<0.050
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50	<0.50
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020

PFAS Extended List (Low Level) (Water) - Analysed By Envirolab Services Sydney

Envirolab ID	Units	PQL	PFG1479-06	PFG1479-07	PFG1479-08
Your Reference			BH1	BH7	Rep1-1
Date Sampled			23/07/2024	23/07/2024	23/07/2024
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020	<0.0020
Surrogate 13C8 PFOS	%		*103*	*101*	*103*
Surrogate 13C2 PFOA	%		*110*	*98.6*	*107*
Total +ve PFHxS+PFOS	µg/L	0.0010	<0.0010	0.0021	<0.0010
Total +ve PFOA+PFOS	µg/L	0.0010	<0.0010	0.0021	<0.0010
Total +ve PFAS	µg/L	0.0010	<0.0010	0.0038	<0.0010
Extraction Internal Standard 13C3 PFBS	%		*70.0*	*74.0*	*75.0*
Extraction Internal Standard 18O2 PFHxS	%		*89.0*	*91.0*	*98.0*
Extraction Internal Standard 13C4 PFOS	%		*81.0*	*81.0*	*87.0*
Extraction Internal Standard 13C4 PFBA	%		*60.0*	*45.0 [4]*	*47.0 [4]*
Extraction Internal Standard 13C3 PFPeA	%		*93.0*	*82.0*	*94.0*
Extraction Internal Standard 13C2 PFHxA	%		*123*	*109*	*123*
Extraction Internal Standard 13C4 PFHpA	%		*136*	*139*	*144*
Extraction Internal Standard 13C4 PFOA	%		*94.0*	*93.0*	*91.0*
Extraction Internal Standard 13C5 PFNA	%		*99.0*	*103*	*108*
Extraction Internal Standard 13C2 PFDA	%		*154 [4]*	*136*	*144*
Extraction Internal Standard 13C2 PFUnDA	%		*154 [4]*	*141*	*177 [4]*
Extraction Internal Standard 13C2 PFDoDA	%		*111*	*77.0*	*115*
Extraction Internal Standard 13C2 PFTeDA	%		*182 [4]*	*126*	*## [4]*
Extraction Internal Standard 13C2 4:2FTS	%		*184 [4]*	*162 [4]*	*190 [4]*
Extraction Internal Standard 13C2 6:2FTS	%		*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C2 8:2FTS	%		*## [4]*	*## [4]*	*## [4]*
Extraction Internal Standard 13C8 FOSA	%		*115*	*106*	*125*
Extraction Internal Standard d3 N MeFOSA	%		*95.0*	*98.0*	*93.0*
Extraction Internal Standard d5 N EtFOSA	%		*103*	*98.0*	*103*
Extraction Internal Standard d7 N MeFOSE	%		*91.0*	*100*	*92.0*
Extraction Internal Standard d9 N EtFOSE	%		*96.0*	*93.0*	*96.0*
Extraction Internal Standard d3 N MeFOSAA	%		*165 [4]*	*176 [4]*	*175 [4]*
Extraction Internal Standard d5 N EtFOSAA	%		*## [4]*	*## [4]*	*## [4]*

Subcontracted Radiological - Certificate: ME365152 - Analysed By SGS Environment Services (VIC) (Water)

Envirolab ID	Units	PQL	PFG1479-03	PFG1479-04
Your Reference			MW103	MW104
Date Sampled			23/07/2024	23/07/2024
Gross alpha	Bq/L		<0.041 [6]	0.077 [6]
Gross beta	Bq/L		<0.07 [6]	<0.078 [6]

Result Comments

Identifier	Description
[3]	Surrogate recovery was low due to sample(s) emulsifying during liquid liquid extraction.
[4]	For PFAS Extracted Internal Standards denoted with ## or being outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).
[6]	The sub-contracting laboratory did not provide analysis and/or preparation and/or sample receipt dates. The date(s) the sample(s) was/were received at the sub-contracting laboratory has/have been used to assess holding time(s).

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - ION	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-006	Alkalinity - determined titrimetrically based on APHA latest edition 2320-B. Solids reported from a 1:5 water extract unless otherwise specified. Total Carbon Dioxide - determined by calculation in accordance with APHA latest edition,4500-CO2 D.
INORG-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% i.e. total anions = total cations +/-15%.
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-081	Anions determined by Ion Chromatography. Waters samples are filtered on receipt prior to analysis. Solids are analysed from a water extract. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.Salt forms and/or anion/cation forms (e.g. FeO, PbO, ZnO, BO3) are determined stoichiometrically from the base metal concentration.
ORG-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
ORG-020_SILICA_GEL	Soil/solid/biota samples are extracted with solvent and waters by LLE and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40). Analysis for TRHs conducted after Silica Gel clean-up.
ORG-022_PAH	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and solids using DCM/Acetone/Methanol. For PAHs:- Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, for Total +ve calculations, the PQL is reflective of the lowest individual PQL and therefore, for example, "Total +ve PAHs" is simply a sum of the positive individual PAHs.
ORG-023	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Soils are extracted with Methanol, diluted and analysed by purge and trap GC-MS.
ORG-023_F1_TOT	Determination of volatile organic compounds (VOCs) by P&T-GC-MS. Water samples are analysed directly by purge and trap GC-MS. Solids are extracted with Methanol, diluted and analysed by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

Method Summary

Method ID	Methodology Summary
ORG-029	Soil/solid and sorbent samples are extracted with basified Methanol. Waters and soil/sorbent extracts are directly injected and/or concentrated/extracted using SPE. TCLP/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MSMS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.
SUB-027_GAB1	Subcontracted to SGS - Accreditation number 2562

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

Miscellaneous Information

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

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

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PFG1479

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	224972.01 - Rockingham
Date Issued	09/08/2024

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	No	Surrogates / Extracted ISTD Outliers Exist - See detailed list below
QC Frequency	No	QC Frequency Outliers Exist - See detailed list below

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PFG1479

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Fumigants | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
VOC - MAH | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Halogenated Aliphatics | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Halogenated Aromatics | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Other VOC | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
VOC - Surrogates | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
vTRH&MBTEXN | Water	9	23/07/2024	24/07/2024	25/07/2024	Yes
	1-7	23/07/2024	25/07/2024	25/07/2024	Yes
	8	23/07/2024	25/07/2024	26/07/2024	Yes
BTEX TS | Water	10	23/07/2024	29/07/2024	29/07/2024	Yes
sTRH | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
sTRH Silica Gel Cleanup step | Water	6-7	23/07/2024	08/08/2024	08/08/2024	No
PAH | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Total Phosphorus | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Dissolved Metals (LL) | Water	1-6	23/07/2024	25/07/2024	25/07/2024	Yes
	7-8	23/07/2024	25/07/2024	26/07/2024	Yes
Dissolved Metals (LL)-Hg | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Alkalinity Suite | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Chloride | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Dissolved Cations | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
Ion Balance | Water	1-8	23/07/2024	25/07/2024	25/07/2024	Yes
	1-8	23/07/2024	25/07/2024	31/07/2024	Yes
Sulfate | Water	1-8	23/07/2024	24/07/2024	25/07/2024	Yes
Nitrogen - Ammonia | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Nitrate | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Nitrite | Water	1-8	23/07/2024	26/07/2024	26/07/2024	No
Nitrogen - NOx | Water	1-8	23/07/2024	26/07/2024	26/07/2024	Yes
Nitrogen - Total N | Water	1-8	23/07/2024	25/07/2024	26/07/2024	Yes
Phosphate as P | Water	1-8	23/07/2024	26/07/2024	26/07/2024	No
TKN as N calc | Water	1-8	23/07/2024	25/07/2024	31/07/2024	Yes
PFAS EXT LL -ISTD | Water	1-8	23/07/2024	30/07/2024	30/07/2024	Yes
PFAS-Extended (LL) | Water	1-8	23/07/2024	30/07/2024	30/07/2024	Yes
Gross alpha & beta | Water	3-4	23/07/2024	24/07/2024	31/07/2024	Yes

Data Quality Assessment Summary PFG1479

Outliers: Matrix Spike

ORG-020|Semi-volatile TRH (Water)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
BFG4173-MS1#	TRH >C16-C34 (F3)	60 - 140	##[1]
BFG4173-MS1#	TRH >C34-C40 (F4)	60 - 140	##[1]
BFG4173-MS1#	TRH C15-C28	60 - 140	##[1]
BFG4173-MS1#	TRH C29-C36	60 - 140	##[1]

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Water)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
BFG4173-MS2#	Benzo(a)pyrene	60 - 140	##[2]

Data Quality Assessment Summary PFG1479

Outliers: Surrogate / Extracted Internal Standards

ORG-020|Semi-volatile TRH (Matrix)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
PFG1479-07	o-Terphenyl	60 - 140	47.8% [3]

ORG-020_SILICA_GEL|Semi-volatile TRH with Silica Gel Cleanup (Matrix)| Batch BFH1402

Sample ID	Analyte	% Limits	% Recovery
PFG1479-07	o-Terphenyl	60 - 140	44.1% [3]

ORG-022_PAH|Polycyclic Aromatic Hydrocarbons (Matrix)| Batch BFG4173

Sample ID	Analyte	% Limits	% Recovery
PFG1479-07	p-Terphenyl-D14	60 - 140	36.8% [3]

ORG-029|PFAS Extended List (Low Level) (Matrix)| Batch BFG5026

Sample ID	Analyte	% Limits	% Recovery
PFG1479-01	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	152 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	166 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	47.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	182 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	187 [4]
PFG1479-02	Extraction Internal Standard 13C2 PFUnDA	50 - 150	181 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	41.0 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	161 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	196 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	189 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
PFG1479-03	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	185 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	170 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C4 PFHpA	50 - 150	151 [4]
PFG1479-04	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	164 [4]

Data Quality Assessment Summary PFG1479

ORG-029|PFAS Extended List (Low Level) (Matrix)| Batch BFG5026

Sample ID	Analyte	% Limits	% Recovery
PFG1479-04	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	182 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	46.0 [4]
PFG1479-05	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	166 [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	174 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	40.0 [4]
	Extraction Internal Standard 13C4 PFHpA	50 - 150	157 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	## [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	## [4]
PFG1479-06	Extraction Internal Standard 13C2 PFTeDA	50 - 150	182 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	154 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	184 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	165 [4]
	Extraction Internal Standard 13C2 PFDA	50 - 150	154 [4]
PFG1479-07	Extraction Internal Standard 13C4 PFBA	50 - 150	45.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	176 [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	162 [4]
	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
PFG1479-08	Extraction Internal Standard d5 N EtFOSAA	50 - 150	## [4]
	Extraction Internal Standard 13C2 4:2FTS	50 - 150	190 [4]
	Extraction Internal Standard 13C2 6:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 8:2FTS	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFTeDA	50 - 150	## [4]
	Extraction Internal Standard 13C2 PFUnDA	50 - 150	177 [4]
	Extraction Internal Standard 13C4 PFBA	50 - 150	47.0 [4]
	Extraction Internal Standard d3 N MeFOSAA	50 - 150	175 [4]

Data Quality Assessment Summary PFG1479

Outliers: QC Frequency

ORG-020_SILICA_GEL|Semi-volatile TRH with Silica Gel Cleanup (Water)| Batch BFH1402

Analysis	QC Type	Expected	Reported
sTRH Silica Gel Cleanup step	Duplicate	1	0

ORG-023|Volatile Organic Compounds - Fumigants (Water)| Batch BFG4231

Analysis	QC Type	Expected	Reported
Fumigants	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aliphatics	Duplicate	1	0
	Matrix Spike	1	0
Halogenated Aromatics	Duplicate	1	0
	Matrix Spike	1	0
Other VOC	Duplicate	1	0
	Matrix Spike	1	0

ORG-023_F1_TOT|Volatile Organic Compounds - MAH (Water)| Batch BFG4231

Analysis	QC Type	Expected	Reported
VOC - MAH	Duplicate	1	0
	Matrix Spike	1	0
vTRH&MBTEXN	Duplicate	2	0
	Matrix Spike	1	0

ORG-023_F1_TOT|Volatile TRH and BTEX (Water)| Batch BFG5292

Analysis	QC Type	Expected	Reported
	Duplicate	1	0
	Matrix Spike	1	0

Quality Control PFG1479

ORG-023|Volatile Organic Compounds - Fumigants (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
2,2-Dichloropropane	µg/L	1.0	<1.0	[NA]
1,2-Dichloropropane	µg/L	1.0	<1.0	114
cis-1,3-Dichloropropene	µg/L	1.0	<1.0	114
trans-1,3-Dichloropropene	µg/L	1.0	<1.0	118
1,2-Dibromoethane	µg/L	1.0	<1.0	107

ORG-023_F1_TOT|Volatile Organic Compounds - MAH (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Benzene	µg/L	1.0	<1.0	119
Toluene	µg/L	1.0	<1.0	117
Ethylbenzene	µg/L	1.0	<1.0	119
meta+para Xylene	µg/L	2.0	<2.0	111
Styrene	µg/L	1.0	<1.0	[NA]
ortho-Xylene	µg/L	1.0	<1.0	116
Isopropylbenzene	µg/L	1.0	<1.0	[NA]
n-Propylbenzene	µg/L	1.0	<1.0	[NA]
1,3,5-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
tert-Butylbenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trimethylbenzene	µg/L	1.0	<1.0	[NA]
sec-Butylbenzene	µg/L	1.0	<1.0	[NA]
4-Isopropyltoluene	µg/L	1.0	<1.0	[NA]
n-Butyl benzene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Dichlorodifluoromethane (Freon-12)	µg/L	10	<10	[NA]
Chloromethane	µg/L	10	<10	[NA]
Vinyl chloride	µg/L	10	<10	[NA]
Bromomethane	µg/L	10	<10	[NA]
Chloroethane	µg/L	10	<10	[NA]
Trichlorofluoromethane (Freon-11)	µg/L	10	<10	[NA]
1,1-Dichloroethene	µg/L	1.0	<1.0	[NA]
trans-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
1,1-Dichloroethane	µg/L	1.0	<1.0	120
cis-1,2-Dichloroethene	µg/L	1.0	<1.0	[NA]
Bromochloromethane	µg/L	1.0	<1.0	[NA]
Chloroform	µg/L	1.0	<1.0	120
1,1,1-Trichloroethane	µg/L	1.0	<1.0	117
1,1-Dichloropropene	µg/L	1.0	<1.0	[NA]
Carbon Tetrachloride	µg/L	1.0	<1.0	[NA]
1,2-Dichloroethane	µg/L	1.0	<1.0	117
Trichloroethene	µg/L	1.0	<1.0	118
Dibromomethane	µg/L	1.0	<1.0	[NA]
Bromodichloromethane	µg/L	1.0	<1.0	119
1,1,2-Trichloroethane	µg/L	1.0	<1.0	[NA]
1,3-Dichloropropane	µg/L	1.0	<1.0	[NA]
Tetrachloroethene	µg/L	1.0	<1.0	120
Dibromochloromethane	µg/L	1.0	<1.0	112
1,1,1,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
Bromoform	µg/L	1.0	<1.0	116
1,1,2,2-Tetrachloroethane	µg/L	1.0	<1.0	[NA]
1,2,3-Trichloropropane	µg/L	1.0	<1.0	[NA]

Quality Control PFG1479

ORG-023|Volatile Organic Compounds - Halogenated Aliphatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
1,2-Dibromo-3-chloropropane	µg/L	1.0	<1.0	[NA]
Hexachlorobutadiene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Halogenated Aromatics (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Chlorobenzene	µg/L	1.0	<1.0	[NA]
Bromobenzene	µg/L	1.0	<1.0	[NA]
2-Chlorotoluene	µg/L	1.0	<1.0	[NA]
4-Chlorotoluene	µg/L	1.0	<1.0	[NA]
1,3-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,4-Dichlorobenzene	µg/L	1.0	<1.0	115
1,2-Dichlorobenzene	µg/L	1.0	<1.0	[NA]
1,2,4-Trichlorobenzene	µg/L	1.0	<1.0	104
1,2,3-Trichlorobenzene	µg/L	1.0	<1.0	[NA]

ORG-023|Volatile Organic Compounds - Other VOCs (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Cyclohexane	µg/L	1.0	<1.0	119

ORG-023|Volatile Organic Compounds - Surrogates (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
Surrogate Dibromofluoromethane	*%*		*99.3*	*100*
Surrogate Toluene-D8	*%*		*99.1*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*99.8*	*101*

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BFG4231

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	119
TRH C6-C10	µg/L	10	<10	112
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	110
Toluene	µg/L	1.0	<1.0	112
Ethylbenzene	µg/L	1.0	<1.0	102
meta+para Xylene	µg/L	2.0	<2.0	103
ortho-Xylene	µg/L	1.0	<1.0	103
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	*%*		*103*	*105*
Surrogate Toluene-D8	*%*		*101*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*95.8*	*93.2*

Quality Control PFG1479

ORG-023_F1_TOT|Volatile TRH and BTEX (Water) | Batch BFG5292

Analyte	Units	PQL	Blank	LCS %
TRH C6-C9	µg/L	10	<10	118
TRH C6-C10	µg/L	10	<10	113
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	[NA]
Methyl tert butyl ether (MTBE)	µg/L	1.0	<1.0	[NA]
Benzene	µg/L	1.0	<1.0	110
Toluene	µg/L	1.0	<1.0	112
Ethylbenzene	µg/L	1.0	<1.0	102
meta+para Xylene	µg/L	2.0	<2.0	103
ortho-Xylene	µg/L	1.0	<1.0	103
Total Xylene	µg/L	3.0	<3.0	[NA]
Naphthalene (value used in F2 calc)	µg/L	1.0	<1.0	[NA]
Surrogate Dibromofluoromethane	*%*		*103*	*105*
Surrogate Toluene-D8	*%*		*101*	*101*
Surrogate 4-Bromofluorobenzene	*%*		*95.8*	*93.2*

ORG-020|Semi-volatile TRH (Water) | Batch BFG4173

Analyte	Units	PQL	Blank	DUP1 BFG4173-DUP1# Samp | QC | RPD %	DUP2 BFG4173-DUP2# Samp | QC | RPD %	LCS %	Spike % BFG4173-MS1#
TRH C10-C14	µg/L	50	<50	74.1 | 69.8 | [NA]	67.4 | 60.5 | [NA]	104	92.9
TRH C15-C28	µg/L	100	<100	1670 | 1760 | 5.21	<100 | <100 | [NA]	117	##[1]
TRH C29-C36	µg/L	100	<100	633 | 796 | 22.8	<100 | <100 | [NA]	119	##[1]
TRH >C10-C16	µg/L	50	<50	105 | 99.3 | [NA]	56.8 | 50.6 | [NA]	111	102
TRH >C16-C34 (F3)	µg/L	100	<100	2160 | 2400 | 10.3	<100 | <100 | [NA]	120	##[1]
TRH >C34-C40 (F4)	µg/L	100	<100	230 | 318 | [NA]	<100 | <100 | [NA]	118	##[1]
Surrogate o-Terphenyl	*%*		*103*	*79.0 | 77.8*	*78.7 | 79.7*	*103*	*100*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-020_SILICA_GEL|Semi-volatile TRH with Silica Gel Cleanup (Water) | Batch BFH1402

Analyte	Units	PQL	Blank	LCS %
TRH (Silica) C10-C14	µg/L	50	<50	104
TRH (Silica) C15-C28	µg/L	100	<100	114
TRH (Silica) C29-C36	µg/L	100	<100	98.5
TRH (Silica) >C10-C16	µg/L	50	<50	106
TRH (Silica) >C16-C34	µg/L	100	<100	113
TRH (Silica) >C34-C40	µg/L	100	<100	113
Total TRH (Silica) C10-C36	µg/L	250		111
Total TRH (Silica) >C10-C40	µg/L	250		111
Surrogate o-Terphenyl	*%*		*92.1*	*107*

Quality Control PFG1479

ORG-022_PAH | Polycyclic Aromatic Hydrocarbons (Water) | Batch BFG4173

Analyte	Units	PQL	Blank	DUP1 BFG4173-DUP1# Samp | QC | RPD %	DUP2 BFG4173-DUP2# Samp | QC | RPD %	LCS %	Spike % BFG4173-MS2#
Naphthalene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	81.8	83.1
Acenaphthylene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Acenaphthene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	83.4	72.0
Fluorene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.3	85.2
Phenanthrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	90.8	90.1
Anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fluoranthene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	93.8	92.1
Pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	91.6	90.7
Benzo(a)anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chrysene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	87.0	78.1
Benzo(b,j,k)fluoranthene	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Benzo(a)pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	83.3	##[2]
Indeno(1,2,3-c,d)pyrene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Dibenzo(a,h)anthracene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Benzo(g,h,i)perylene	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*96.7*	*83.7 | 79.6*	*70.6 | 71.9*	*76.2*	*82.6*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020 | Acid Extractable Metals (Water) | Batch BFG4119

Analyte	Units	PQL	Blank	DUP1 BFG4119-DUP1# Samp | QC | RPD %	DUP2 PFG1479-02 Samp | QC | RPD %	LCS %	Spike % BFG4119-MS1#
Phosphorus	mg/L	0.050	<0.050	0.200 | 0.193 | [NA]	0.0621 | <0.050 | [NA] [5]	105	99.3

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022 | Dissolved Low Level Metals (Water) | Batch BFG4174

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4174-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Aluminium	µg/L	10	<10	<10 | <10 | [NA]	23.7 | 28.2 | [NA]	98.6	103
Arsenic	µg/L	1.0	<1.0	43.3 | 43.9 | 1.55	<1.0 | <1.0 | [NA]	102	111
Barium	µg/L	1.0	<1.0	14.3 | 14.1 | 0.930	1.70 | 2.15 | [NA] [5]	96.8	94.9
Beryllium	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	86.3	88.8
Boron	µg/L	20	<20	80.2 | 83.8 | [NA]	<20 | <20 | [NA]	89.0	90.7
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	103
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	100	101
Cobalt	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	103
Copper	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	22.8 | 26.4 | 14.5	99.5	97.1
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	96.9	93.2
Manganese	µg/L	1.0	<1.0	24.8 | 25.0 | 0.929	1.04 | 1.20 | [NA]	98.3	85.4
Nickel	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.1	96.4
Selenium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	102	121
Vanadium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	98.5	103
Zinc	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	16.8 | 19.3 | 13.8	97.7	76.7

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021 | Dissolved Low Level Metals (Water) | Batch BFG4315

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4315-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	112	105

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

INORG-081 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4115

Analyte	Units	PQL	Blank	DUP1 BFG4115-DUP1# Samp | QC | RPD %	DUP2 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % BFG4115-MS1#
Chloride	mg/L	1.0	<1.0	3.79 | 3.78 | [NA]	200 | 202 | 0.598	98.0	98.2
Sulfate	mg/L	1.0	<1.0	1.08 | 1.05 | [NA]	155 | 156 | 0.527	94.4	101

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-006 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4166

Analyte	Units	PQL	Blank	DUP1 BFG4166-DUP1# Samp | QC | RPD %	DUP2 BFG4166-DUP2# Samp | QC | RPD %	LCS %
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	261 | 256 | 1.79	169 | 176 | 4.03	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	261 | 256 | 1.80	169 | 176 | 4.03	97.6

Analyte	Units	PQL	Blank	LCS %
Total Alkalinity as CaCO3	mg/L as CaCO3	5		109

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-006 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4167

Analyte	Units	PQL	Blank	DUP1 BFG4167-DUP1# Samp | QC | RPD %	LCS %
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	150 | 151 | 0.412	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	150 | 151 | 0.416	93.4

Analyte	Units	PQL	Blank	LCS %
Total Alkalinity as CaCO3	mg/L as CaCO3	5		112

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020 | Inorganics - Ionic Balance and Indexes (Water) | Batch BFG4170

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4170-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Calcium	mg/L	0.50	<0.50	123 | 123 | 0.252	<0.50 | <0.50 | [NA]	100	94.7
Magnesium	mg/L	0.50	<0.50	38.5 | 38.2 | 0.910	<0.50 | <0.50 | [NA]	100	106
Potassium	mg/L	0.50	<0.50	2.49 | 2.45 | [NA]	<0.50 | <0.50 | [NA]	99.8	99.7
Sodium	mg/L	0.50	<0.50	107 | 106 | 1.05	6.99 | 7.01 | 0.251	97.0	86.7
Hardness (calc) equivalent CaCO3	mg/L	3.0	<3.0	467 | 464 | 0.475	<3.0 | <3.0 | [NA]	[NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127 | Inorganics - Nutrients (Water) | Batch BFG4277

Analyte	Units	PQL	Blank	DUP1 BFG4277-DUP1# Samp | QC | RPD %	DUP2 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % BFG4277-MS1#
Total Nitrogen	mg/L	0.10	<0.10	1.58 | 1.49 | [NA]	0.702 | 0.694 | 1.22	110	115

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

INORG-057|Inorganics - Nutrients (Water) | Batch BFG4492

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	DUP2 BFG4492-DUP2# Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Ammonia as N	mg/L	0.0050	<0.0050	0.392 | 0.395 | 0.737	0.0452 | 0.0467 | 3.14	96.0	82.9
Nitrate as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	0.0100 | 0.0103 | [NA]	108	98.8
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	0.0129 | 0.0127 | [NA]	<0.0050 | <0.0050 | [NA]	[NA]	111
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	0.0139 | 0.0147 | [NA]	0.0103 | 0.0107 | [NA]	108	98.7
Phosphate as P	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	103	108

Analyte	Units	PQL	Blank	LCS %
Nitrite as N	mg/L	0.005		86.7

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PFG1479

ORG-029|PFAS Extended List (Low Level) (Water) | Batch BFG5026

Analyte	Units	PQL	Blank	DUP1 PFG1479-01 Samp | QC | RPD %	LCS %	Spike % PFG1479-02
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	104	122
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	103	109
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	91.3	84.5
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	110	119
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	95.0	101
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	96.0	100
Perfluorobutanoic acid (PFBA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	99.7	113
Perfluoropentanoic acid (PFPeA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	105	115
Perfluorohexanoic acid (PFHxA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	87.3	85.8
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	91.0	88.1
Perfluorooctanoic acid (PFOA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	104	106
Perfluorononanoic acid (PFNA)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	110	120
Perfluorodecanoic acid (PFDA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	86.1	82.3
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	80.4	87.0
Perfluorododecanoic acid (PFDoDA)	µg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	106	100
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.010	<0.010	<0.010 | <0.010 | [NA]	125	122
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	96.6	79.5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	92.8	89.5
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.0010	<0.0010	<0.0010 | <0.0010 | [NA]	88.6	98.3
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	92.3	103
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	118	135
Perfluorooctane sulfonamide (FOSA)	µg/L	0.010	<0.010	<0.010 | <0.010 | [NA]	84.7	84.3
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	104	99.4
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	96.7	90.4
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	104	104
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	104	108
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	97.9	124
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0020	<0.0020	<0.0020 | <0.0020 | [NA]	99.3	100
Surrogate 13C8 PFOS	*%*		*101*	*104 | 103*	*99.6*	*101*
Surrogate 13C2 PFOA	*%*		*102*	*104 | 99.2*	*105*	*96.5*
Extraction Internal Standard 13C3 PFBS	*%*		*63.0*	*67.0 | 71.0 | 5.80*	*[NA]*	*[NA]*
Extraction Internal Standard 18O2 PFHxS	*%*		*87.0*	*88.0 | 90.0 | 2.25*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOS	*%*		*80.0*	*82.0 | 83.0 | 1.21*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFBA	*%*		*107*	*47.0 | 51.0 | 8.16*	*[NA]*	*[NA]*
Extraction Internal Standard 13C3 PFPeA	*%*		*92.0*	*87.0 | 91.0 | 4.49*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFHxA	*%*		*118*	*121 | 121 | 0.00*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFHpA	*%*		*117*	*140 | 135 | 3.64*	*[NA]*	*[NA]*
Extraction Internal Standard 13C4 PFOA	*%*		*90.0*	*92.0 | 93.0 | 1.08*	*[NA]*	*[NA]*
Extraction Internal Standard 13C5 PFNA	*%*		*103*	*113 | 112 | 0.889*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFDA	*%*		*142*	*152 | 149 | 1.99*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFUnDA	*%*		*149*	*166 | 160 | 3.68 [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard 13C2 PFDoDA	*%*		*116*	*127 | 117 | 8.20*	*[NA]*	*[NA]*
Extraction Internal Standard 13C2 PFTeDA	*%*		*127*	*## | ## | [NA] [4]*	*[NA]*	*##[4]*
Extraction Internal Standard 13C2 4:2FTS	*%*		*157 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard 13C2 6:2FTS	*%*		*163 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*##[4]*
Extraction Internal Standard 13C2 8:2FTS	*%*		*199 [4]*	*## | ## | [NA] [4]*	*## [4]*	*##[4]*
Extraction Internal Standard 13C8 FOSA	*%*		*99.0*	*114 | 115 | 0.873*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSA	*%*		*99.0*	*98.0 | 96.0 | 2.06*	*[NA]*	*[NA]*
Extraction Internal Standard d5 N EtFOSA	*%*		*106*	*105 | 106 | 0.948*	*[NA]*	*[NA]*
Extraction Internal Standard d7 N MeFOSE	*%*		*96.0*	*91.0 | 95.0 | 4.30*	*[NA]*	*[NA]*
Extraction Internal Standard d9 N EtFOSE	*%*		*100*	*97.0 | 103 | 6.00*	*[NA]*	*[NA]*
Extraction Internal Standard d3 N MeFOSAA	*%*		*158 [4]*	*## | ## | [NA] [4]*	*[NA] [4]*	*[NA]*
Extraction Internal Standard d5 N EtFOSAA	*%*		*## [4]*	*## | ## | [NA] [4]*	*## [4]*	*##[4]*

Quality Control PFG1479

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[2]	Spike recovery is outside routine acceptance criteria (60-140%), this may be due to suspected non-homogeneity and/or matrix interference effects. However, an acceptable recovery was achieved for the LCS.
[4]	For PFAS Extracted Internal Standards denoted with ## or being outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).
[5]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.

Maike Oscenda

Subject: FW: PFG1479 (224972.01) - Rockingham - Additional Analysis
Attachments: PFG1479_COC_01.PDF

From: Rob Shapland <Rob.Shapland@douglaspartners.com.au>
Sent: Friday, August 2, 2024 7:41 AM
To: Maike Oscenda <MOscenda@mpl.com.au>
Cc: Meredith Conroy <MConroy@mpl.com.au>; Sample Receipt WA <SampleReceiptWA@mpl.com.au>
Subject: PFG1479 (224972.01) - Rockingham - Additional Analysis

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Maike,

Can you please arrange a silica gel cleanup on BH1 and BH7 ?

Can you please also forward chromatograms for BH1 and BH7 ?

Kind regards,

Rob Shapland | Environmental Chemist / Senior Associate

08 9204 3511 +61 412 448 485 Rob.Shapland@douglaspartners.com.au

www.douglaspartners.com.au 36 O'Malley Street, Osborne Park, WA 6017 | Whadjuk Country

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1/2 1/99

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 224972.01	**Suburb:** Rockingha		**To:** MPL
Project Manager: RS	**Order Number:** PE251619	**Sampler:** VH	Hayden Crt, Myaree
Emai rob.shapland@douglaspartners.com.au			**Attn:** Sample Receipt
Turnaround time: ☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			93172505 Lab email
Prior Storage: ☑ Fridge ☐ Freezer ☐ Esky ☐ Shelf	**Do samples contain 'potential' HBM?** ☑ No	☐ Yes (YES, handle, transport, store in accordance with FPM HAZID)	

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Dissolved Metals (16)	TRH/BTEX	PAH	VOC	Nutrient Suite	PFAS (long suite)	Gross Alpha Beta	Anions and Cations	v-TRH			Notes/ Preservation/ Additional Requirements
	MW101			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	MW102			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	MW103			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	MW104			23/7/2024	W	G/P	X	X	X	X	X	X	X	X				
	MW105			23/7/2024	W	G/P	X	X	X	X	X	X	X	X				
	BH1			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	BH7			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	Rep1-1			23/7/2024	W	G/P	X	X	X	X	X	X		X				
	Rep1-2			23/7/2024	W	G/P	X	X	X	X	X	X		X				Send to ARL/Eurofins
	Trip Blank				W	G									X			
	Trip Spike				W	G									X			

Metals to analyse: Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Mn, Hg, Ni, Pb, Se, V, Zn

Number of samples in container:

Transported to laboratory by: Courier

Send results to: Douglas Partners Pty Ltd

Addr 36 O'Malley Street, Osborne Park **Phone:** 92043511

Relinquished by: VH **Date:** 7/23/2024 **Signed:**

LAB RECEIPT

Lab Ref. No:

Received by: MC

Date & Time 23/7/24 18:02

Signed:

9.5°C

1400 24/7/2024

www.eurofins.com.au EnviroSales@eurofins.com

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Christchurch 7675
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IANZ# 1290

Tauranga
1277 Cameron Road,
Gate Pa,
Tauranga 3112
+64 9 525 0568
IANZ# 1402

Sample Receipt Advice

Company name: Douglas Partners Pty Ltd
Contact name: - Invoices Only
Project name: Not provided
Project ID: 224972.01
Turnaround time: 5 Day
Date/Time received Jul 24, 2024 2:00 PM
Eurofins reference 1121199

Sample Information

✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

✓ All samples have been received as described on the above COC.

✓ COC has been completed correctly.

✓ Attempt to chill was evident.

✓ Appropriately preserved sample containers have been used.

✓ All samples were received in good condition.

✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

✓ Appropriate sample containers have been used.

✓ Sample containers for volatile analysis received with zero headspace.

X Split sample sent to requested external lab.

X Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

Contact

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

Celeste Chinnery on phone : or by email: celestechinnery@eurofins.com

Results will be delivered electronically via email to - Invoices Only - accounts.payable.invoices@douglaspartners.com.au.

Note: A copy of these results will also be delivered to the general Douglas Partners Pty Ltd email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Company Name: Douglas Partners Pty Ltd
Address: 36 O'Malley Street
Osborne Park
WA 6017

Project Name:
Project ID: 224972.01

Order No.: PE251619
Report #: 1121199
Phone: 08 9204 3511
Fax:

Received: Jul 24, 2024 2:00 PM
Due: To Be Advised
Priority: 5 Day
Contact Name: - Invoices Only

Eurofins Analytical Services Manager : Celeste Chinnery

Sample Detail						Eurofins Suite B4	Metals (As/Cd/Cr/Cu/Ni/Pb/Zn/Hg/Sb/Ba/Be/Co/Fe/	VOCs in Water by GCMS	Major Ions in Water	Eurofins Suite B19E	Per- and Polyfluoroalkyl Substances (PFASs)
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	Rep1-2	Jul 23, 2024		Water	L24-Jl0062505	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Douglas Partners Pty Ltd
36 O'Malley Street
Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370

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

Attention: **Rob Shapland**

Report **1121199-W**
Project name
Project ID 224972.01
Received Date Jul 24, 2024

Client Sample ID			**Rep1-2**
Sample Matrix			**Water**
Eurofins Sample No.			**L24-JI0062505**
Date Sampled			**Jul 23, 2024**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons			
TRH C6-C9	0.02	mg/L	< 0.02
TRH C10-C14	0.02	mg/L	< 0.02
TRH C15-C28	0.04	mg/L	< 0.04
TRH C29-C36	0.04	mg/L	< 0.04
TRH C10-C36 (Total)	0.04	mg/L	< 0.04
TRH C6-C10*	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
TRH >C10-C16	0.02	mg/L	< 0.02
TRH >C10-C16 less Naphthalene (F2)*[N01]	0.02	mg/L	< 0.02
TRH >C16-C34	0.05	mg/L	< 0.05
TRH >C34-C40*	0.05	mg/L	< 0.05
TRH >C10-C40 (total)*	0.05	mg/L	< 0.05
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
BTEX			
4-Bromofluorobenzene (surr.)	1	%	80
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.001	mg/L	< 0.001
VOCs in Water by GCMS			
Benzene	0.5	ug/L	< 0.5
Carbon tetrachloride	0.5	ug/L	< 0.5
Chlorobenzene	0.5	ug/L	< 0.5
DCM	5	ug/L	< 5
Ethylbenzene	0.5	ug/L	< 0.5
Hexachlorobutadiene	0.5	ug/L	< 0.5
Methyl tert Butyl Ether	0.5	ug/L	< 0.5
Styrene	0.5	ug/L	< 0.5
Perchloroethene (PCE)	0.5	ug/L	< 0.5
Toluene	0.5	ug/L	< 0.5
Trichloroethylene(TCE)	0.5	ug/L	< 0.5

Client Sample ID			Rep1-2
Sample Matrix			Water
Eurofins Sample No.			L24-JI0062505
Date Sampled			Jul 23, 2024
Test/Reference	LOR	Unit	
VOCs in Water by GCMS			
Vinyl Chloride	0.2	ug/L	< 0.2
Xylenes (Total)	3	ug/L	< 3
1.1-Dichloroethane	0.5	ug/L	< 0.5
1.2-Dichloroethane	0.5	ug/L	< 0.5
1.1-Dichloroethene	0.5	ug/L	< 0.5
cis-1.2-Dichloroethene	0.5	ug/L	< 0.5
trans-1.2-Dichloroethene	2	ug/L	< 2
1.1.1-Trichloroethane	0.5	ug/L	< 0.5
1.1.1.2-Tetrachloroethane	0.5	ug/L	< 0.5
1.1.2.2-Tetrachloroethane	0.5	ug/L	< 0.5
1.2-Dichlorobenzene	0.5	ug/L	< 0.5
1.3-Dichlorobenzene	0.5	ug/L	< 0.5
1.4-Dichlorobenzene	0.5	ug/L	< 0.5
1.2.3-Trichlorobenzene	0.5	ug/L	< 0.5
1.2.4-Trichlorobenzene	0.5	ug/L	< 0.5
1.3.5-Trichlorobenzene	0.5	ug/L	< 0.5
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	69
p-Terphenyl-d14 (surr.)	1	%	70
Ammonia-N	0.02	mg/L	0.40
Chloride	5	mg/L	230
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01
Nitrate-N	0.01	mg/L	< 0.01
Nitrite-N	0.01	mg/L	0.02
NOx-N	0.01	mg/L	0.02
Sulfate	1	mg/L	180
Total Kjeldahl Nitrogen	0.2	mg/L	0.4
Total Nitrogen	0.2	mg/L	0.4
Total Phosphorus	0.01	mg/L	0.04

Client Sample ID			Rep1-2
Sample Matrix			Water
Eurofins Sample No.			L24-JI0062505
Date Sampled			Jul 23, 2024
Test/Reference	LOR	Unit	
Alkalinity (speciated)			
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	310
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5
Total Alkalinity (as CaCO3)	5	mg/L	310
Alkali Metals			
Potassium	0.5	mg/L	2.3
Sodium	0.5	mg/L	110
Heavy Metals			
Antimony	0.001	mg/L	< 0.001
Arsenic	0.001	mg/L	0.040
Barium	0.01	mg/L	0.02
Beryllium	0.001	mg/L	< 0.001
Cadmium	0.0001	mg/L	< 0.0001
Chromium	0.001	mg/L	< 0.001
Cobalt	0.001	mg/L	< 0.001
Copper	0.001	mg/L	< 0.001
Iron	0.01	mg/L	1.3
Lead	0.001	mg/L	< 0.001
Manganese	0.005	mg/L	0.028
Mercury	0.0001	mg/L	< 0.0001
Nickel	0.001	mg/L	< 0.001
Tin	0.001	mg/L	< 0.001
Vanadium	0.005	mg/L	< 0.005
Zinc	0.005	mg/L	< 0.005
Perfluoroalkyl carboxylic acids (PFCAs)			
Perfluorobutanoic acid (PFBA)[N11]	0.05	ug/L	< 0.05
Perfluoropentanoic acid (PFPeA)[N11]	0.01	ug/L	< 0.01
Perfluorohexanoic acid (PFHxA)[N11]	0.01	ug/L	< 0.01
Perfluoroheptanoic acid (PFHpA)[N11]	0.05	ug/L	< 0.05
Perfluorooctanoic acid (PFOA)[N11]	0.01	ug/L	< 0.01
Perfluorononanoic acid (PFNA)[N11]	0.01	ug/L	< 0.01
Perfluorodecanoic acid (PFDA)[N11]	0.01	ug/L	< 0.01
Perfluoroundecanoic acid (PFUnDA)[N11]	0.01	ug/L	< 0.01
Perfluorododecanoic acid (PFDoDA)[N11]	0.01	ug/L	< 0.01
Perfluorotridecanoic acid (PFTrDA)[N15]	0.01	ug/L	< 0.01
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.01	ug/L	< 0.01
13C4-PFBA (surr.)	1	%	87
13C5-PFPeA (surr.)	1	%	89
13C5-PFHxA (surr.)	1	%	79
13C4-PFHpA (surr.)	1	%	80
13C8-PFOA (surr.)	1	%	81
13C5-PFNA (surr.)	1	%	81
13C6-PFDA (surr.)	1	%	81
13C2-PFUnDA (surr.)	1	%	80
13C2-PFDoDA (surr.)	1	%	76
13C2-PFTeDA (surr.)	1	%	85

Client Sample ID			Rep1-2
Sample Matrix			**Water**
Eurofins Sample No.			**L24-JI0062505**
Date Sampled			**Jul 23, 2024**
Test/Reference	LOR	Unit	
Perfluoroalkyl sulfonamido substances			
Perfluorooctane sulfonamide (FOSA)[N11]	0.05	ug/L	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.05	ug/L	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.05	ug/L	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)[N11]	0.05	ug/L	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)[N11]	0.05	ug/L	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.05	ug/L	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.05	ug/L	< 0.05
13C8-FOSA (surr.)	1	%	78
D3-N-MeFOSA (surr.)	1	%	64
D5-N-EtFOSA (surr.)	1	%	63
D7-N-MeFOSE (surr.)	1	%	54
D9-N-EtFOSE (surr.)	1	%	45
D5-N-EtFOSAA (surr.)	1	%	84
D3-N-MeFOSAA (surr.)	1	%	79
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.01	ug/L	< 0.01
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)[N11]	0.05	ug/L	< 0.05
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.01	ug/L	< 0.01
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.01	ug/L	< 0.01
13C2-4:2 FTSA (surr.)	1	%	79
13C2-6:2 FTSA (surr.)	1	%	152
13C2-8:2 FTSA (surr.)	1	%	86
13C2-10:2 FTSA (surr.)	1	%	100
Perfluoroalkyl sulfonic acids (PFSAs)			
Perfluorobutanesulfonic acid (PFBS)[N11]	0.01	ug/L	< 0.01
Perfluorononanesulfonic acid (PFNS)*[N15]	0.01	ug/L	< 0.01
Perfluoropropanesulfonic acid (PFPrS)*[N15]	0.01	ug/L	< 0.01
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.01	ug/L	< 0.01
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.01	ug/L	< 0.01
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.01	ug/L	< 0.01
Perfluorooctanesulfonic acid (PFOS)[N11]	0.01	ug/L	< 0.01
Perfluorodecanesulfonic acid (PFDS)[N15]	0.01	ug/L	< 0.01
13C3-PFBS (surr.)	1	%	79
18O2-PFHxS (surr.)	1	%	77
13C8-PFOS (surr.)	1	%	78
PFASs Summations			
Sum (PFHxS + PFOS)*	0.01	ug/L	< 0.01
Sum of PFASs (n=30)*	0.1	ug/L	< 0.1
Sum of US EPA PFAS (PFOS + PFOA)*	0.01	ug/L	< 0.01
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.01	ug/L	< 0.01
Sum of WA DWER PFAS (n=10)*	0.05	ug/L	< 0.05

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Welshpool	Jul 24, 2024	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jul 24, 2024	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Welshpool	Jul 24, 2024	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Jul 24, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Welshpool	Jul 24, 2024	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
VOCs in Water by GCMS	Welshpool	Jul 24, 2024	14 Days
- Method: ARL132 - Purgeable Volatile Organic Compounds in Water by GCMS			
Metals (As/Cd/Cr/Cu/Ni/Pb/Zn/Hg/Sb/Ba/Be/Co/Fe/Mn/Sn/V)	Welshpool	Jul 24, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Ammonia-N	Welshpool	Jul 24, 2024	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Jul 24, 2024	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Jul 24, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Jul 24, 2024	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Jul 24, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Jul 24, 2024	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Jul 24, 2024	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Jul 24, 2024	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Chloride	Welshpool	Jul 24, 2024	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Jul 24, 2024	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Alkalinity (speciated)	Welshpool	Jul 24, 2024	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Alkali Metals	Welshpool	Jul 24, 2024	6 Months
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Perfluoroalkyl carboxylic acids (PFCAs)	Welshpool	Jul 24, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl sulfonamido substances	Welshpool	Jul 24, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Welshpool	Jul 24, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
Perfluoroalkyl sulfonic acids (PFSAs)	Welshpool	Jul 24, 2024	28 Days
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			
PFASs Summations	Welshpool	Jul 24, 2024	
- Method: Method ARL0510_ARL0511 PFAS in aqueous & solid samples by LC-MS/MS			

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Project Name:
Project ID: 224972.01

Order No.: PE251619
Report #: 1121199
Phone: 08 9204 3511
Fax:

Received: Jul 24, 2024 2:00 PM
Due: Jul 31, 2024
Priority: 5 Day
Contact Name: Rob Shapland

Eurofins Analytical Services Manager : Celeste Chinnery

Sample Detail						Eurofins Suite B4	Metals (As/Cd/Cr/Cu/Ni/Pb/Zn/Hg/Sb/Ba/Be/Co/Fe/	VOCs in Water by GCMS	Major Ions in Water	Eurofins Suite B19E	Per- and Polyfluoroalkyl Substances (PFASs)
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	Rep1-2	Jul 23, 2024		Water	L24-Jl0062505	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.02			0.02	Pass	
TRH C15-C28	mg/L	< 0.04			0.04	Pass	
TRH C29-C36	mg/L	< 0.04			0.04	Pass	
TRH C6-C10*	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34	mg/L	< 0.05			0.05	Pass	
TRH >C34-C40*	mg/L	< 0.05			0.05	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.001			0.001	Pass	
Method Blank							
VOCs in Water by GCMS							
Benzene	ug/L	< 0.5			0.5	Pass	
Carbon tetrachloride	ug/L	< 0.5			0.5	Pass	
Chlorobenzene	ug/L	< 0.5			0.5	Pass	
DCM	ug/L	< 5			5	Pass	
Ethylbenzene	ug/L	< 0.5			0.5	Pass	
Hexachlorobutadiene	ug/L	< 0.5			0.5	Pass	
Methyl tert Butyl Ether	ug/L	< 0.5			0.5	Pass	
Styrene	ug/L	< 0.5			0.5	Pass	
Perchloroethene (PCE)	ug/L	< 0.5			0.5	Pass	
Toluene	ug/L	< 0.5			0.5	Pass	
Trichloroethylene(TCE)	ug/L	< 0.5			0.5	Pass	
Vinyl Chloride	ug/L	< 0.2			0.2	Pass	
Xylenes (Total)	ug/L	< 3			3	Pass	
1.1-Dichloroethane	ug/L	< 0.5			0.5	Pass	
1.2-Dichloroethane	ug/L	< 0.5			0.5	Pass	
1.1-Dichloroethene	ug/L	< 0.5			0.5	Pass	
cis-1.2-Dichloroethene	ug/L	< 0.5			0.5	Pass	
trans-1.2-Dichloroethene	ug/L	< 2			2	Pass	
1.1.1-Trichloroethane	ug/L	< 0.5			0.5	Pass	
1.1.1.2-Tetrachloroethane	ug/L	< 0.5			0.5	Pass	
1.1.2.2-Tetrachloroethane	ug/L	< 0.5			0.5	Pass	
1.2-Dichlorobenzene	ug/L	< 0.5			0.5	Pass	
1.3-Dichlorobenzene	ug/L	< 0.5			0.5	Pass	
1.4-Dichlorobenzene	ug/L	< 0.5			0.5	Pass	
1.2.3-Trichlorobenzene	ug/L	< 0.5			0.5	Pass	
1.2.4-Trichlorobenzene	ug/L	< 0.5			0.5	Pass	
1.3.5-Trichlorobenzene	ug/L	< 0.5			0.5	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Hydroxide Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals							
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Antimony	mg/L	< 0.001			0.001	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.01			0.01	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0001			0.0001	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Tin	mg/L	< 0.001			0.001	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs)							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorobutanoic acid (PFBA)	ug/L	< 0.05			0.05	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.01			0.01	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.01			0.01	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.05			0.05	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.01			0.01	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.01			0.01	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.01			0.01	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.01			0.01	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.01			0.01	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.01			0.01	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.01			0.01	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.05			0.05	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.05			0.05	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.05			0.05	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	ug/L	< 0.05			0.05	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	ug/L	< 0.05			0.05	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.05			0.05	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.05			0.05	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.01			0.01	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	ug/L	< 0.05			0.05	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.01			0.01	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.01			0.01	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.01			0.01	Pass	
Perfluorononanesulfonic acid (PFNS)*	ug/L	< 0.01			0.01	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	ug/L	< 0.01			0.01	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.01			0.01	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.01			0.01	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.01			0.01	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.01			0.01	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.01			0.01	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C10-C14	%	103			70-130	Pass	
TRH >C10-C16	%	101			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	96			70-130	Pass	
Toluene	%	111			70-130	Pass	
Ethylbenzene	%	101			70-130	Pass	
m&p-Xylenes	%	95			70-130	Pass	
o-Xylene	%	111			70-130	Pass	
Xylenes - Total*	%	100			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	100			70-130	Pass	
LCS - % Recovery							
VOCs in Water by GCMS							
Benzene	%	83			60-120	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Carbon tetrachloride	%	87			60-120	Pass	
Chlorobenzene	%	90			60-120	Pass	
DCM	%	83			60-120	Pass	
Ethylbenzene	%	84			60-120	Pass	
Hexachlorobutadiene	%	83			60-120	Pass	
Methyl tert Butyl Ether	%	83			60-120	Pass	
Styrene	%	84			60-120	Pass	
Perchloroethene (PCE)	%	83			60-120	Pass	
Toluene	%	82			60-120	Pass	
Trichloroethylene(TCE)	%	85			60-120	Pass	
Vinyl Chloride	%	86			60-120	Pass	
Xylenes (Total)	%	91			60-120	Pass	
1.1-Dichloroethane	%	104			60-120	Pass	
1.2-Dichloroethane	%	87			60-120	Pass	
1.1-Dichloroethene	%	82			60-120	Pass	
cis-1.2-Dichloroethene	%	82			60-120	Pass	
trans-1.2-Dichloroethene	%	83			60-120	Pass	
1.1.1-Trichloroethane	%	82			60-120	Pass	
1.1.1.2-Tetrachloroethane	%	94			60-120	Pass	
1.1.2.2-Tetrachloroethane	%	81			60-120	Pass	
1.2-Dichlorobenzene	%	80			60-120	Pass	
1.3-Dichlorobenzene	%	80			60-120	Pass	
1.4-Dichlorobenzene	%	89			60-120	Pass	
1.2.3-Trichlorobenzene	%	87			60-120	Pass	
1.2.4-Trichlorobenzene	%	81			60-120	Pass	
1.3.5-Trichlorobenzene	%	99			60-120	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			70-130	Pass	
Acenaphthylene	%	101			70-130	Pass	
Anthracene	%	100			70-130	Pass	
Benz(a)anthracene	%	93			70-130	Pass	
Benzo(a)pyrene	%	93			70-130	Pass	
Benzo(b&j)fluoranthene	%	100			70-130	Pass	
Benzo(g.h.i)perylene	%	98			70-130	Pass	
Benzo(k)fluoranthene	%	93			70-130	Pass	
Chrysene	%	98			70-130	Pass	
Dibenz(a.h)anthracene	%	86			70-130	Pass	
Fluoranthene	%	104			70-130	Pass	
Fluorene	%	100			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	104			70-130	Pass	
Naphthalene	%	100			70-130	Pass	
Phenanthrene	%	100			70-130	Pass	
Pyrene	%	104			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Potassium	%	96			80-120	Pass	
Sodium	%	94			80-120	Pass	
LCS - % Recovery							
Heavy Metals							
Antimony	%	104			80-120	Pass	
Arsenic	%	103			80-120	Pass	
Barium	%	105			80-120	Pass	
Beryllium	%	103			80-120	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Cadmium	%	102			80-120	Pass	
Chromium	%	100			80-120	Pass	
Cobalt	%	100			80-120	Pass	
Copper	%	96			80-120	Pass	
Iron	%	101			80-120	Pass	
Lead	%	98			80-120	Pass	
Manganese	%	100			80-120	Pass	
Mercury	%	97			80-120	Pass	
Nickel	%	97			80-120	Pass	
Tin	%	102			80-120	Pass	
Vanadium	%	97			80-120	Pass	
Zinc	%	99			80-120	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	%	90			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	81			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	92			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	88			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	90			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	94			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	94			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	108			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	104			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	83			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	93			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	%	89			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	107			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	111			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	%	95			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	%	101			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	86			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	96			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	88			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	%	93			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	97			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	93			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	%	89			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)*	%	85			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	%	94			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	84			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	87			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	106			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	100			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	116			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C10-C14	L24-JI0058412	NCP	%	104			70-130	Pass	
TRH >C10-C16	L24-JI0058412	NCP	%	102			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	L24-JI0060412	NCP	%	108			70-130	Pass	
Toluene	L24-JI0060412	NCP	%	109			70-130	Pass	
Ethylbenzene	L24-JI0060412	NCP	%	118			70-130	Pass	
m&p-Xylenes	L24-JI0060412	NCP	%	106			70-130	Pass	
o-Xylene	L24-JI0060412	NCP	%	106			70-130	Pass	
Xylenes - Total*	L24-JI0060412	NCP	%	106			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	L24-JI0060412	NCP	%	91			70-130	Pass	
Spike - % Recovery									
VOCs in Water by GCMS				Result 1					
Benzene	L24-JI0058035	NCP	%	94			60-120	Pass	
Carbon tetrachloride	L24-JI0058035	NCP	%	86			60-120	Pass	
Chlorobenzene	L24-JI0058035	NCP	%	90			60-120	Pass	
DCM	L24-JI0058035	NCP	%	93			60-120	Pass	
Ethylbenzene	L24-JI0058035	NCP	%	91			60-120	Pass	
Hexachlorobutadiene	L24-JI0058035	NCP	%	89			60-120	Pass	
Methyl tert Butyl Ether	L24-JI0058035	NCP	%	83			60-120	Pass	
Styrene	L24-JI0058035	NCP	%	87			60-120	Pass	
Perchloroethene (PCE)	L24-JI0058035	NCP	%	93			60-120	Pass	
Toluene	L24-JI0058035	NCP	%	94			60-120	Pass	
Trichloroethylene(TCE)	L24-JI0058035	NCP	%	95			60-120	Pass	
Vinyl Chloride	L24-JI0058035	NCP	%	116			60-120	Pass	
Xylenes (Total)	L24-JI0058035	NCP	%	91			60-120	Pass	
1.1-Dichloroethane	L24-JI0058035	NCP	%	88			60-120	Pass	
1.2-Dichloroethane	L24-JI0058035	NCP	%	84			60-120	Pass	
1.1-Dichloroethene	L24-JI0058035	NCP	%	84			60-120	Pass	
cis-1.2-Dichloroethene	L24-JI0058035	NCP	%	90			60-120	Pass	
trans-1.2-Dichloroethene	L24-JI0058035	NCP	%	88			60-120	Pass	
1.1.1-Trichloroethane	L24-JI0058035	NCP	%	86			60-120	Pass	
1.1.1.2-Tetrachloroethane	L24-JI0058035	NCP	%	90			60-120	Pass	
1.1.2.2-Tetrachloroethane	L24-JI0058035	NCP	%	100			60-120	Pass	
1.2-Dichlorobenzene	L24-JI0058035	NCP	%	87			60-120	Pass	
1.3-Dichlorobenzene	L24-JI0058035	NCP	%	90			60-120	Pass	
1.4-Dichlorobenzene	L24-JI0058035	NCP	%	82			60-120	Pass	
1.2.3-Trichlorobenzene	L24-JI0058035	NCP	%	85			60-120	Pass	
1.2.4-Trichlorobenzene	L24-JI0058035	NCP	%	85			60-120	Pass	
1.3.5-Trichlorobenzene	L24-JI0058035	NCP	%	87			60-120	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	L24-JI0057417	NCP	%	101			70-130	Pass	
Acenaphthylene	L24-JI0057417	NCP	%	102			70-130	Pass	
Anthracene	L24-JI0057417	NCP	%	107			70-130	Pass	
Benz(a)anthracene	L24-JI0057417	NCP	%	98			70-130	Pass	
Benzo(a)pyrene	L24-JI0057417	NCP	%	95			70-130	Pass	
Benzo(b&j)fluoranthene	L24-JI0057417	NCP	%	100			70-130	Pass	
Benzo(g.h.i)perylene	L24-JI0042376	NCP	%	88			70-130	Pass	
Benzo(k)fluoranthene	L24-JI0057417	NCP	%	94			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chrysene	L24-JI0057417	NCP	%	99			70-130	Pass	
Dibenz(a.h)anthracene	L24-JI0042376	NCP	%	93			70-130	Pass	
Fluoranthene	L24-JI0057417	NCP	%	98			70-130	Pass	
Fluorene	L24-JI0057417	NCP	%	104			70-130	Pass	
Indeno(1.2.3-cd)pyrene	L24-JI0057417	NCP	%	101			70-130	Pass	
Naphthalene	L24-JI0057417	NCP	%	103			70-130	Pass	
Phenanthrene	L24-JI0057417	NCP	%	103			70-130	Pass	
Pyrene	L24-JI0057417	NCP	%	99			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia-N	L24-JI0061579	NCP	%	105			80-120	Pass	
Chloride	L24-JI0061579	NCP	%	103			70-130	Pass	
Nitrate-N	L24-JI0061579	NCP	%	111			70-130	Pass	
Nitrite-N	L24-JI0061579	NCP	%	99			80-120	Pass	
NOx-N	L24-JI0061579	NCP	%	106			80-120	Pass	
Sulfate	L24-JI0061579	NCP	%	114			70-130	Pass	
Total Nitrogen	L24-JI0062088	NCP	%	114			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Potassium	L24-JI0062505	CP	%	94			75-125	Pass	
Sodium	L24-JI0062505	CP	%	Q05			75-125	Fail	Q05
Spike - % Recovery									
Heavy Metals				Result 1					
Antimony	L24-JI0062505	CP	%	104			75-125	Pass	
Arsenic	L24-JI0062505	CP	%	102			75-125	Pass	
Barium	L24-JI0062505	CP	%	103			75-125	Pass	
Beryllium	L24-JI0062505	CP	%	94			75-125	Pass	
Cadmium	L24-JI0062505	CP	%	100			75-125	Pass	
Chromium	L24-JI0062505	CP	%	95			75-125	Pass	
Cobalt	L24-JI0062505	CP	%	94			75-125	Pass	
Copper	L24-JI0062505	CP	%	89			75-125	Pass	
Iron	L24-JI0062505	CP	%	79			75-125	Pass	
Lead	L24-JI0062505	CP	%	96			75-125	Pass	
Manganese	L24-JI0062505	CP	%	92			75-125	Pass	
Mercury	L24-JI0062505	CP	%	95			75-125	Pass	
Nickel	L24-JI0062505	CP	%	90			75-125	Pass	
Tin	L24-JI0062505	CP	%	104			75-125	Pass	
Vanadium	L24-JI0062505	CP	%	95			75-125	Pass	
Zinc	L24-JI0062505	CP	%	93			75-125	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1					
Perfluorobutanoic acid (PFBA)	L24-JI0059529	NCP	%	84			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	L24-JI0059529	NCP	%	89			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	L24-JI0059529	NCP	%	94			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	L24-JI0059529	NCP	%	92			50-150	Pass	
Perfluorooctanoic acid (PFOA)	L24-JI0059529	NCP	%	88			50-150	Pass	
Perfluorononanoic acid (PFNA)	L24-JI0059529	NCP	%	95			50-150	Pass	
Perfluorodecanoic acid (PFDA)	L24-JI0059529	NCP	%	92			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	L24-JI0059529	NCP	%	98			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	L24-JI0059529	NCP	%	99			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	L24-JI0059529	NCP	%	107			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	L24-JI0059529	NCP	%	107			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances				Result 1					
Perfluorooctane sulfonamide (FOSA)	L24-JI0059529	NCP	%	93			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L24-JI0059529	NCP	%	122			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L24-JI0059529	NCP	%	131			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L24-JI0059529	NCP	%	107			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L24-JI0059529	NCP	%	115			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L24-JI0059529	NCP	%	86			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L24-JI0059529	NCP	%	103			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L24-JI0059529	NCP	%	95			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L24-JI0059529	NCP	%	94			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L24-JI0059529	NCP	%	93			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L24-JI0059529	NCP	%	102			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	L24-JI0059529	NCP	%	87			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)*	L24-JI0059529	NCP	%	84			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	L24-JI0059529	NCP	%	77			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	L24-JI0059529	NCP	%	87			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	L24-JI0059529	NCP	%	94			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	L24-JI0059529	NCP	%	97			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	L24-JI0059529	NCP	%	91			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	L24-JI0059529	NCP	%	91			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	L24-JI0062505	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	L24-JI0060412	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C15-C28	L24-JI0060412	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass	
TRH C29-C36	L24-JI0060412	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass	
TRH C6-C10*	L24-JI0062505	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	L24-JI0060412	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C16-C34	L24-JI0060412	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C34-C40*	L24-JI0060412	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	L24-JI0059585	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	L24-JI0059585	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	L24-JI0059585	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	L24-JI0059585	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	L24-JI0059585	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	L24-JI0059585	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	L24-JI0059585	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
VOCs in Water by GCMS				Result 1	Result 2	RPD			
Benzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Carbon tetrachloride	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Chlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
DCM	L24-JI0058421	NCP	ug/L	< 5	< 5	<1	30%	Pass	
Ethylbenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Hexachlorobutadiene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Styrene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Perchloroethene (PCE)	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Toluene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Trichloroethylene(TCE)	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Vinyl Chloride	L24-JI0058421	NCP	ug/L	< 0.2	< 0.2	<1	30%	Pass	
Xylenes (Total)	L24-JI0058421	NCP	ug/L	< 3	< 3	<1	30%	Pass	
1.1-Dichloroethane	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.2-Dichloroethane	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.1-Dichloroethene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
cis-1.2-Dichloroethene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
trans-1.2-Dichloroethene	L24-JI0058421	NCP	ug/L	< 2	< 2	<1	30%	Pass	
1.1.1-Trichloroethane	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.1.1.2-Tetrachloroethane	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.1.2.2-Tetrachloroethane	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.2-Dichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.3-Dichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.4-Dichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.2.3-Trichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.2.4-Trichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
1.3.5-Trichlorobenzene	L24-JI0058421	NCP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	L24-JI0057905	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L24-JI0062505	CP	mg/L	0.40	0.36	9.9	20%	Pass	
Chloride	L24-JI0062505	CP	mg/L	230	220	2.0	30%	Pass	
Filterable Reactive Phosphorus	L24-JI0062505	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Nitrate-N	L24-JI0062505	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrite-N	L24-JI0062505	CP	mg/L	0.02	0.02	<1	20%	Pass	
NOx-N	L24-JI0062505	CP	mg/L	0.02	0.02	2.7	20%	Pass	
Sulfate	L24-JI0062505	CP	mg/L	180	180	<1	30%	Pass	
Total Nitrogen	L24-JI0063474	NCP	mg/L	3.3	3.1	5.3	30%	Pass	
Total Phosphorus	L24-JI0063474	NCP	mg/L	0.18	0.17	5.8	20%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Potassium	L24-JI0060129	NCP	mg/L	11	11	<1	30%	Pass	
Sodium	L24-JI0060129	NCP	mg/L	130	130	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Antimony	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Arsenic	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Barium	L24-JI0060129	NCP	mg/L	0.42	0.42	1.2	30%	Pass	
Beryllium	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium	L24-JI0060129	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cobalt	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper	L24-JI0060129	NCP	mg/L	0.013	0.013	<1	30%	Pass	
Iron	L24-JI0060129	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Lead	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese	L24-JI0060129	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Mercury	L24-JI0060129	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	L24-JI0060129	NCP	mg/L	0.003	0.003	2.1	30%	Pass	
Tin	L24-JI0060129	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Vanadium	L24-JI0060129	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Zinc	L24-JI0060129	NCP	mg/L	0.024	0.024	<1	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	L24-JI0059528	NCP	ug/L	0.02	0.02	1.2	30%	Pass	
Perfluorohexanoic acid (PFHxA)	L24-JI0059528	NCP	ug/L	0.03	0.03	3.5	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	L24-JI0059528	NCP	ug/L	0.01	0.01	2.5	30%	Pass	
Perfluorononanoic acid (PFNA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonamido substances				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol(N-MeFOSE)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol(N-EtFOSE)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid(6:2 FTSA)	L24-JI0059528	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	L24-JI0059528	NCP	ug/L	0.02	0.02	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)*	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)*	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	L24-JI0059528	NCP	ug/L	0.02	0.02	6.5	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	L24-JI0059528	NCP	ug/L	0.19	0.18	3.7	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	L24-JI0059528	NCP	ug/L	0.29	0.28	1.8	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	L24-JI0059528	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined

Authorised by:

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John Horwood	Senior Analyst-PFAS
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Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request

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Appendix I

Data Quality Assessment

I1 Data Quality Objectives

The baseline contamination investigation (BCI) has been devised broadly in accordance with the seven-step data quality objectives (DQO) process which is provided in Appendix B, Schedule B2 of NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [the 'NEPM']* (NEPC, 2013).

Table 1: Data quality objectives

Step	Summary
1: State the problem	The objectives of the investigation were to: • Identify potential sources of contamination and establish associated contaminants of potential concern (CoPC) at the site; • Identify areas of potential contamination at the site; • Identify potential human and ecological receptors that may be impacted by the CoPC; • Identify potentially affected media (soil, sediment, groundwater); • Provide soil and groundwater contamination data prior to commencement of the lease; • Provide a reference for direct comparison at the end of the lease term; • Where contamination is found to be present, assess whether contamination poses an unacceptable ecological and/or human health risk under the proposed commercial industrial land use; and • If required, inform the need for further investigations to address data gaps and/or the need for remediation and/or management of identified contamination. A preliminary conceptual site model (CSM) has been prepared (Section 8) for the proposed development. The project team consisted of experienced engineers and scientists working in the roles of Project Principal, Project Reviewer, Project Manager and field staff.
2: Identify the decisions / goal of the study	The site history and review of the proposed development has identified possible contaminating historical and future uses which are identified in the CSM. The CSM identifies the associated contaminants of potential concern (CoPC) and the likely impacted media. The decision is to establish whether the results fall below the adopted Site Assessment Criteria (SAC – Section 10) or whether or not the 95% upper confidence limit (UCL) of the sample population falls below the SAC. On this basis, an assessment of the site's suitability from a contamination

Step	Summary
	perspective and whether (or not) further assessment and / or remediation will be derived.
3: Identify the information inputs	Inputs to the investigation comprised site history information, a site inspection, field observations during sampling, and the results of analysis of soil samples to measure the concentrations of CoPC identified in the CSM at the site using National Association of Testing Authorities (NATA) accredited laboratories and methods, where possible. A photoionisation detector (PID) was used on-site to screen soils for VOC. PID readings were used to inform sample selection for laboratory analysis.
4: Define the study boundaries	The lateral boundaries of the site are shown on Drawing 2, Appendix B. The vertical boundaries are to the extent of contamination impact as established from the site history assessment and site observations. The investigation is limited to the timeframe over which the field investigation was conducted.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with the adopted SAC (based on NEPC (2013)). Where guideline values are absent, other sources of guideline values accepted by NEPC (2013) and the DWER shall be adopted where possible. Where a sample result exceeds the adopted criterion, a further site-specific assessment will be made as to the risk posed by the presence of that contaminant(s). Initial comparisons will be with individual results then, where required, summary statistics (including mean, standard deviation and 95% UCL of the arithmetic mean (95% UCL)) to assess potential risks posed by the site contamination. Quality control (QC) results are to be assessed according to their relative percent difference (RPD) values. For field duplicates, triplicates and laboratory results, RPDs should generally be below 50%; for field blanks. The field and laboratory quality assurance assessment is included in Appendix I.
6: Specify the performance or acceptance criteria	Baseline condition: Contaminants at the site exceed human health and environmental SAC and pose a potentially unacceptable risk to receptors (null hypothesis). Alternative condition: Contaminants at the site comply with human health and environmental SAC and as such, do not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true. Uncertainty that may exist due to the above potential decision errors shall be mitigated as follows: As well as a primary screening exercise, the use of the 95% UCL as per NEPC (2013) may be applied, ie: 95% is the defined confidence level associated with the UCL on the geometric mean for contaminant data. The resultant 95% UCL shall subsequently be screened against the corresponding SAC.

Step	Summary
	The statistical assessment will only be able to be applied to certain datasets, such as those obtained via systematic sampling. Identification of areas for targeted sampling will be via professional judgement and errors will not be able to have a probability assigned to them.
7: Optimise the design for obtaining data	As the purpose of the sampling program is to assess for potential contamination across the site, the sampling program is reliant on professional judgement to identify and sample the potentially affected areas. Further details regarding the sampling plan is presented in Section 9.

I2 Field and Laboratory Data Quality Assurance and Quality Control

The field and laboratory quality control (QC) procedures and results are summarised in QAQC Table 1 and QAQC Table 2. Reference should be made to the field work and analysis procedures presented in section 11, and the laboratory results certificates provided in Appendix I for further details.

QAQC Table 1: Field QC

Item	Frequency	Acceptance Criteria	Achievement
Intra-laboratory replicate Inter-laboratory-replicate	5% to 10% primary samples	RPD <50% inorganics), <30% (organics)	Yes[1]
Trip Blank	One per field batch	<LOR	Yes
Trip Spike	One per field batch	four times LOR	Yes

Notes:
1 Qualitative assessment of RPD results overall
RPD Relative Percentage Difference
LOR Limit of Reporting

QAQC Table 2: Field and laboratory quality control

Item	Frequency	Acceptance Criteria	Achievement
Analytical laboratories used	-	NATA accreditation	Yes
Holding times	-	In accordance with NEPM which references various Australian and international standards	Yes
Laboratory/ Reagent Blank	One per lab batch	<LOR	Yes

Laboratory duplicate	10% primary samples	<10 x LOR Any RPD 10-20 x LOR 0 – 50% >20 x LOR 0 – 30%	Yes
Matrix Spike	One per lab batch	Variable Results, Refer to Interpretive Quality Control Report	Yes
Surrogate Spike	Organics by GC	Variable Results, Refer to Interpretive Quality Control Report	Yes
Control Sample	One per lab batch	Variable Results, Refer to Interpretive Quality Control Report	Yes

Laboratory QC data is considered to be of sufficient quality to be acceptable for the assessment.

I2.1 Intra-Laboratory and Inter-laboratory Replicates

Intra-laboratory replicates were analysed as an internal check of the reproducibility within the primary laboratory (MPL) and as a measure of consistency of sampling techniques. Inter-laboratory replicates were analysed by NATA accredited laboratory Eurofins. The comparative results of analysis between original, intra-laboratory and inter-laboratory replicate samples are summarised in Tables I-1 to I-3 in Appendix I of the investigation.

Note that, where both samples are below the LOR, the difference and RPD has been given as zero.

The calculated RPD values were within the acceptable range except for those highlighted in Appendix I. However, this is not considered to be significant because:

- Where RPDs exceed 50% the highest result was used for the assessment as a conservative approach;
- Most of the RPDs within a replicate pair being within the acceptable limits; and
- All other QA/QC parameters met the adopted DQOs.

Overall, the intra-laboratory and inter-laboratory replicate comparisons indicate that the sampling techniques were generally consistent and repeatable.

I3 Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQI):

- Completeness: a measure of the amount of usable data from a data collection activity;
- Comparability: the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;

- Representativeness: the confidence (qualitative) of data representativeness of media present on-site;
- Precision: a measure of variability or reproducibility of data; and
- Accuracy: a measure of closeness of the data to the 'true' value.

QAQC Table 3: Data quality indicators

Data quality indicator	Method(s) of achievement
Completeness	Planned targeted and/or judgmental sampling locations sampled; Preparation of field logs, sample location plan and chain of custody (CoC) records; Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the CoC; Samples analysed for CoPC identified in the CSM; Completion of CoC documentation; NATA endorsed laboratory certificates provided by the laboratory; and Satisfactory frequency and results for field and laboratory QC samples as discussed in Section QAQC2.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project; Works conducted by appropriately experienced and trained Douglas engineer; Use of NATA accredited laboratories, with test methods the same or similar between laboratories; and Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled; Spatial and temporal distribution of sample locations; Sample numbers recovered and analysed are considered to be representative of the target media and complying with the DQOs; Samples were extracted and analysed within holding times; and Samples were analysed in accordance with the requested analyses.
Precision	Acceptable RPD between original samples and replicates; and Satisfactory results for all other field and laboratory QC samples.
Accuracy	Satisfactory results for all field and laboratory QC samples.

Based on the above, it is considered that the DQOs have been complied with. As such, it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

Table I-1: Summary of QC Laboratory Results (Soil Intra-Laboratory Duplicates and Trip Spikes)

Analyte Group / Analyte	Unit	LOR	TP40	Rep1-1	RPD %	TP44	Rep4-1	RPD %	TP46	Rep2-1	RPD %	TP56
			0.05-0.15	0.05-0.15		0.05-0.15	0.05-0.15		0.05-0.15	0.05-0.15		0.05-0.15
			18/06/2024	18/06/2024		19/06/2024	19/06/2024		18/06/2024	18/06/2024		20/06/2024
Metals / metalloids												
Aluminium	mg/kg	10	1100	1200	**9**	-	-	-	-	-	-	930
Arsenic	mg/kg	4	6.9	7.6	**10**	-	-	-	-	-	-	5.6
Boron	mg/kg	10	<10	<10	0	-	-	-	-	-	-	<10
Barium	mg/kg	1	6.6	7.4	**11**	-	-	-	-	-	-	8.2
Beryllium	mg/kg	1	<1.0	<1.0	0	-	-	-	-	-	-	<1.0
Cadmium	mg/kg	0.4	<0.40	<0.40	0	-	-	-	-	-	-	<0.40
Cobalt	mg/kg	1	<1.0	<1.0	0	-	-	-	-	-	-	<1.0
Chromium	mg/kg	1	11	13	**17**	-	-	-	-	-	-	9.8
Copper	mg/kg	1	<1.0	<1.0	0	-	-	-	-	-	-	<1.0
Mercury	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Manganese	mg/kg	1	26	30	**14**	-	-	-	-	-	-	29
Nickel	mg/kg	1	3.3	7.8	**81**	-	-	-	-	-	-	6.8
Lead	mg/kg	1	2.9	3.5	**19**	-	-	-	-	-	-	3.3
Selenium	mg/kg	2	<2.0	<2.0	0	-	-	-	-	-	-	<2.0
Vanadium	mg/kg	1	5.2	6	**14**	-	-	-	-	-	-	4.7
Zinc	mg/kg	1	1.3	1.8	**32**	-	-	-	-	-	-	1.4
Total Recoverable Hydrocarbons												
TRH C6 - C9	mg/kg	25	<25	<25	0	-	-	-	-	-	-	<25
TRH C6 - C10	mg/kg	25	<25	<25	0	-	-	-	-	-	-	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<25	0	-	-	-	-	-	-	<25
TRH C10 - C14	mg/kg	50	<50	<50	0	-	-	-	-	-	-	<50
TRH C15 - C28	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
TRH C29 - C36	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
TRH >C10 - C16	mg/kg	50	<50	<50	0	-	-	-	-	-	-	<50
TRH >C10-C16 less N (F2)	mg/kg	50	<50	<50	0	-	-	-	-	-	-	<50
TRH >C16 - C34	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
TRH >C34 - C40	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
Monocyclic Aromatic Hydrocarbons												
MTBE	mg/kg	0.5	<0.5	<0.5	0	-	-	-	-	-	-	<0.5
Benzene	mg/kg	0.2	<0.2	<0.2	0	-	-	-	-	-	-	<0.2
Toluene	mg/kg	0.5	<0.5	<0.5	0	-	-	-	-	-	-	<0.5
Ethylbenzene	mg/kg	1	<1	<1	0	-	-	-	-	-	-	<1
m+p-xylene	mg/kg	2	<2	<2	0	-	-	-	-	-	-	<2
o-xylene	mg/kg	1	<1	<1	0	-	-	-	-	-	-	<1
Naphthalene	mg/kg	1	<1	<1	0	-	-	-	-	-	-	<1
Polycyclic Aromatic Hydrocarbons												
Naphthalene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	<0.2	<0.2	0	-	-	-	-	-	-	<0.2
Benzo(a)pyrene	mg/kg	0.05	<0.05	<0.05	0	-	-	-	-	-	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	<0.1	0	-	-	-	-	-	-	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.5	<0.5	<0.5	0	-	-	-	-	-	-	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.5	<0.5	<0.5	0	-	-	-	-	-	-	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	<0.5	<0.5	0	-	-	-	-	-	-	<0.5
Total Positive PAHs	mg/kg	0.05	<0.05	<0.05	0	-	-	-	-	-	-	<0.05
Per- and Poly-fluoronated Alkyl Substances												
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.1	0.16	0.13	**21**	0.18	0.21	**11**	<0.1	<0.1	0	0.22
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
Perfluorobutanoic acid (PFBA)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	0.32
Perfluoropentanoic acid (PFPeA)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluorononanoic acid (PFNA)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5	<5	<5	0	<5	<5	0	<5	<5	0	<5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1	<1	<1	0	<1	<1	0	<1	<1	0	<1
N-Methyl perfluorooctane sulfonamide (MeFO	µg/kg	1	<1	<1	0	<1	<1	0	<1	<1	0	<1
N-Ethyl perfluorooctane sulfonamide (EtFOSA	µg/kg	1	<1	<1	0	<1	<1	0	<1	<1	0	<1
N-Methyl perfluorooctane sulfonamidoethanc	µg/kg	1	<1	<1	0	<1	<1	0	<1	<1	0	<1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5	<5	<5	0	<5	<5	0	<5	<5	0	<5
N-Methyl perfluorooctane sulfonamidoacetic	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
N-Ethyl perfluorooctane sulfonamidoacetic ac	µg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
Total +ve PFHxS+PFOS	µg/kg	0.1	0.16	0.13	**21**	0.18	0.21	**11**	<0.1	<0.1	0	0.22
Total +ve PFOA+PFOS	µg/kg	0.1	0.16	0.13	**21**	0.18	0.21	**11**	<0.1	<0.1	0	0.22
Total +ve PFAS	µg/kg	0.1	0.16	0.13	**21**	0.18	0.21	**11**	<0.1	<0.1	0	0.54

Table I-2: Summary of QC Laboratory Results (Soil Inter-Laboratory Duplicates)

Analyte Group / Analyte	Unit	LOR	TP40	Rep1-2	RPD %	TP44	Rep4-2	RPD %	TP46	Rep2-2	RPD %	TP56
			0.05-0.15	0.05-0.15		0.05-0.15	0.05-0.15		0.05-0.15	0.05-0.15		0.05-0.15
			18/06/2024	18/06/2024		19/06/2024	19/06/2024		18/06/2024	18/06/2024		20/06/2024
Metals / metalloids												
Aluminium	mg/kg	10	1100	580	**62**	-	-	**-**	-	-	**-**	930
Arsenic	mg/kg	4	6.9	2.2	**103**	-	-	**-**	-	-	**-**	5.6
Boron	mg/kg	10	<10	<10	0	-	-	-	-	-	-	<10
Barium	mg/kg	1	6.6	<10	N/A	-	-	**-**	-	-	**-**	8.2
Beryllium	mg/kg	1	<1.0	<2	N/A	-	-	-	-	-	-	<1.0
Cadmium	mg/kg	0.4	<0.40	0.1	N/A	-	-	-	-	-	-	<0.40
Cobalt	mg/kg	1	<1.0	<5	N/A	-	-	**-**	-	-	**-**	<1.0
Chromium	mg/kg	1	11	7.1	**43**	-	-	**-**	-	-	**-**	9.8
Copper	mg/kg	1	<1.0	<1	0	-	-	**-**	-	-	**-**	<1.0
Mercury	mg/kg	0.1	<0.1	<0.02	N/A	-	-	-	-	-	-	<0.1
Manganese	mg/kg	1	26	21	**21**	-	-	**-**	-	-	**-**	29
Nickel	mg/kg	1	3.3	2.8	**16**	-	-	**-**	-	-	**-**	6.8
Lead	mg/kg	1	2.9	1.3	**76**	-	-	**-**	-	-	**-**	3.3
Selenium	mg/kg	2	<2.0	<2	0	-	-	-	-	-	-	<2.0
Vanadium	mg/kg	1	5.2	<10	N/A	-	-	**-**	-	-	**-**	4.7
Zinc	mg/kg	1	1.3	<5	N/A	-	-	**-**	-	-	**-**	1.4
Total Recoverable Hydrocarbons												
TRH C6 - C9	mg/kg	25	<25	<20	N/A	-	-	-	-	-	-	<25
TRH C6 - C10	mg/kg	25	<25	<20	N/A	-	-	-	-	-	-	<25
TRH C6-C10 less BTEX (F1)	mg/kg	25	<25	<20	N/A	-	-	-	-	-	-	<25
TRH C10 - C14	mg/kg	50	<50	<20	N/A	-	-	-	-	-	-	<50
TRH C15 - C28	mg/kg	100	<100	<50	N/A	-	-	-	-	-	-	<100
TRH C29 - C36	mg/kg	100	<100	<50	N/A	-	-	-	-	-	-	<100
TRH >C10 - C16	mg/kg	50	<50	<50	0	-	-	-	-	-	-	<50
TRH >C10-C16 less N (F2)	mg/kg	50	<50	<50	0	-	-	-	-	-	-	<50
TRH >C16 - C34	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
TRH >C34 - C40	mg/kg	100	<100	<100	0	-	-	-	-	-	-	<100
Monocyclic Aromatic Hydrocarbons												
MTBE	mg/kg	0.5	<0.5	-	N/A	-	-	-	-	-	-	<0.5
Benzene	mg/kg	0.2	<0.2	<0.1	N/A	-	-	-	-	-	-	<0.2
Toluene	mg/kg	0.5	<0.5	<0.1	N/A	-	-	-	-	-	-	<0.5
Ethylbenzene	mg/kg	1	<1	<0.1	N/A	-	-	-	-	-	-	<1
m+p-xylene	mg/kg	2	<2	<0.2	N/A	-	-	-	-	-	-	<2
o-xylene	mg/kg	1	<1	<0.1	N/A	-	-	-	-	-	-	<1
Naphthalene	mg/kg	1	<1	<0.5	N/A	-	-	-	-	-	-	<1
Polycyclic Aromatic Hydrocarbons												
Naphthalene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Acenaphthylene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Acenaphthene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Fluorene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Phenanthrene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Anthracene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Chrysene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	<0.2	<0.5	N/A	-	-	-	-	-	-	<0.2
Benzo(a)pyrene	mg/kg	0.05	<0.05	<0.5	N/A	-	-	-	-	-	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Dibenzo(a,h)anthracene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	<0.5	N/A	-	-	-	-	-	-	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.5	<0.5	<0.5	N/A	-	-	-	-	-	-	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.5	<0.5	0.6	N/A	-	-	-	-	-	-	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	<0.5	1.2	N/A	-	-	-	-	-	-	<0.5
Total Positive PAHs	mg/kg	0.05	<0.05	<0.5	N/A	-	-	-	-	-	-	<0.05
Per- and Poly-fluoronated Alkyl Substances												
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.1	0.16	<5	N/A	0.18	<5	N/A	<0.1	<0.1	0	0.22
Perfluorodecanesulfonic acid (PFDS)	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
Perfluorobutanoic acid (PFBA)	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	0.32
Perfluoropentanoic acid (PFPeA)	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
Perfluorohexanoic acid (PFHxA)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluorooctanoic acid (PFOA)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluorononanoic acid (PFNA)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
Perfluorodecanoic acid (PFDA)	µg/kg	0.5	<0.5	<5	N/A	<0.5	<5	N/A	<0.5	<0.5	0	<0.5
Perfluoroundecanoic acid (PFUnDA)	µg/kg	0.5	<0.5	<5	N/A	<0.5	<5	N/A	<0.5	<0.5	0	<0.5
Perfluorododecanoic acid (PFDoDA)	µg/kg	0.5	<0.5	<5	N/A	<0.5	<5	N/A	<0.5	<0.5	0	<0.5
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.5	<0.5	<5	N/A	<0.5	<5	N/A	<0.5	<0.5	0	<0.5
Perfluorotetradecanoic acid (PFTeDA)	µg/kg	5	<5	<5	N/A	<5	<5	N/A	<5	<5	0	<5
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/kg	0.1	<0.1	<5	N/A	<0.1	<5	N/A	<0.1	<0.1	0	<0.1
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/kg	0.1	<0.1	<10	N/A	<0.1	<10	N/A	<0.1	<0.1	0	<0.1
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
Perfluorooctane sulfonamide (FOSA)	µg/kg	1	<1	<5	N/A	<1	<5	N/A	<1	<1	0	<1
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/kg	1	<1	<10	N/A	<1	<10	N/A	<1	<1	0	<1
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/kg	1	<1	<10	N/A	<1	<10	N/A	<1	<1	0	<1
N-Methyl perfluorooctane sulfonamidoethanol	µg/kg	1	<1	<5	N/A	<1	<5	N/A	<1	<1	0	<1
N-Ethyl perfluorooctane sulfonamidoethanol	µg/kg	5	<5	<5	N/A	<5	<5	N/A	<5	<5	0	<5
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/kg	0.2	<0.2	<5	N/A	<0.2	<5	N/A	<0.2	<0.2	0	<0.2
Total +ve PFHxS+PFOS	µg/kg	0.1	0.16	<5	N/A	0.18	<5	N/A	<0.1	<0.1	0	0.22
Total +ve PFOA+PFOS	µg/kg	0.1	0.16	<5	N/A	0.18	<5	N/A	<0.1	<0.1	0	0.22
Total +ve PFAS	µg/kg	0.1	0.16	<50	N/A	0.18	<50	N/A	<0.1	<0.1	0	0.54

Table I-3: Summary of QC Laboratory Results (Groundwater)

Analyte Group / Analyte	Unit	LOR	MW101	Rep1-1 (intra)	RPD	MW101	Rep1-2 (inter)	RPD	Trip Blank	Trip Spike
			23/07/2024	23/07/2024		23/07/2024	23/07/2024		23/07/2024	23/07/2024
Inorganics										
Bicarbonate HCO3 as CaCO3	mg/L	5	310	300	**3**	310	310	0	-	-
Carbonate CO32- as CaCO3	mg/L	5	<5	<5	0	<5	<5	0	-	-
Hydroxide OH- as CaCO3	mg/L	5	<5	<5	0	<5	<5	0	-	-
Total Alkalinity as CaCO3	mg/L	5	310	300	**3**	310	310	0	-	-
Chloride	mg/L	5	200	210	**5**	200	230	**14**	-	-
Sulfate	mg/L	5	160	160	0	160	180	**12**	-	-
Calcium	mg/L	5	120	130	**8**	120	-	N/A	-	-
Magnesium	mg/L	5	39	39	0	39	-	N/A	-	-
Potassium	mg/L	5	2.5	2.5	0	2.5	2.3	**8**	-	-
Sodium	mg/L	5	110	110	0	110	110	0	-	-
Hardness	mg/L	5	470	480	**2**	470	-	N/A	-	-
Ionic Balance	%		-3.5	-2.5	**33**	-3.5	-	N/A	-	-
Total Anions	mg/L	5	670	670	0	670	-	N/A	-	-
Total Cations	mg/L	5	270	280	**4**	270	-	N/A	-	-
Nutrients										
Ammonia as N	mg/L	0.005	0.39	0.35	**11**	0.39	0.4	**3**	-	-
Nitrate as N	mg/L	0.005	<0.005	<0.005	0	<0.005	-	N/A	-	-
Nitrate as NO3	mg/L	0.02	<0.02	<0.020	0	<0.02	<0.01	N/A	-	-
Nitrite as N	mg/L	0.005	0.013	0.0098	**28**	0.013	0.02	**42**	-	-
Nitrite as NO2	mg/L	0.02	0.042	0.032	**27**	0.042	-	N/A	-	-
Nox as N	mg/L	0.005	0.014	0.013	**7**	0.014	0.02	**35**	-	-
TKN as N	mg/L	0.1	0.69	0.71	**3**	0.69	0.4	**53**	-	-
Organic Nitrogen	mg/L	0.1	0.3	0.36	18	0.3	-	N/A	-	-
Total Nitrogen	mg/L	0.1	0.7	0.72	3	0.7	0.4	**55**	-	-
Phophate as P	mg/L	0.005	<0.005	<0.005	0	<0.005	<0.01	N/A	-	-
Phosphorus	mg/L	0.05	<0.050	<0.050	0	<0.050	0.04	N/A	-	-
Dissolved Metals										
Aluminium-Dissolved	µg/L	10	<10	<10	0	<10	-	N/A	-	-
Arsenic-Dissolved	µg/L	1	43	32	**29**	43	40	**7**	-	-
Boron-Dissolved	µg/L	20	80	89	**11**	80	-	N/A	-	-
Barium-Dissolved	µg/L	1	14	15	**7**	14	20	**35**	-	-
Beryllium-Dissolved	µg/L	0.5	<0.50	<0.50	0	<0.50	<1	N/A	-	-
Cadmium-Dissolved	µg/L	0.1	<0.10	<0.10	0	<0.10	<0.1	0	-	-
Cobalt-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	<1	0	-	-
Chromium-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	<1	0	-	-
Copper-Dissolved	µg/L	1	<1.0	1.2	N/A	<1.0	<1	0	-	-
Mercury-Dissolved	µg/L	0.05	<0.050	<0.050	0	<0.050	<0.1	N/A	-	-
Manganese-Dissolved	µg/L	1	25	25	0	25	28	**11**	-	-
Nickel-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	<1	0	-	-
Lead-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	<1	0	-	-
Selenium-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	-	N/A	-	-
Vanadium-Dissolved	µg/L	1	<1.0	<1.0	0	<1.0	<5	N/A	-	-
Zinc-Dissolved	µg/L	1	<1.0	2.3	N/A	<1.0	<5	N/A	-	-
Total Recoverable Hydrocarbons										
TRH C6 - C9	µg/L	10	<10	<10	0	<10	<20	N/A	<10	-
TRH C6 - C10	µg/L	10	<10	<10	0	<10	<20	N/A	<10	-
TRH C6-C10 less BTEX (F1)	µg/L	10	<10	<10	0	<10	<20	N/A	<10	-
TRH C10 - C14	µg/L	50	<50	<50	0	<50	<20	N/A	**-**	**-**
TRH C15 - C28	µg/L	100	<100	<100	0	<100	<40	N/A	-	**-**
TRH C29 - C36	µg/L	100	<100	<100	0	<100	<40	N/A	-	-
TRH >C10 - C16	µg/L	50	<50	<50	0	<50	<20	N/A	**-**	**-**
TRH >C10-C16 less N (F2)	µg/L	50	<50	<50	0	<50	<20	N/A	**-**	**-**
TRH >C16 - C34 (F3)	µg/L	100	<100	<100	0	<100	<50	N/A	-	**-**
TRH >C34 - C40 (F4)	µg/L	100	<100	<100	0	<100	<50	N/A	-	-
Monocyclic Aromatic Hydrocarbons										
MTBE	µg/L	1	<1	<1	0	<1	-	N/A	<1	-
Benzene	µg/L	1	<1	<1	0	<1	<1	0	<1	115
Toluene	µg/L	1	<1	<1	0	<1	<1	0	<1	113
Ethylbenzene	µg/L	1	<1	<1	0	<1	<1	0	<1	113
m+p-xylene	µg/L	2	<2	<2	0	<2	<2	0	<2	114
o-xylene	µg/L	1	<1	<1	0	<1	<1	0	<1	113
Naphthalene (used in F2 calc)	µg/L	1	<1	<1	0	<1	<1	0	<1	-
Polycyclic Aromatic Hydrocarbons										
Naphthalene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Acenaphthylene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Acenaphthene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Fluorene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Phenanthrene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Anthracene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Fluoranthene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Pyrene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Benzo(a)anthracene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Chrysene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Benzo(b,j+k)fluoranthene	µg/L	0.2	<0.2	<0.2	0	<0.2	<1	N/A	-	-
Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Dibenzo(a,h)anthracene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Benzo(g,h,i)perylene	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-
Total +ve PAH's	µg/L	0.1	<0.1	<0.1	0	<0.1	<1	N/A	-	-

Table I-3: Summary of QC Laboratory Results (Groundwater)

Analyte Group / Analyte	Unit	LOR	MW101	Rep1-1 (intra)	RPD	MW101	Rep1-2 (inter)	RPD	Trip Blank	Trip Spike
			23/07/2024	23/07/2024		23/07/2024	23/07/2024		23/07/2024	23/07/2024
Volatile Organic Compunds										
2,2-dichloropropane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,2-dichloropropane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
cis-1,3-dichloropropene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
trans-1,3-dichloropropene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,2-dibromoethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Benzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Toluene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Ethylbenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
m+p-xylene	µg/L	2	<2	<2	0	<2	<3	N/A	-	-
Styrene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
o-xylene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Isopropylbenzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
n-propyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,3,5-trimethyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Tert-butyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,2,4-trimethyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Sec-butyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
4-isopropyl toluene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
n-butyl benzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Dichlorodifluoromethane	µg/L	10	<10	<10	0	<10	-	N/A	-	-
Chloromethane	µg/L	10	<10	<10	0	<10	-	N/A	-	-
Vinyl Chloride	µg/L	10	<10	<10	0	<10	<0.2	N/A	-	-
Bromomethane	µg/L	10	<10	<10	0	<10	-	N/A	-	-
Chloroethane	µg/L	10	<10	<10	0	<10	-	N/A	-	-
Trichlorofluoromethane	µg/L	10	<10	<10	0	<10	-	N/A	-	-
1,1-Dichloroethene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Trans-1,2-dichloroethene	µg/L	1	<1	<1	0	<1	<2	N/A	-	-
1,1-dichloroethane	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Cis-1,2-dichloroethene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Bromochloromethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Chloroform	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,1,1-trichloroethane	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,1-dichloropropene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Carbon tetrachloride	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,2-dichloroethane	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Trichloroethene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Dibromomethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Bromodichloromethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,1,2-trichloroethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,3-dichloropropane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Tetrachloroethene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Dibromochloromethane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,1,1,2-tetrachloroethane	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Bromoform	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,1,2,2-tetrachloroethane	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,2,3-trichloropropane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,2-dibromo-3-chloropropane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Hexachlorobutadiene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Chlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Bromobenzene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
2-chlorotoluene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
4-chlorotoluene	µg/L	1	<1	<1	0	<1	-	N/A	-	-
1,3-dichlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,4-dichlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,2-dichlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,2,4-trichlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
1,2,3-trichlorobenzene	µg/L	1	<1	<1	0	<1	<0.5	N/A	-	-
Cyclohexane	µg/L	1	<1	<1	0	<1	-	N/A	-	-
Per- and Poly-Fluoroalkyl Substances										
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluoropentanesulfonic acid (PFPeS)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluoroheptanesulfonic acid (PFHpS)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorooctanesulfonic acid (PFOS)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
Perfluoropentanoic acid (PFPeA)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluoroheptanoic acid (PFHpA)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorooctanoic acid (PFOA)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorononanoic acid (PFNA)	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	<0.01	N/A	-	-
Perfluorodecanoic acid (PFDA)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
Perfluorododecanoic acid (PFDoDA)	µg/L	0.005	<0.005	<0.005	0	<0.005	-	N/A	-	-
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.01	<0.010	<0.010	0	<0.010	-	N/A	-	-
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	<0.05	<0.05	0	<0.05	-	N/A	-	-
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.01	N/A	-	-
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	µg/L	0.001	<0.001	<0.001	0	<0.001	<0.05	N/A	-	-
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	<0.01	N/A	-	-
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.002	<0.002	<0.002	0	<0.002	<0.01	N/A	-	-
Perfluorooctane sulfonamide (FOSA)	µg/L	0.01	<0.010	<0.010	0	<0.010	<0.05	N/A	-	-
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05	<0.050	<0.050	0	<0.050	<0.05	N/A	-	-
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.1	<0.1	<0.1	0	<0.1	<0.05	N/A	-	-
N-Methyl perfluorooctane sulfonamidoethanol	µg/L	0.05	<0.05	<0.05	0	<0.05	-	N/A	-	-
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.5	<0.5	<0.5	0	<0.5	-	N/A	-	-
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	-	N/A	-	-
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.0020	<0.0020	0	<0.0020	-	N/A	-	-
Total +ve PFHxS+PFOS	µg/L	0.001	<0.010	<0.010	0	<0.010	-	N/A	-	-
Total +ve PFOA+PFOS	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	-	N/A	-	-
Total +ve PFAS	µg/L	0.001	<0.0010	<0.0010	0	<0.0010	-	N/A	-	-

Appendix 7
Transport Impact Assessment

Confidential

transcore
20 years anniversary

transport planning
traffic engineering
modelling

Proposed Industrial Facility, Lot 108 Patterson Road, East Rockingham

Transport Impact Assessment

PREPARED FOR:
Ramboll

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1 Summary

This Transport Impact Assessment has been prepared by Transcore on behalf of Ramboll with respect to the proposed Agriculture/Industrial Facility at Lot 108 Patterson Road in East Rockingham, City of Rockingham (hereafter the subject site).

The subject site is situated at the western side of Patterson Road and to the south of Ward Road. The site is also located immediately south of the existing WA Kaolin storage facility and the Halliburton Chemicals manufacture plant site.

The development proposal involves construction of a canola crushing plant with associated processing and storage facilities, ancillary administrative building and on-site parking. The plant is proposed to be served via a service road connecting to Ward Road which further connects to Patterson Road.

In accordance with the WAPC document *"Transport Impact Assessment Guidelines for Developments, Volume 4 – Individual Developments (2016)"* a Transport Impact Assessment (hereafter TIA) is required for developments that are likely to generate high volumes of traffic and therefore would have a high overall impact on the surrounding land uses and transport networks.

The focus of this report is the traffic impact assessment of the proposed development including assessment of the local intersection of Patterson Road/Ward Road. This report also considers existing and proposed pedestrian and cyclist facilities as well as the availability of public transportation within the locality.

For the purpose of this TIA, Transcore undertook traffic count survey at the Patterson Road/Ward Road intersection during the established typical weekday morning and afternoon peak hour periods of traffic activity in December 2023.

During the process of preparation of this report Transcore and the Project Team liaised with the City of Rockingham and Main Roads WA in order to investigate the alternative access option for the site directly off Patterson Road. Ultimately, it was agreed that at this stage site access off Ward Road is the preferred option and should form the basis of the assessments moving forward.

2 Introduction

The subject site, approximately 13ha in size, is situated at the southern end of the Kwinana Industrial Zone occupying area west of Rockingham Road/Patterson Road, as shown in **Figure 1**.



Figure 1: Location of the subject site

The site is located immediately to the south of the existing WA Kaolin storage facility and the Halliburton Chemicals manufacture plant site and between the railway tracks and Patterson Road. CBH Kwinana Grain Terminal is located immediately to the west of railway tracks and the subject site. Accordingly, the site entail only one road frontage to Patterson Road at the east. The site is currently vacant and has no formal vehicular access at present apart from an informal gravel track running along the western boundary of Halliburton Chemicals manufacture plant site connecting to Ward Road at the northern end.

Key issue that will be addressed in this report include capacity of the adjacent road network to accommodate the anticipated traffic from the proposed development. The parking provision for the development and access to the site by all modes of transport will also be addressed.

The location of the subject site within the *Metropolitan Region Scheme* context is illustrated in **Figure 2**. Review of the *Metropolitan Regional Scheme* identifies Patterson Road as *"Primary Regional Roads"* under care and control of Main Roads

WA while Ward Road is a local road under care and control of the local authority. The subject site is zoned as *"Industrial"* in the *MRS*.



Figure 2. Site location within Metropolitan Region Scheme

3 Development Proposal

Cargill Australia proposes to build a canola crushing plant adjacent to the CBH Kwinana Grain Terminal in East Rockingham. The capacity of the proposed plant is 3,000 tonnes per day (tpd).

The canola crushing plant is proposed to comprise the following key components:

- Canola truck logistics facilities (seed silos);
- Canola processing, with the solvent Hexane;
- Meal storage & loading out facility;
- Crude degummed canola oil storage & loading out (oil pipe to the jetty);
- Natural gas or biomass steam boiler;
- Wastewater treatment plant;
- Compressed air station;
- Firefighting facilities;
- Weigh bridges;
- Switchgear station & MCC room; and,
- Buildings including offices, laboratory, maintenance facilities, other utilities, and truck parking areas.

The plant is proposed to be served by a two-way accessway running along the western boundary of the Halliburton Chemicals manufacture plant site and connecting to Ward Road at the northern end. At its eastern end, Ward Road connects to Patterson Road facilitating access to the site via this regional level road.

Car parking for visitors and staff will be fully contained within the site as will be the parking for heavy vehicles.

Appropriate industrial standard driveways ranging in width between 8.0 – 10.0m are provided throughout the site designed to accommodate access, manoeuvring within the site and egress of vehicle combinations of up to 27.5m in length (i.e., B-Doubles).

For the purpose of this assessment, it is assumed that the proposed plant would be completed and fully operational by the end of 2026. Refer **Appendix B** for the proposed site plan.

4 Existing Situation

4.1 Context

The subject site is situated at the western side of Patterson Road and immediately south of existing WA Kaolin storage facility and the Halliburton Chemicals manufacture plant site. CBH Kwinana Grain Terminal is located immediately to the west of railway tracks and the subject site. The site is currently vacant.

4.2 Existing Road Network

Patterson Road, in this vicinity, is constructed as a dual-carriageway, four-lane road with a 20m wide landscaped median and on-road sealed shoulders/cycling lanes. There are no paths on either side of the road in this locality. Refer **Figure 3** and **Figure 4** for more details.

According to the Main Roads WA *Perth Metropolitan Area – Functional Road Hierarchy* document, Patterson Road is classified as a *Distributor B* road. It operates under a 60km/h transitioning to 80km/h speed limit regime. Patterson Road is also classified as a *"Primary Regional Road"* and as such is under care and control of Main Roads WA.



Figure 3: Northbound view along Patterson Road in the vicinity of the site



Figure 4: Southbound view along Patterson Road in the vicinity of the site

Ward Road, is a 360m-long single-carriageway, two-lane road terminating at the western end and forming an intersection with Patterson Road at the eastern end. No footpaths/shared paths are in place on either side of the road in this location. Refer Figure 5 and Figure 6 for more details. Ward Road provides access to WA Kaolin storage facility and the Halliburton Chemicals manufacture plant site.



Figure 5: Eastbound view along Ward Road

According to the Main Roads WA *Perth Metropolitan Area – Functional Road Hierarchy* document, Ward Road is classified as an *Industrial Road*. It operates under a 50km/h speed limit regime. Ward Road is a local road under care and control of the Local Government.



Figure 6: Westbound view along Ward Road

Ward Road forms a priority-controlled T-intersection with Patterson Road at the eastern end. Patterson Road entails a 120m-long right-turn pocket at the intersection. Ward Road flares on approach to the intersection accommodating movement of large trucks (RAV 4).

4.3 Existing Traffic Volumes

According to the latest available Main Roads WA traffic counts from 2021/2022 Patterson Road (south of Charles Street) carried approximately 34,100 vehicles per weekday (vpd). The classified counts for this road indicate approximately 7.1% participation of heavy vehicles in the total daily traffic mix.

There are no formal traffic counts available for Ward Road at present; however, based on Transcore's own traffic surveys from December 2023, there is currently minimal traffic activity observed on this road.

4.4 Heavy Vehicles

Restricted Access Vehicle (RAV) Network routes are designated for access by large heavy vehicle combinations, which is managed by Main Roads WA.

As illustrated in **Figure 7**, Ward Road and Patterson Road (south of Kwinana Beach Road) are classified as RAV Network 4 roads. North of Kwinana Beach Road Patterson Road is classified as RAV 7 Network road. RAV 4 and RAV 7 classification permits operation of heavy vehicle combinations of up 27.5m and 36.5m in length, respectively.



Figure 7: Existing heavy vehicle road network classification (RAV)

4.5 Crash Data

Information available on Main Roads WA crash statistics web site confirms no crashes were recorded during the five-year period ending in December 2022 at the Patterson Road/Ward Road intersection.

5 Changes to Surrounding Transport Networks

As part of this project, it is proposed to upgrade the intersection of Patterson Road with Ward Road by constructing a left-turn slip lane on Patterson Road. No other changes to the exiting road network in this vicinity are proposed as part of the proposal.

6 Integration with Surrounding Area

The proposed development is an industrial development and as such is in line with the industrial character of this locality.

7 Traffic Assessment

7.1 Assessment Period

The nature of the proposed project is such that the peak traffic activity is anticipated to be recorded during the 1-hour shift changeover period in the early morning and late afternoon. Accordingly, the two distinct peak hour traffic activity periods are expected to occur between 6:00-7:00AM (day shift arrival and night shift departure) and 6:00-7:00PM (night shift arrival and day shift departure).

The transport task (i.e., delivery of goods to and distribution of product from the site) will be carried out by large vehicles (trucks of up to B-Doubles) and as such this traffic component will also have a notable traffic impact on the surrounding road network. Hence, road-specific weekday peak hour (3:00-4:00PM) and near-peak hour (4:00-5:00PM) assessment will be also undertaken in this report. The peak and near-peak weekday periods have been established from the available Main Roads WA traffic survey data for Patterson Road (2021/22).

Accordingly, trip generation is estimated, and traffic analysis is undertaken, for the four distinct weekday peak hour periods.

It is assumed that the proposed development would be fully constructed and operational by the end of 2026. As such, 2026 assessment is undertaken for the post-development scenario.

In line with the requirements of the document *"Transport Impact Assessment Guidelines for Developments, Volume 4 – Individual Developments (2016)"* additional assessment is undertaken for a 10-year post development time horizon (i.e., 2036 in this case).

7.2 Trip Generation and Distribution

The estimation of the traffic volume that will be generated by the proposed industrial development has been based on the operations/office staff shift schedule and transport task schedule, both provided by the future plant operator. The traffic generation of the proposed facility is explained in detail and quantified in the following paragraphs.

Operation and office staff commute to/from the plant

According to the advice provided to Transcore, personnel will be arriving to and departing the site by private (passenger) vehicles. Some level of car-pooling is anticipated but will not be quantified here in order to ensure a robust assessment. Typically, passenger vehicles, 4WD and utility vehicles will be used for this purpose. However, for the purpose of a conservative assessment, a one person per car ratio is assumed for staff traffic.

Occasionally visitors will also be arriving to the site; however, this traffic is expected to be random and limited in volume.

Site operations will be conducted in two shifts each weekday (day and night shifts). Accordingly, a total of up to 59 personnel including 34 operations staff and 22 office staff (day shift) and additional three operations staff (night shift) would arrive and depart the site each weekday generating up to 118 total daily trips (inbound and outbound trips combined).

This would further mean that 59 personnel would change over within each 1-hour window of morning shift changeover (6:00–7 :00AM) and evening shift changeover (6:00–7:00PM) periods translating into total of 59 trips (inbound and outbound combined) during each 1-hour period. Refer **Table 1** for trip split details (which allows for some in/out fluctuation).

Table 1: Total weekday personnel traffic generation

Time	Day shift personnel	Night shift personnel	Total trips
6:00 – 7:00 AM	51 arrivals	8 departures	**59 trips**
6:00 – 7:00 PM	8 departures	51 arrivals	**59 trips**

Total daily transport task

The daily transport task schedule has been provided by the future operator and includes the anticipated regular raw material, equipment and other necessary deliveries to the site and product distribution/byproduct disposal from the site. Although there is bound to be some level of fluctuation in transport task subject to production schedules/stock levels the prepared transport task provides a reasonably good approximation of the regular daily transport activity. Refer **Table 2** for more details.

Table 2: Typical daily transport task

Task	Trucks	Type	Trips
Seed delivery	36	B-Doubles	72
Meal transport	15	B-Doubles	30
Oil distribution	14	B-Doubles/Semi-trailers/Rigid trucks	28
Biomass supply	8	B-Doubles/Semi-trailers/Rigid trucks	16
Ash removal	3	B-Doubles/Semi-trailers/Rigid trucks	6
Other transport	2	B-Doubles/Semi-trailers/Rigid trucks	4
Total	**78**		**156**

Broadly based on the advice provided by the operator, the split of heavy vehicles by type/size is conservatively assumed to be 75% of B-Doubles and 25% of semi-trailers and large/small rigid trucks. For the modelling purpose however, an even more

conservative assumption was applied whereas 75% of all heavy vehicles would be of Class 10 type with all the balance of heavy vehicles being of Class 6-9[1]vehicles.

With respect to the heavy vehicle traffic distribution throughout the day, it is assumed that minimal truck movement will be occurring during the shift changeover hours. It is assumed that optimal transport task scheduling will be applied in this instance, where heavy vehicle activity is mostly concentrated during lower road network traffic activity periods in order to minimise the conflict between delivery/distribution traffic and the local road network peak traffic activity periods. It is also advised that due to the 24-hour nature of the operation a proportion of transport task will be carried out over the 7:00PM-6:00AM period where traffic load on Patterson Road is at its lowest.

Accordingly, it is estimated that approximately up to 5% of transport task (i.e., eight heavy vehicle trips, four inbound and four outbound) will occur during typical weekday one-hour road network peak and near-peak periods.

Deliveries and waste collection traffic and shutdowns

The proposed development will need to be serviced on regular basis and as such various minor deliveries and waste collection vehicles will be accessing the site several times a week or day. This type of traffic is typically occurring outside peak road network periods and is not significant enough to have notable impact on the capacity of the road network.

Similarly, plant shutdowns which experience higher volume of light vehicles (technical staff attending the site) and wind down of heavy vehicle transport is experienced once every two years. Hence, these changed traffic scenarios will not be investigated in detail as they are an anomaly of the typical plant operation.

Accordingly, it is estimated that the proposed development would generate the following traffic activity during the key assessment periods:

- A total of approximately **274** total weekday daily light and heavy vehicle trips (both inbound and outbound);
- A total of approximately **59** light vehicle trips (both inbound and outbound) during the weekday early morning peak hour period (shift changeover 6:00-7:00AM);
- A total of approximately **59** light vehicle trips (both inbound and outbound) during the weekday late evening peak hour period (shift changeover 6:00-7:00PM);
- A total of approximately **8** heavy vehicle trips (both inbound and outbound) during the road network peak hour period (4:00-5:00PM);
- A total of approximately **8** heavy vehicle trips (both inbound and outbound) during the road network near-peak hour period (3:00-4:00PM);

[1] *AUSTROADS Vehicle Classification System used in SIDRA traffic modelling software*

7.3 Traffic Flows

With respect to the assumed distribution and assignment of the development-generated traffic consideration was given to the location of the site and the likely and convenient access and egress routes to and from the site.

For the purpose of this assessment the distribution of operations/office staff type of traffic was assumed to be as follows:

- 50% to/from the north direction (via Patterson Road); and,
- 50% to/from the south direction (via Patterson Road).

According to the advice provided by the operator, the (anticipated) distribution of the traffic associated with the transport task component is assumed to be as follows:

- 50% to/from the north direction (via Patterson Road); and,
- 50% to/from the south direction (via Patterson Road).

The traffic movements generated by the proposed development have been manually assigned to the adjacent road network and the resulting traffic movements generated by this development during the weekday shift changeover and road network peak and near-peak hours are illustrated in **Figure 8** and **Figure 9**, respectively.



Figure 8: Estimated development-generated traffic – weekday AM and PM shift changeover peak hour traffic



Figure 9: Estimated development-generated heavy vehicle traffic – weekday peak and near-peak road network hour traffic

The outcome of the weekday morning and afternoon peak hour traffic survey undertaken by Transcore on Monday 4 December 2023 at the Patterson Road/Ward Road intersection is shown in **Figure 10**.



Figure 10. Existing traffic flows at the Patterson Road/Ward Road intersection – weekday Am and PM peak hour

7.4 Analysis of Local Intersections and Development Crossovers

For the purpose of this assessment, it is assumed that the proposed development would be completed and fully activated by the end of 2026, hence this year was assumed for the post-development assessment scenario.

The 10-year time horizon assessment typically forms part of the TIA scope and as such the 10-year time horizon scenario (assessment year 2036 in this case) is also considered.

A review of the historical traffic data at multiple locations along Patterson Road indicates that the daily traffic volumes for this road have generally plateaued in the last 5-year period. The pre-Covid 2018/19 and post-Covid 2021/22 traffic volumes are almost identical. Hence, a 0.2% p.a. background traffic growth was assumed for Patterson Road for the post-development and 10-year post-development assessment scenarios in order to secure a robust assessment.

Capacity analysis of the Patterson Road/Ward Road intersection for the identified critical weekday peak hour periods (discussed in **Sections 7.1** and **7.2**) was undertaken using the SIDRA computer software package.

SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- **Degree of Saturation**: is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- **Level of Service**: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- **Average Delay**: is the average of all travel time delays for vehicles through the intersection.
- **95% Queue**: is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis of Patterson Road/Ward Road intersection are summarised in tables attached in **Appendix A** and discussed in the following paragraphs. It should be noted that the intersection modelling for post-development and 10-year horizon scenarios includes addition of a left-turn slip lane on Patterson Road as a proposed upgrade to this intersection. This slip lane is primarily intended to improve the safety of operations at the intersection.

A summary of the SIDRA analysis results of the Patterson Road/Ward Road intersection for the existing, post-development and 10-year horizon scenarios is presented in Table 3.

Table 3: SIDRA result summary – Level of Service & Capacity Level - Patterson Road/Ward Road intersection

Intersection Approach		NW Ward St		SW Patterson Rd		SE Median	NE Patterson Rd		NW Median
Turn		L	T	L	T	T	T	R	R
Existing	AM peak	B	D	A	A	D	A	A	A
		0.009		0.502		0.011	0.214		0.002
	3-4PM (near peak)	A	B	A	A	A	A	A	D
		0.003		0.338		0.003	0.523		0.009
	4-5PM (road peak)	A	B	A	A	A	A	A	F
		0.003		0.335		0.003	0.631		0.26
	PM peak	A	A	A	A	A	A	A	A
		0.002		0.141		0.001	0.224		0.002
Post Development	AM peak	B	F	A	A	E	A	A	A
		0.098		0.506		0.305	0.215		0.006
	3-4PM (near peak)	D	F	A	A	F	A	A	F
		0.122		0.341		0.126	0.527		0.774
	4-5PM (road peak)	D	F	A	A	F	A	A	F
		0.160		0.337		0.119	0.637		0.841
	PM peak	A	A	A	A	A	A	A	A
		0.042		0.142		0.006	0.226		0.044
10-year Horizon	AM peak	B	F	A	A	E	A	A	A
		0.110		0.516		0.337	0.220		0.006
	3-4PM (near peak)	D	F	A	A	F	A	A	F
		0.142		0.347		0.140	0.537		0.828
	4-5PM (road peak)	D	F	A	A	F	A	A	F
		0.174		0.344		0.132	0.649		0.845
	PM peak	A	A	A	A	A	A	A	A
		0.043		0.145		0.006	0.230		0.044

As can be seen from the above table the intersection of Patterson Road/Ward Road has sufficient capacity to accommodate the anticipated development-generated traffic with approximately 15% spare capacity available during the most pronounced road peak hour period of 4:00-5:00PM even in the 10-year horizon scenario.

The most pronounced delays are expected for the right-turn out and in movements from/to Ward Road due to need to cross through traffic on Patterson Road. This is particularly true in case of heavy vehicles, as these vehicles require longer gaps in through traffic stream to perform their turn movements.

This situation is a result of the sheer volume of traffic along Patterson Roads and lack of (theoretical) gaps for right-turn movements and not the number of right-turn traffic associated with the proposed development. However, this situation is similar to other existing priority-controlled intersections along Patterson Road in the immediate vicinity, namely Alumina Road/Patterson Road intersection to the south which serves similar number of industrial projects. Patterson Road/Ward Road intersection has only recorded one crash in the previous 5-year period with no evidence of safety issues.

Detailed intersection analysis results are presented in **Table 4** through to **Table 15** in **Appendix A** for more details.

The outcome of the capacity analysis confirms the necessity for proactive and smart transport task planning to ensure minimum amount of heavy vehicle activity associated with the project is coinciding with the road network peak activity periods.

7.5 Impact on Surrounding Roads

The WAPC *Transport Impact Assessment Guidelines Volume 4 – Individual Developments* (2016) provides guidance on the assessment of traffic impacts:

"As a general guide, an increase in traffic of less than 10 percent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 percent may. All sections of road with an increase greater than 10 percent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 percent of capacity. Therefore, any section of road where the development traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis."

As discussed in section **7.2** of this report, the proposed agriculture/industrial facility is expected to generate about 280 daily vehicle trips (vpd) on a regular weekday. This level of traffic increase represents less than 0.1% of additional traffic on Patterson Road north and south of the site.

Accordingly, it can be concluded that the traffic impact of the proposed development will not adversely impact the existing traffic operations of Patterson Road.

7.6 Impact on Neighbouring Areas

Considering the location of the subject site, its accessibility via major regional roads and roads within the generally industrial zone, the traffic impact from the proposed development on neighbouring areas will be insignificant.

7.7 Traffic Noise and Vibration

Due to the location of the subject site and with respect to the surrounding land uses traffic noise and vibration impacts is not a consideration.

7.8 Road Safety

No particular safety-related issues have been identified for this development.

8 Parking

At this stage only a concept site plan has been developed outlining the location and shape of key development components within the subject site. It is therefore assumed that the on-site car parking provision will be designed to meet the anticipated practical demand for the proposed agriculture/industrial operation.

The on-site parking provision will need to meet the parking demand for office personnel, operational staff and visitor as well. All parking should be designed to conform to provisions stipulated in AS 2890.1 document. Appropriate amount of ACROD bays will also be required to be located at convenient location with easy access to entrances into respective buildings.

9 Provision for Service Vehicles

The subject site is expected to be accessed by heavy vehicle combinations of up to 27.5m in length (i.e., B-Doubles) on regular basis. As such, internal site driveways will need to be designed to accommodate such vehicles.

As vehicles performing various tasks and functions will be interacting within the site on regular basis appropriate way-finding signs and line-marking will need to be provided throughout the site at visible locations to ensure safe and efficient internal traffic flows. Wherever possible, light and heavy vehicle traffic should be separated in order to minimise conflicts between two types of traffic. All internal driveways, turning and laydown areas should be designed to ensure that all large vehicles will only ever need to move through the site in forward gear.

Waste collection and other service vehicles accessing the site will generally be of medium-large rigid vehicle type and as such will comfortably access, manoeuvre and egress the site.

10 Pedestrian and Cyclist Access

The subject site is located within the relatively remote area and as such limited or no pedestrian and cyclist facilities are available on roads within this area.

There is no direct pedestrian access to the subject site available at present as no footpaths/shared paths are in place on Patterson Road or Ward Road. However, a sealed shoulder on Patterson Road accommodates demand for cycling trips.

Considering the type/use of the proposed development and the location of the subject site pedestrian and cyclist trips are not anticipated.

The *Perth Bike Map* series published by the Department of Transport (see **Figure 10** overleaf) indicates available pedestrian and cyclist facilities within the locality.



Figure 11: Perth Bike Map (source: Department of Transport)

11 Public Transport Access

At present, the subject site has indirect access to public transport service via the existing bus service No. 548 which operates along Patterson Road, as shown in **Figure 10**. The closest existing bus stops are in place on either side of Patterson Road adjacent to Ward Road intersection.



Figure 12: Local bus service map (source: Transperth)

12 Conclusions

This Transport Impact Assessment has been prepared by Transcore on behalf of Ramboll with respect to the proposed Agriculture/Industrial Facility at Lot 108 Patterson Road in East Rockingham, City of Rockingham.

The subject site is situated at the western side of Patterson Road and to the south of Ward Road. The site is also located immediately south of the existing WA Kaolin storage facility and the Halliburton Chemicals manufacture plant site. CBH Kwinana Grain Terminal is located immediately to the west of railway tracks and the subject site.
The development proposal involves construction of a canola crushing plant with associated processing and storage facilities, ancillary administrative building and on-site parking.

The plant is proposed to be served via a new service road which will be connecting to Ward Road which further connects to Patterson Road.

It is estimated that the proposed development would generate up to approximately **280** total weekday daily trips (both inbound and outbound) with approximately **59** peak hour trips during the weekday AM and PM peak periods (shift changeover). The development-traffic comprises staff traffic and the transport task which involves use of heavy vehicles of up to 27.5m in length (i.e., B-Doubles).

The comprehensive traffic modelling and assessment undertaken in this report demonstrates that impact from the proposed development on the surrounding road network will be acceptable and within the capacity of relevant roads.

Accordingly, the traffic-related issues should not form an impediment to the approval of the proposed development.

Appendix A

SIDRA RESULTS

20 years anniversary
transcore
transport planning
traffic engineering
modelling

Table 4. SIDRA result for Patterson Road/Ward Road intersection – AM Peak Hour (Existing)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	1	0.0	1	0.0	0.011	32.9	LOS D	0.0	0.2	0.93	0.93	0.93	20.9
Approach			1	0.0	1	0.0	0.011	32.9	LOS D	0.0	0.2	0.93	0.93	0.93	20.9
NorthWest: Ward Street															
1	L2	All MCs	1	0.0	1	0.0	0.002	10.5	LOS B	0.0	0.1	0.69	0.67	0.69	49.3
2	T1	All MCs	1	0.0	1	0.0	0.009	32.0	LOS D	0.0	0.2	0.92	0.96	0.92	22.4
Approach			2	0.0	2	0.0	0.009	21.3	LOS C	0.0	0.2	0.81	0.82	0.81	36.4
SouthWest: Patterson Road															
3	L2	All MCs	1	0.0	1	0.0	0.502	7.1	LOS A	0.0	0.0	0.00	0.00	0.00	68.3
4	T1	All MCs	1837	0.9	1837	0.9	0.502	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.5
Approach			1838	0.9	1838	0.9	0.502	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.5
All Vehicles			1841	0.9	1841	0.9	0.502	0.2	NA	0.0	0.2	0.00	0.00	0.00	79.4
NorthEast: Patterson Road															
2	T1	All MCs	782	0.9	782	0.9	0.214	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
3	R2	All MCs	1	0.0	1	0.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			783	0.9	783	0.9	0.214	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
NorthWest: Median Storage															
1	R2	All MCs	1	0.0	1	0.0	0.002	3.0	LOS A	0.0	0.0	0.51	0.34	0.51	53.7
Approach			1	0.0	1	0.0	0.002	3.0	LOS A	0.0	0.0	0.51	0.34	0.51	53.7
All Vehicles			784	0.9	784	0.9	0.214	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8

Table 5. SIDRA result for Patterson Road/Ward Road intersection – 3-4PM Peak Hour (Existing)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	1	0.0	1	0.0	0.003	8.7	LOS A	0.0	0.1	0.77	0.63	0.77	33.1
Approach			1	0.0	1	0.0	0.003	8.7	LOS A	0.0	0.1	0.77	0.63	0.77	33.1
NorthWest: Ward Street															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.2	LOS A	0.0	0.0	0.53	0.56	0.53	51.9
2	T1	All MCs	1	0.0	1	0.0	0.003	12.4	LOS B	0.0	0.1	0.76	0.74	0.76	33.9
Approach			2	0.0	2	0.0	0.003	9.8	LOS A	0.0	0.1	0.64	0.65	0.64	44.9
SouthWest: Patterson Road															
3	L2	All MCs	1	0.0	1	0.0	0.338	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	68.4
4	T1	All MCs	1237	0.9	1237	0.9	0.338	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1238	0.9	1238	0.9	0.338	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
All Vehicles			1241	0.9	1241	0.9	0.338	0.1	NA	0.0	0.1	0.00	0.00	0.00	79.6
NorthEast: Patterson Road															
2	T1	All MCs	1914	0.9	1914	0.9	0.523	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.4
3	R2	All MCs	1	0.0	1	0.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			1915	0.9	1915	0.9	0.523	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.4
NorthWest: Median Storage															
1	R2	All MCs	1	0.0	1	0.0	0.009	27.2	LOS D	0.0	0.2	0.92	0.92	0.92	32.1
Approach			1	0.0	1	0.0	0.009	27.2	LOS D	0.0	0.2	0.92	0.92	0.92	32.1
All Vehicles			1916	0.9	1916	0.9	0.523	0.2	NA	0.0	0.2	0.00	0.00	0.00	79.4

Table 6. SIDRA result for Patterson Road/Ward Road intersection – 4-5PM Peak Hour (Existing)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	1	0.0	1	0.0	0.003	8.5	LOS A	0.0	0.1	0.76	0.62	0.76	33.3
Approach			1	0.0	1	0.0	0.003	8.5	LOS A	0.0	0.1	0.76	0.62	0.76	33.3
NorthWest: Ward Street															
1	L2	All MCs	1	0.0	1	0.0	0.001	7.2	LOS A	0.0	0.0	0.53	0.56	0.53	51.9
2	T1	All MCs	1	0.0	1	0.0	0.003	12.2	LOS B	0.0	0.1	0.75	0.73	0.75	34.1
Approach			2	0.0	2	0.0	0.003	9.7	LOS A	0.0	0.1	0.64	0.65	0.64	45.0
SouthWest: Patterson Road															
3	L2	All MCs	1	0.0	1	0.0	0.335	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	68.4
4	T1	All MCs	1224	0.9	1224	0.9	0.335	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1225	0.9	1225	0.9	0.335	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
All Vehicles			1228	0.9	1228	0.9	0.335	0.1	NA	0.0	0.1	0.00	0.00	0.00	79.6
NorthEast: Patterson Road															
2	T1	All MCs	2312	0.9	2312	0.9	0.631	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	79.1
3	R2	All MCs	1	0.0	1	0.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			2313	0.9	2313	0.9	0.631	0.3	NA	0.0	0.0	0.00	0.00	0.00	79.1
NorthWest: Median Storage															
1	R2	All MCs	1	0.0	1	0.0	0.026	66.0	LOS F	0.1	0.4	0.97	0.97	0.97	19.5
Approach			1	0.0	1	0.0	0.026	66.0	LOS F	0.1	0.4	0.97	0.97	0.97	19.5
All Vehicles			2314	0.9	2314	0.9	0.631	0.3	NA	0.1	0.4	0.00	0.00	0.00	79.1

Table 7. SIDRA result for Patterson Road/Ward Road intersection – PM Peak Hour (Existing)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	1	0.0	1	0.0	0.001	1.8	LOS A	0.0	0.0	0.45	0.24	0.45	39.8
Approach			1	0.0	1	0.0	0.001	1.8	LOS A	0.0	0.0	0.45	0.24	0.45	39.8
NorthWest: Ward Street															
1	L2	All MCs	1	0.0	1	0.0	0.001	5.4	LOS A	0.0	0.0	0.33	0.48	0.33	53.1
2	T1	All MCs	1	0.0	1	0.0	0.002	7.1	LOS A	0.0	0.0	0.51	0.55	0.51	39.2
Approach			2	0.0	2	0.0	0.002	6.2	LOS A	0.0	0.0	0.42	0.52	0.42	46.1
SouthWest: Patterson Road															
3	L2	All MCs	1	0.0	1	0.0	0.141	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	68.6
4	T1	All MCs	515	0.9	515	0.9	0.141	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			516	0.9	516	0.9	0.141	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.9
All Vehicles			519	0.9	519	0.9	0.141	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
NorthEast: Patterson Road															
2	T1	All MCs	820	0.9	820	0.9	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
3	R2	All MCs	1	0.0	1	0.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			821	0.9	821	0.9	0.224	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
NorthWest: Median Storage															
1	R2	All MCs	1	0.0	1	0.0	0.002	3.2	LOS A	0.0	0.0	0.53	0.36	0.53	53.3
Approach			1	0.0	1	0.0	0.002	3.2	LOS A	0.0	0.0	0.53	0.36	0.53	53.3
All Vehicles			822	0.9	822	0.9	0.224	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8

Table 8. SIDRA result for Patterson Road/Ward Road intersection – AM Peak Hour (Post Development)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	28	0.0	28	0.0	0.305	42.2	LOS E	0.8	6.2	0.95	1.01	1.06	18.3
Approach			28	0.0	28	0.0	0.305	42.2	LOS E	0.8	6.2	0.95	1.01	1.06	18.3
NorthWest: Ward Street															
1	L2	All MCs	4	0.0	4	0.0	0.009	10.7	LOS B	0.0	0.2	0.70	0.75	0.70	49.1
2	T1	All MCs	4	0.0	4	0.0	0.098	75.2	LOS F	0.2	1.8	0.97	0.98	0.97	12.9
Approach			8	0.0	8	0.0	0.098	42.9	LOS E	0.2	1.8	0.83	0.87	0.83	26.9
SouthWest: Patterson Road															
3	L2	All MCs	26	0.0	26	0.0	0.019	7.4	LOS A	0.1	0.6	0.09	0.58	0.09	54.2
4	T1	All MCs	1852	0.9	1852	0.9	0.506	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.5
Approach			1878	0.9	1878	0.9	0.506	0.3	LOS A	0.1	0.6	0.00	0.01	0.00	79.0
All Vehicles			1915	0.9	1915	0.9	0.506	1.1	NA	0.8	6.2	0.02	0.03	0.02	77.2
NorthEast: Patterson Road															
2	T1	All MCs	788	0.9	788	0.9	0.215	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
3	R2	All MCs	28	0.0	28	0.0	0.015	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			817	0.9	817	0.9	0.215	0.3	NA	0.0	0.0	0.00	0.02	0.00	79.4
NorthWest: Median Storage															
1	R2	All MCs	4	0.0	4	0.0	0.006	3.2	LOS A	0.0	0.1	0.53	0.40	0.53	53.3
Approach			4	0.0	4	0.0	0.006	3.2	LOS A	0.0	0.1	0.53	0.40	0.53	53.3
All Vehicles			821	0.9	821	0.9	0.215	0.3	NA	0.0	0.1	0.00	0.02	0.00	79.3

Table 9. SIDRA result for Patterson Road/Ward Road intersection – 3-4PM Peak Hour (Post Development)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	366.7		366.7		0.126	130.0	LOS F	0.2	3.6	0.95	0.96	0.97	8.2
Approach			366.7		366.7		0.126	130.0	LOS F	0.2	3.6	0.95	0.96	0.97	8.2
NorthWest: Ward Street															
1	L2	All MCs	366.7		366.7		0.021	28.3	LOS D	0.1	1.3	0.77	0.86	0.77	29.2
2	T1	All MCs	366.7		366.7		0.122	118.7	LOS F	0.2	3.3	0.94	0.98	0.96	9.1
Approach			666.7		666.7		0.122	73.5	LOS F	0.2	3.3	0.85	0.92	0.86	17.7
SouthWest: Patterson Road															
3	L2	All MCs	366.7		366.7		0.004	9.5	LOS A	0.0	0.4	0.05	0.58	0.05	51.1
4	T1	All MCs	1247	0.9	1247	0.9	0.341	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1251	1.1	1251	1.1	0.341	0.1	LOS A	0.0	0.4	0.00	0.00	0.00	79.6
All Vehicles			1260	1.6	1260	1.6	0.341	0.8	NA	0.2	3.6	0.01	0.01	0.01	78.2
NorthEast: Patterson Road															
2	T1	All MCs	1929	0.9	1929	0.9	0.527	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.4
3	R2	All MCs	366.7		366.7		0.005	9.1	LOS A	0.0	0.0	0.00	0.64	0.00	61.5
Approach			1933	1.0	1933	1.0	0.527	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.4
NorthWest: Median Storage															
1	R2	All MCs	366.7		366.7		0.774	282.9	LOS F	1.2	24.1	1.00	1.01	1.02	5.6
Approach			366.7		366.7		0.774	282.9	LOS F	1.2	24.1	1.00	1.01	1.02	5.6
All Vehicles			1936	1.1	1936	1.1	0.774	0.6	NA	1.2	24.1	0.00	0.00	0.00	78.5

Table 10. SIDRA result for Patterson Road/Ward Road intersection – 4-5PM Peak Hour (Post Development)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	366.7		366.7		0.119	123.1	LOS F	0.2	3.5	0.94	0.96	0.96	8.6
Approach			366.7		366.7		0.119	123.1	LOS F	0.2	3.5	0.94	0.96	0.96	8.6
NorthWest: Ward Street															
1	L2	All MCs	366.7		366.7		0.021	27.7	LOS D	0.1	1.3	0.76	0.85	0.76	29.4
2	T1	All MCs	366.7		366.7		0.160	114.6	LOS F	0.2	3.2	0.94	0.99	0.97	9.4
Approach			666.7		666.7		0.160	71.2	LOS F	0.2	3.2	0.85	0.92	0.87	18.0
SouthWest: Patterson Road															
3	L2	All MCs	366.7		366.7		0.004	9.5	LOS A	0.0	0.4	0.05	0.58	0.05	51.1
4	T1	All MCs	1235	0.9	1235	0.9	0.337	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1238	1.1	1238	1.1	0.337	0.1	LOS A	0.0	0.4	0.00	0.00	0.00	79.6
All Vehicles			1247	1.6	1247	1.6	0.337	0.8	NA	0.2	3.5	0.01	0.01	0.01	78.2
NorthEast: Patterson Road															
2	T1	All MCs	2331	0.9	2331	0.9	0.637	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	79.1
3	R2	All MCs	366.7		366.7		0.005	9.1	LOS A	0.0	0.0	0.00	0.64	0.00	61.5
Approach			2334	1.0	2334	1.0	0.637	0.3	NA	0.0	0.0	0.00	0.00	0.00	79.1
NorthWest: Median Storage															
1	R2	All MCs	366.7		366.7		0.841	466.1	LOS F	2.0	41.9	1.00	1.01	1.01	3.7
Approach			366.7		366.7		0.841	466.1	LOS F	2.0	41.9	1.00	1.01	1.01	3.7
All Vehicles			2337	1.1	2337	1.1	0.841	0.9	NA	2.0	41.9	0.00	0.00	0.00	78.0

Table 11. SIDRA result for Patterson Road/Ward Road intersection – PM Peak Hour (Post Development)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	5	0.0	5	0.0	0.006	1.9	LOS A	0.0	0.1	0.45	0.29	0.45	39.3
Approach			5	0.0	5	0.0	0.006	1.9	LOS A	0.0	0.1	0.45	0.29	0.45	39.3
NorthWest: Ward Street															
1	L2	All MCs	27	0.0	27	0.0	0.022	5.4	LOS A	0.1	0.6	0.34	0.54	0.34	53.1
2	T1	All MCs	28	0.0	28	0.0	0.042	7.9	LOS A	0.2	1.2	0.52	0.68	0.52	38.5
Approach			56	0.0	56	0.0	0.042	6.7	LOS A	0.2	1.2	0.43	0.61	0.43	47.6
SouthWest: Patterson Road															
3	L2	All MCs	5	0.0	5	0.0	0.004	7.3	LOS A	0.0	0.1	0.03	0.60	0.03	54.5
4	T1	All MCs	519	0.9	519	0.9	0.142	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			524	0.9	524	0.9	0.142	0.1	LOS A	0.0	0.1	0.00	0.01	0.00	79.6
All Vehicles			585	0.8	585	0.8	0.142	0.7	NA	0.2	1.2	0.05	0.07	0.05	76.3
NorthEast: Patterson Road															
2	T1	All MCs	827	0.9	827	0.9	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
3	R2	All MCs	5	0.0	5	0.0	0.003	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			833	0.9	833	0.9	0.226	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
NorthWest: Median Storage															
1	R2	All MCs	28	0.0	28	0.0	0.044	3.6	LOS A	0.1	1.0	0.55	0.51	0.55	52.8
Approach			28	0.0	28	0.0	0.044	3.6	LOS A	0.1	1.0	0.55	0.51	0.55	52.8
All Vehicles			861	0.9	861	0.9	0.226	0.2	NA	0.1	1.0	0.02	0.02	0.02	79.1

Table 12. SIDRA result for Patterson Road/Ward Road intersection – AM Peak Hour (10-year Horizon)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	28	0.0	28	0.0	0.337	47.6	LOS E	0.9	6.7	0.96	1.02	1.08	17.1
Approach			28	0.0	28	0.0	0.337	47.6	LOS E	0.9	6.7	0.96	1.02	1.08	17.1
NorthWest: Ward Street															
1	L2	All MCs	4	0.0	4	0.0	0.009	11.0	LOS B	0.0	0.2	0.71	0.76	0.71	48.8
2	T1	All MCs	4	0.0	4	0.0	0.110	81.4	LOS F	0.3	2.0	0.97	0.99	0.97	12.2
Approach			8	0.0	8	0.0	0.110	46.2	LOS E	0.3	2.0	0.84	0.88	0.84	25.8
SouthWest: Patterson Road															
3	L2	All MCs	26	0.0	26	0.0	0.019	7.4	LOS A	0.1	0.6	0.09	0.58	0.09	54.2
4	T1	All MCs	1888	0.9	1888	0.9	0.516	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.5
Approach			1915	0.9	1915	0.9	0.516	0.3	LOS A	0.1	0.6	0.00	0.01	0.00	79.0
All Vehicles			1952	0.9	1952	0.9	0.516	1.1	NA	0.9	6.7	0.02	0.03	0.02	77.1
NorthEast: Patterson Road															
2	T1	All MCs	804	0.9	804	0.9	0.220	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
3	R2	All MCs	28	0.0	28	0.0	0.015	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			833	0.9	833	0.9	0.220	0.3	NA	0.0	0.0	0.00	0.02	0.00	79.4
NorthWest: Median Storage															
1	R2	All MCs	4	0.0	4	0.0	0.006	3.4	LOS A	0.0	0.1	0.54	0.41	0.54	53.1
Approach			4	0.0	4	0.0	0.006	3.4	LOS A	0.0	0.1	0.54	0.41	0.54	53.1
All Vehicles			837	0.9	837	0.9	0.220	0.3	NA	0.0	0.1	0.00	0.02	0.00	79.3

Table 13. SIDRA result for Patterson Road/Ward Road intersection – 3-4PM Peak Hour (10-year Horizon)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	366.7		366.7		0.140	144.4	LOS F	0.2	3.9	0.95	0.98	0.98	7.6
Approach			366.7		366.7		0.140	144.4	LOS F	0.2	3.9	0.95	0.98	0.98	7.6
NorthWest: Ward Street															
1	L2	All MCs	366.7		366.7		0.022	29.4	LOS D	0.1	1.4	0.77	0.87	0.77	28.9
2	T1	All MCs	366.7		366.7		0.142	130.4	LOS F	0.2	3.5	0.95	0.99	0.98	8.4
Approach			666.7		666.7		0.142	79.9	LOS F	0.2	3.5	0.86	0.93	0.87	16.8
SouthWest: Patterson Road															
3	L2	All MCs	366.7		366.7		0.004	9.5	LOS A	0.0	0.4	0.05	0.58	0.05	51.1
4	T1	All MCs	1272	0.9	1272	0.9	0.347	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1275	1.1	1275	1.1	0.347	0.1	LOS A	0.0	0.4	0.00	0.00	0.00	79.6
All Vehicles			1284	1.5	1284	1.5	0.347	0.9	NA	0.2	3.9	0.01	0.01	0.01	78.1
NorthEast: Patterson Road															
2	T1	All MCs	1967	0.9	1967	0.9	0.537	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.4
3	R2	All MCs	366.7		366.7		0.005	9.1	LOS A	0.0	0.0	0.00	0.64	0.00	61.5
Approach			1971	1.0	1971	1.0	0.537	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.4
NorthWest: Median Storage															
1	R2	All MCs	366.7		366.7		0.828	332.7	LOS F	1.4	28.1	1.00	1.01	1.02	4.9
Approach			366.7		366.7		0.828	332.7	LOS F	1.4	28.1	1.00	1.01	1.02	4.9
All Vehicles			1974	1.1	1974	1.1	0.828	0.7	NA	1.4	28.1	0.00	0.00	0.00	78.4

Table 14. SIDRA result for Patterson Road/Ward Road intersection – 4-5PM Peak Hour (10-year Horizon)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	366.7		366.7		0.132	136.7	LOS F	0.2	3.8	0.95	0.97	0.97	7.9
Approach			366.7		366.7		0.132	136.7	LOS F	0.2	3.8	0.95	0.97	0.97	7.9
NorthWest: Ward Street															
1	L2	All MCs	366.7		366.7		0.022	28.8	LOS D	0.1	1.3	0.77	0.87	0.77	29.1
2	T1	All MCs	366.7		366.7		0.174	125.4	LOS F	0.2	3.4	0.95	0.99	0.98	8.7
Approach			666.7		666.7		0.174	77.1	LOS F	0.2	3.4	0.86	0.93	0.88	17.2
SouthWest: Patterson Road															
3	L2	All MCs	366.7		366.7		0.004	9.5	LOS A	0.0	0.4	0.05	0.58	0.05	51.1
4	T1	All MCs	1259	0.9	1259	0.9	0.344	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			1262	1.1	1262	1.1	0.344	0.1	LOS A	0.0	0.4	0.00	0.00	0.00	79.6
All Vehicles			1272	1.6	1272	1.6	0.344	0.8	NA	0.2	3.8	0.01	0.01	0.01	78.1
NorthEast: Patterson Road															
2	T1	All MCs	2377	0.9	2377	0.9	0.649	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	79.1
3	R2	All MCs	366.7		366.7		0.005	9.1	LOS A	0.0	0.0	0.00	0.64	0.00	61.5
Approach			2380	1.0	2380	1.0	0.649	0.3	NA	0.0	0.0	0.00	0.00	0.00	79.0
NorthWest: Median Storage															
1	R2	All MCs	366.7		366.7		0.845	465.3	LOS F	2.0	41.5	1.00	1.01	1.01	3.7
Approach			366.7		366.7		0.845	465.3	LOS F	2.0	41.5	1.00	1.01	1.01	3.7
All Vehicles			2383	1.1	2383	1.1	0.845	0.9	NA	2.0	41.5	0.00	0.00	0.00	77.9

Table 15. SIDRA result for Patterson Road/Ward Road intersection – PM Peak Hour (10-year Horizon)

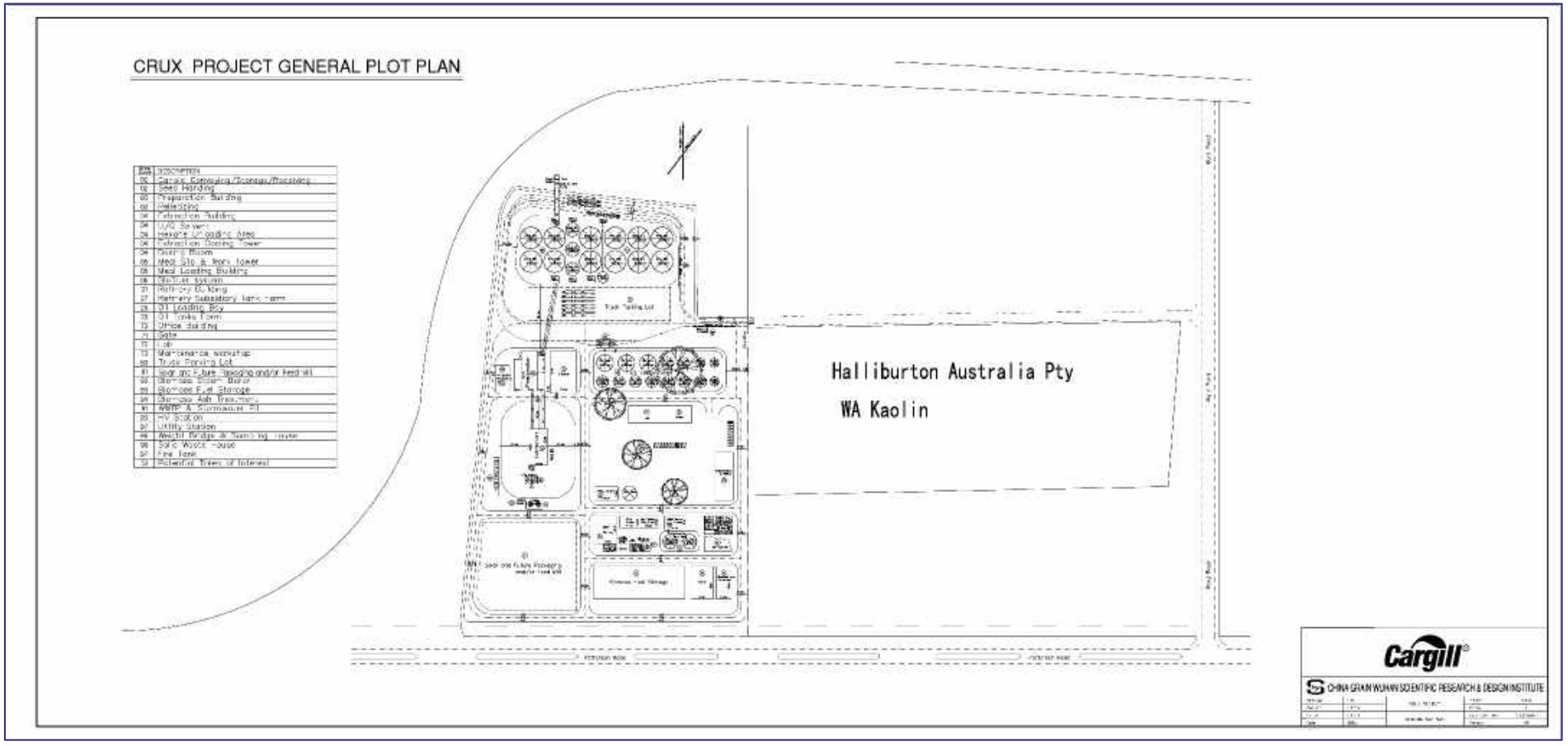
Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Median Storage															
5	T1	All MCs	5	0.0	5	0.0	0.006	2.0	LOS A	0.0	0.1	0.45	0.29	0.45	39.3
Approach			5	0.0	5	0.0	0.006	2.0	LOS A	0.0	0.1	0.45	0.29	0.45	39.3
NorthWest: Ward Street															
1	L2	All MCs	27	0.0	27	0.0	0.022	5.4	LOS A	0.1	0.6	0.34	0.54	0.34	53.1
2	T1	All MCs	28	0.0	28	0.0	0.043	8.0	LOS A	0.2	1.2	0.53	0.68	0.53	38.4
Approach			56	0.0	56	0.0	0.043	6.7	LOS A	0.2	1.2	0.44	0.61	0.44	47.5
SouthWest: Patterson Road															
3	L2	All MCs	5	0.0	5	0.0	0.004	7.3	LOS A	0.0	0.1	0.03	0.60	0.03	54.5
4	T1	All MCs	529	0.9	529	0.9	0.145	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			535	0.9	535	0.9	0.145	0.1	LOS A	0.0	0.1	0.00	0.01	0.00	79.6
All Vehicles			596	0.8	596	0.8	0.145	0.7	NA	0.2	1.2	0.05	0.07	0.05	76.3
NorthEast: Patterson Road															
2	T1	All MCs	843	0.9	843	0.9	0.230	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
3	R2	All MCs	5	0.0	5	0.0	0.003	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	61.5
Approach			848	0.9	848	0.9	0.230	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
NorthWest: Median Storage															
1	R2	All MCs	28	0.0	28	0.0	0.044	3.7	LOS A	0.1	1.0	0.56	0.53	0.56	52.6
Approach			28	0.0	28	0.0	0.044	3.7	LOS A	0.1	1.0	0.56	0.53	0.56	52.6
All Vehicles			877	0.9	877	0.9	0.230	0.2	NA	0.1	1.0	0.02	0.02	0.02	79.1

Appendix B

PROPOSED SITE PLAN

20 transcore years anniversary
transport planning
traffic engineering
modelling


CRUX PROJECT GENERAL PLOT PLAN
Halliburton Australia Pty
WA Kaolin
Cargill
CHINA GRAIN WUHAN SCIENTIFIC RESEARCH & DESIGN INSTITUTE